MATILIJA DAM
Ecosystem Restoration Feasibility Study

Appendix E
ECONOMICS

September 2004

TABLE OF CONTENT

INTRODUCTION

Purpose

The purpose of this section is to provide the economic analysis for the Matilija Dam Ecosystem Restoration Feasibility Study. The study area is from the Matilija Creek sub-watershed and as it joins the Ventura River on its flow to the Pacific Ocean. Matilija Creek sub-watershed is part of the larger Ventura River watershed. The Ventura River watershed is 223 square miles while the Matilija Creek sub-watershed is approximately 55 square miles. The method and procedures follows the current Principles and Guidelines (ER 1105-2-100) and standard economic practices. The first part of the economic analysis, after the section on background information, calculates National Economic Development (NED) economic benefits and costs for the baseline conditions. Later, economic analyses regarding National Ecosystem Restoration (NER) will be conducted on the alternatives ranging from Matilija Dam removal to other environmental restoration options. Finally economic analysis will be done on recreation and on risk and uncertainty. Floodplains of 500-year, 100-year, 50-year, and 10-year were used to estimate expected damage.

Methodology

The analysis involved a review of the current and historical economic conditions in Ventura County and the study area. Inventory of the land parcels were obtained from Ventura County outlining the physical shape and location along with description of land-use. The Corps Hydraulics and Hydrology section provide maps with parcel overlays and flood event depths. Corps' Economics Group conducted a one-day on-site survey inspection of the residential structures in the study area. The cities and towns located within the flood event area are Ventura (San Buenaventura), Ojai, Mira Monte, Meiners Oaks, and Oak View. Roads are mostly two lanes with the center unmarked. Sidewalks in the residential areas do not for the most part exist.

All price levels are FY 2004 for economic values and damages. The Base Year for the Matilija Dam Removal Feasibility Study is 2007.

BACKGROUND

Population and Area

Ventura County in California is 1,873 square miles. The population for Ventura County in the 2000 census was 753,197 and in the 1990 census was 670,132. This is a population increase of 12.4% from the previous census. The current 2002 population for Ventura County is 780,100. Table 1 shows the population for the cities/towns within the study area.

Table 1: Population

Location	Cenus 2000	Cenus 1990	Percent Change
Ventura County	753,197	670,132	12.40%
Ventura (San Buenaventura)	100,916	93,784	7.60%
Ojai	7,862	8,017	-1.93%
Mira Monte	7,177	7,744	-7.32%
Meiners Oaks	3,750	3,329	12.65%
Oak View	4,199	3,606	16.44%

Ventura is the largest city in the Matilija study area and is nearly 33 square miles in size. The other cities/towns are much smaller in size. Table 2 details the area size of the towns.

Table 2: Area

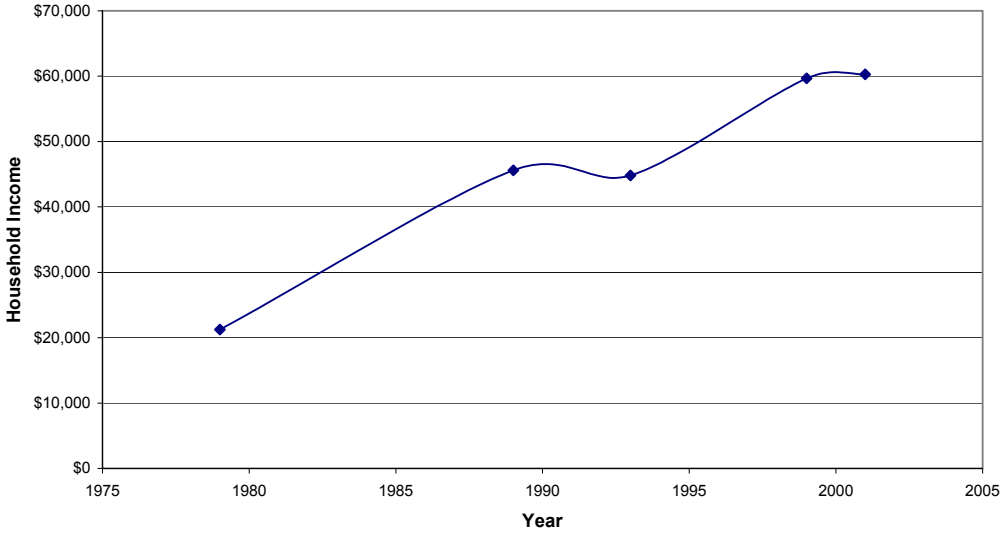
Location	Area in Sq. Miles
Ventura County	1873
Ventura (San Buenaventura)	32.7
Ojai	4.45
Mira Monte	4.22
Meiners Oaks	1.36
Oak View	1.95

Income

Income in Ventura County does vary widely whereas the median household income in 2001 was $60,303. The percent of households receiving Social Security was 22 percent and the average income from Social Security was $13,149. Past median household incomes for Ventura County were in 1999 to be $59,666, in 1993 to be $44,827, in 1989

to be $45,612, and in 1979 to be $21,243. For the City of Ventura the median household income in 2001 was $71,211. The number of household in 2001 for Ventura County was 249,284 and for the City of Ventura it was 146,919. The following graph shows the historical median household income in Ventura County.

Graph 1: Household Income in Ventura County



Employment

In 1999 the largest employer in the Ventura County was the U.S. Navy with over 17,000 workers both military and civilian. The U.S. Census Bureau reported in its 2001 Supplementary Survey that most common occupations were management, professional, and related occupations at 38 percent, followed by sales and office occupations, at 27 percent, next was service occupations at 13 percent, then production, transportation, and material moving occupations at 10 percent, finally construction, extraction, and maintenance at 9 percent. For 2001, the Ventura County total employment was reported to be 302,500 with an unemployment rate of 4.5 percent. The following table shows employment in 2001 by industry for Ventura County.

Table 3: Employment by Industry Ventura County 2001

Industry	Percent
Agr.,Forestry,fishing,hunting,&mining	3%
Construction	6%
Manufacturing	13%
Wholesale trade	6%
Retail trade	10%
Transp.& warehousing, & utilities	3%
Information	3%
Finance,ins,real estate,rent & leasing	9%
Professional and business services	11%
Ed.,health,& social services	18%
Leisure and hospitality	8%
Other services (ex. Public administration)	3%
Public administration	5%

Housing

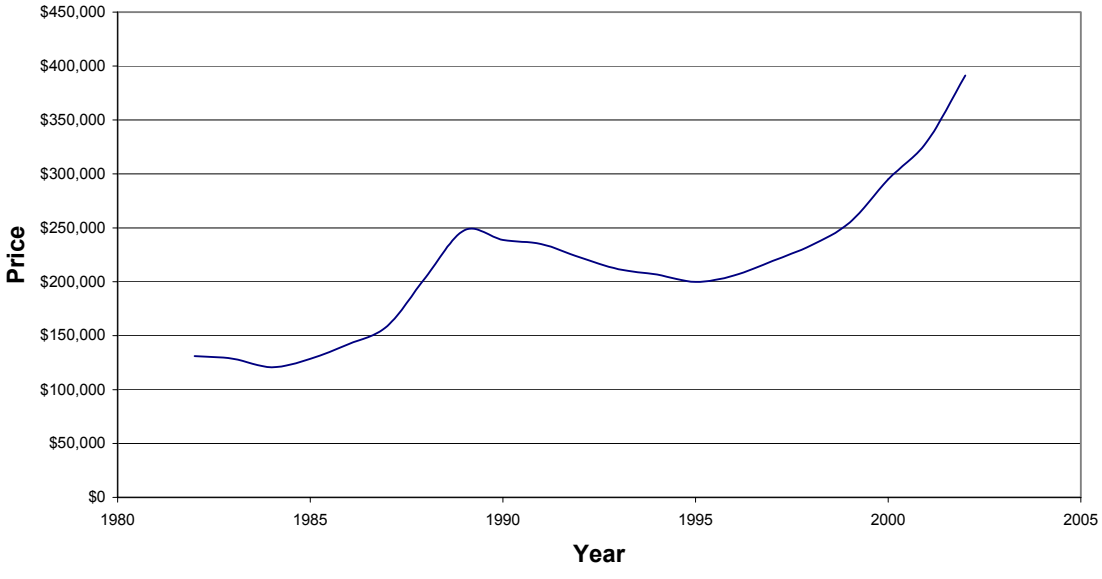
Housing costs in Ventura County has been escalating for the past few years and is expected to continue so long as interest rate remain at historical lows and would continue even if interest rates rise to 7 percent. In 2002 the median home sale price for Ventura County was $391,120. According to real estates analysts the pressure for increasing housing costs are results of limited housing in Ventura County due to a negative housing construction environment, demand stemming from local job growth, and workers in neighboring Santa Barbara County where the median housing cost in 2002 was $744,000 seeking more affordable housing.

The following table and graph displays the median home sales price from 2002 to 1982.

Table 4: Ventura County
Median Home Sales Price

Year	Median Home Sales Price
2002	$391,120
2001	$329,440
2000	$295,080
1999	$254,950
1998	$233,770
1997	$219,300
1996	$205,720
1995	$199,900
1994	$206,640
1993	$211,600
1992	$222,510
1991	$234,930
1990	$238,792
1989	$247,658
1988	$204,318
1987	$159,072
1986	$142,155
1985	$128,531
1984	$120,687
1983	$128,664
1982	$130,890

Graph 2: Ventura County Median Home Sales Prices



According to the U.S. Census Bureau 49 percent of the housing occupants in 2001 were renters. The distribution of housing types for Ventura County in 2001 were single-family units at 72 percent, multi-family units at 24 percent, and the remainder being mobile homes at 4 percent of the total. Recent real estate information indicates the cost of housing has continued to rise.

The U.S Census Bureau reported in 1990 the Ventura County housing stock to be 228,478 and that in 2000 the housing stock was 251,712 units. This is a growth of 10.2 percent in 10 years. This represents an annual growth rate slightly less than 1 percent per year.

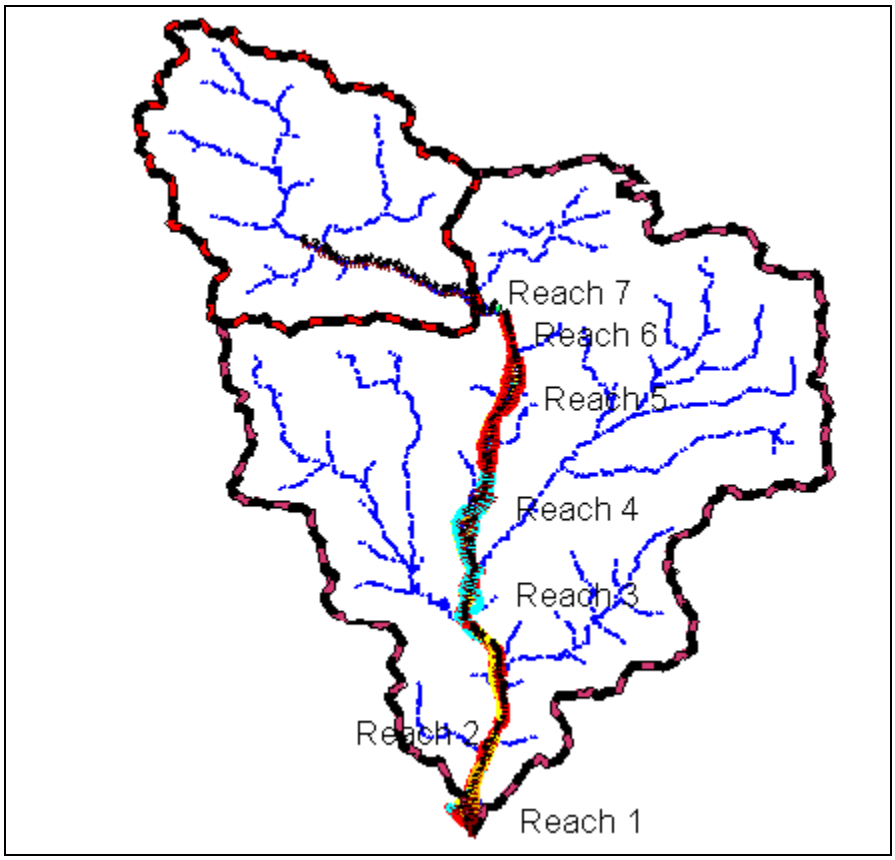
Ojai a city near Matilija Dam and within the study area in the 1990 U.S. Census reported a housing stock of 3,130 units. The U.S. Census Bureau in the 2000 Census reported Ojai had a housing stock of 3,197 units. Between 1990 and 2000 the city of Ojai housing stock grew 2.1 percent. This represents an annual growth rate of 0.21 percent per year. The other cities of Mira Monte, Meiners Oaks, and Oak View in the study area are as a group similar to Ojai in their housing stock growth rates.

ECONOMIC ANALYSIS

General Description of Flood Area (Economic)

The ground area of concern in the economic analysis for the Matilija Study is where potential for flooding is outlined by the 500-year floodplain. All the land parcels that fall within the 500-year floodplain or parcels that could some how be inundated by floodwaters under future "Without Project" conditions were examined and are part of the analysis. The following figure shows the Ventura River Watershed with the part in the middle being the event of flooding. The watercourse is from Matilija Dam to along Matilija Creek, going into Ventura River, and then out to the Pacific Ocean. The length of this travel is approximately 16 miles. In the Matilija study the river station miles identified are critical to the economic analysis.

Figure 1: Ventura River Watershed
Flood Event and Location



The number of land parcels initially examined was nearly 500. These parcels account for 5,550 acres. Many of the parcels eventually fell out as the 500-year floodplain was refined. Most of the expected damages from flooding are due to residential housing. The flood affected residential housings were found to be generally along three areas and are identified by river stations mile 14, river station mile 9.5 and broadly around river station mile 7. The actual count of residential parcels (sites) are 8 parcels around river station mile 14, near river station mile 9.5 are 94 parcels, and cluster about river station mile 7 are 136 parcels. The total number of residential parcels is 243. River station mile 16 represents the approximate location of the Matilija Dam and River station mile 0 represents the point of entry of the Ventura River into the Pacific Ocean.

There are 9 Reaches in Matilija Dam Ecosystem Restoration study area of which 7 are used in the economic analysis. Reach 1 is from where the Ventura River enters the Pacific Ocean to the Main Street Bridge into San Buenaventura (City of Ventura). Reach 2 is from The Main Street Bridge to Foster Park (at Casitas Vista Road Bridge). Reach 3 is from Foster Park to a point just above San Antonia Creek Confluence. Reach 4 is from the San Antonio Creek Confluence to Meiners Oaks. Reach 5 is from Meiners Oaks to the upstream end of Robles Diversion Facilities. Reach 6 is from Robles Diversion to Matilija Dam. Reach 7 is from Matilija Dam to about 2 miles upstream of the dam.

The following table shows the relationship of the Reaches in this study to the River Station mile points along the route.

Table 5: Reach to River Mile (Station)

	River Mile (Station)		
Reach 1	0	to	0.6
Reach 2	0.6	to	6.1
Reach 3	6.1	to	7.9
Reach 4	7.9	to	12.3
Reach 5	12.3	to	14.2
Reach 6	14.2	to	16.5
Reach 7	16.5	to	17.5

Using the GIS system at the Los Angeles District Corps office the parcels affected within the various flood events were identified. The 500-year floodplain involved 425 parcels of which 243 are residential (single family : SF, multi-family : MF, and mobile homes : MH). Industrial parcels accounted for 4 and commercial parcels accounted for 13. Some 33 parcels were classified as farms and pastures. For the most part the farms are orchards and seed crops. There are 85 parcels that are vacant. Parcels classified as Others such as city property, county property, flood control, and etc. numbered 47.

The number of parcels involved at the 100-year floodplain is 273, at the 50-year floodplain the number is 248, and at the 10-year floodplain is 94. The following table details the parcel numbers. The table also shows the number of building structures associated with each of the floodplains such as a single family residence, a mobile home, a school, and etc. By the far the largest group of structures in the Matilija Dam floodplain

area is the single family residences. At the 500-year floodplain the single family residences account for 65 percent of all the structures. However in terms of land area the single-family residences account for only 7.4 percent of the total for the 500-year floodplain while farms and pastures account for 37.1 percent of the total land. About 2,607 acres are involved in the 500-year floodplain. For the 10-year floodplain the amount of land expected to be involved in flooding is 1,588 acres. The difference between the 500-year floodplain and the 10-year floodplain is approximately 1,019 acres.

Table 6: Matilija Dam – Summary – Economic Data

rev 5-13-04 current levees included-summary-4g3.xls				
Event--->	10-Year Flood	50-Year Flood	100-Year Flood	500-Year Flood
Item				
Parcel-Residential SF	0	112	115	227
Parcel-Residential MH	0	3	6	13
Parcel-Residential MF	0	2	2	3
Parcel-Industrial	0	1	2	4
Parcel-Commercial	0	12	12	13
Parcel-Other	20	28	32	47
Parcel-Farm (including pastures)	26	31	32	33
Parcel-Vacant	48	59	72	85
TOTAL	94	248	273	425
Units-Residential SF	0	144	149	285
Units-Residential MH	0	3	41	126
Units-Residential MF	0	7	7	11
Units-Industrial	0	1	2	4
Units-Commercial	0	12	12	12
Units-Other	na	na	na	na
Units-Farm (have buildings)	0	3	4	4
TOTAL	0	170	215	442
Acres-Residential SF	0.0	102.5	103.7	193.3
Acres-Residential MH	0.0	20.1	23.0	33.7
Acres-Residential MF	0.0	0.9	0.9	2.0
Acres-Industrial	0.0	35.9	35.9	48.0
Acres-Commercial	0.0	5.8	5.8	5.8
Acres-Other	426.0	495.3	544.8	651.3
Acres-Farm (including pastures)	623.8	756.2	854.2	967.8
Acres-Vacant	509.1	552.1	565.0	629.9
Acres-Forest	29.0	38.9	48.9	58.9
Acres-Water/Lake	0.0	0.0	10.7	16.0
TOTAL	1587.9	2007.7	2192.9	2606.7

In the next table are some data about the residential structures. Briefly the table shows that slightly smaller residential structures (i.e. homes) are built closer to the area of potential flooding.

Table 7: Matilija Dam Summary – Residential Economic Data

file:summary-4g.xls Floodplains---> Item	10-Year Flood	50-Year Flood	100-Year Flood	500-Year Flood
1ST FLOOR SPACE in SQ FT				
Residential SF Average	na	1062	1060	1162
Residential MF Average	na	na	na	na
Residential MH Average	na	1344	1874	1874
AVERAGE YR BUILT				
Residential SF	na	1952	1943	1950
Residential MF	na	na	na	na
Residential MH	na	1986	1986	1986

(na is not available)

Damage Analysis

The baseline (economic) conditions for the Matilija Dam Feasibility Study are about structural and content damage to residential, commercial, and industrial buildings. The estimates are based upon approved structural and content damage tables and are directly related to the height of the floodwater to the buildings. Crop and pastureland damages are not assessed here but in another section.

Resources for the damage analysis comes from the Marshall & Swift Book on valuation and the use of CECW-PG, dated December 4, 2000, Economic Guidance Memorandum (EGM) 01-03, "Generic Depth-Damage Relationships." The latter is based upon an earlier report entitled "Depth-Damage Functions for Corps of Engineers Flood Damage Reduction Studies" by Stuart A. Davis, Bruce D. Carlson, and David A. Moser, Technical Analysis and Research Division, Institute for Water Resources. The following tables present this depth damage relationship for structure and content. Note the damage functions for contents are based upon a percent of structure value, not content.

Table 8: Depth-Damage Relationship for Structure

	One Story	Two or More Stories
column 1	column 2	column 3
Depth	Mean of Damage	Mean of Damage
-2	0.0%	0.0%
-1	2.5%	3.0%
0	13.4%	9.3%
1	23.3%	15.2%
2	32.0%	20.9%
3	40.1%	26.3%
4	47.1%	31.4%
5	53.2%	36.2%
6	58.6%	40.7%
7	63.2%	44.9%
8	67.2%	48.8%
9	70.5%	52.4%
10	73.2%	55.7%
11	75.4%	58.7%
12	77.2%	61.4%
13	78.5%	63.8%
14	79.5%	65.9%
15	80.2%	67.7%
16	80.7%	69.2%

Table 9: Depth-Damage Relationship for Content

Structure Depth Damage - No Basement		
	One Story	Two or More Stories
column 1	column 2	column 3
Depth	Mean of Damage	Mean of Damage
-2	0.0%	0.0%
-1	2.5%	3.0%
0	13.4%	9.3%
1	23.3%	15.2%
2	32.0%	20.9%
3	40.1%	26.3%
4	47.1%	31.4%
5	53.2%	36.2%
6	58.6%	40.7%
7	63.2%	44.9%
8	67.2%	48.8%
9	70.5%	52.4%
10	73.2%	55.7%
11	75.4%	58.7%
12	77.2%	61.4%
13	78.5%	63.8%
14	79.5%	65.9%
15	80.2%	67.7%
16	80.7%	69.2%

The results are in FY 2004 dollars (without discounting) for flood damage expected to occur as the result of 500, 100, 50, and 10-year floodplains of flooding. The US Bureau of Reclamation calculated floodwater heights at incremental river station points. The difference in the elevation of the building to the expected height of the floodwater determines the amount of expected damage. These damage calculations are presented in the following table.

Table 10: Matilija Dam – Economic Damage Data
Price Levels of FY 2004

rev. 6-29-04 4g3.xls $ in FY 2004	10-Year Flood	50-Year Flood	100-Year Flood	500-Year Flood
Residential - SF Structure Value	$0	$1,942,049	$2,453,107	$7,509,970
Residential - SF Content Value	$0	$1,098,974	$1,372,554	$4,068,462
Residential - MH Structure Value	$0	$30,102	$251,971	$1,072,402
Residential - MH Content Value	$0	$16,838	$139,241	$562,771
Residential - MF Structure Value	$0	$94,994	$94,994	$217,289
Residential - MF Content Value	$0	$53,966	$53,966	$117,819
Commercial - Structure Value	$0	$149,862	$174,431	$225,661
Commercial - Content Value(@res)	$0	$84,700	$97,506	$124,097
Industrial - Structure Value	$0	$2,137	$11,457	$1,824,449
Industrial - Content Value	$0	$2,137	$11,457	$1,824,449
Farms w/buildings Str. Value	$0	$196,907	$226,870	$461,342
Farms w/buildings Cont. Value	$0	$119,026	$137,138	$259,836
TOTAL	$0	$3,791,692	$5,024,692	$18,268,547

From the above damage table it can be determined that residential housing account for 3/4 of the damages due to flooding. The Expected Annual Damages (EAD) calculation in FY 2004 dollars is $148,009 all flood events up to and including the 500-year flood event. Basically, for this without project condition the expectation of future flood damage on an annual basis is the just the probability of the event times its damage value as shown in above table. The EAD for this analysis is a stream amount that will repeats each year given the assumption that the stock of structures (buildings) will remain constant (no growth). The no growth assumption is used to simplify the analysis, but also because Ventura County and specifically in the Ojai area (Matilija region) have for years limited growth of new residential housing.

The following table shows the result of the basic EAD calculation for structural and content damages by Reaches for all flood event up to and including the 500-year event. A 20-year non-damaging point is assumed for Reaches 1,2, and 4. For Reaches 3 and 5 a 45-year non-damaging point is assumed. (In the crop damage section it shows 10-year non-damaging point for some reaches)

Table 11: Matilija Dam Economic (Structure & Content) Expected Damages by Reaches
500-Year and Less – Annualized Values

Locaction	Dollars
Reach 1	$888
Reach 2	$26,019
Reach 3	$86,615
Reach 4	$29,660
Reach 5	$4,826
Reach 6	$0
Reach 7	$0
Total	$148,009

Most of the damages occur in Reach 3 with no structural or content damages in Reaches 6 and 7.

Damage Analysis – Crops

Beside structures, there are farm crops within the area of the Matilija Dam Feasibility Study. Crop and pastureland assessments are done differently from structural and content damage analysis. The types of farm crops found within the flood area are cut flowers, seeds, lemons, oranges, orchards, and truck farming crops. The typical truck crops are tomatoes, lettuces, melons, beets, broccoli, celery, radishes, onions, cabbage, and strawberries. The acres of cropland were determined by estimates using GIS photo mapping tools and from conversation with farmers and knowledgeable individuals. It should be noted the crop damage analysis was limited and does not follow all the guidelines as set forth in the regulations.

The following table shows the crops and the acres involved in the 500-year floodplain. The largest group of crops is the flower and seed group followed by the tree-bearing group of lemons, oranges, and orchards.

Table 12: Matilija Dam - Crops
Affected By The 500-Year Floodplain

Crop	Acres
Flower/Seed	96
Lemons	6
Oranges	5
Orchards	56
Truck Farming	1
Total	164

The crop damage calculations entail the determination of market value per acre by crop. There are 17 crop parcels within the 500-year flood area. Following are notes regarding the assumptions and parameters on the crops.

Flower/Seed notes:
1. Flowers and seeds are grown the year around.
2. Annual revenue per acre averages $15,000.
3. The number of crops per year is 3 to 4.

Citrus notes:
1. Flood damage to citrus can be of two aspects: harvest loss and the tree loss.
2. Loss of tree is by flood uprooting or root rot from standing water on the root.
3. Water standing of 7 days would cause about 50 percent of tree loss.

Truck Farming notes:
1. Crops are grown the year around.
2. Annual revenue per acre averages $12,000.
3. There are multiple crops grown and it is assumed an average of 3 harvests per year.

The annual market value per acre for each crop was determined and is shown in the following table.

Table 13: Matilija Dam Market Values – Crops

Crop	$ Amount/Acre
Flower/Seed	$15,000
Lemons	$6,840
Oranges	$6,840
Orchards	$6,840
Truck Farming	$12,000

The formula for the expected crop damages per acre is as follows:

Expected Crop Damage = Market Value of the crop (times)
Monthly probability of flood (times)
Flood duration probability (0-day, 1-day, … , 7day) (times)
Percent of expected crop damage.

The next table shows the expected crop damages per acre by crops. These unit cost numbers are not changed by the different flood events of 10, 50, 100, and 500 years.

Table 14: Matilija Dam Expect Unit Crop Damages

Crop	$ Amount/Acre
Flower/Seed	$2,160
Lemons	$855
Oranges	$855
Orchards	$855
Truck Farming	$1,728

The following table displays the dollar damage of crops at current market values (without discounting) that are involved for the floodplains of 10, 50, 100, and 500 years. Also shown are the acres involved.

Table 15: Matilija Dam Crop Expected Damages
Price Levels of FY 2004

Event	Dollars	Acres
10-Year Flood	$68,240	42
50-Year Flood	$136,600	92
100-Year Flood	$181,000	115
500-Year Flood	$266,600	164

Using the dollars from the above table on crop damages in the basic EAD calculation found annualized value of crop damages in FY 2004 dollars to be $15,220. The calculation takes into account the dollar amounts of crop damage and the probabilities of the flooding events occurring. The following was assumed in regards to non-damages points. Reaches 1 and 5 have no crops. Reaches 2, 4 and 6 have a 5-year non-damaging point. Reach 3 has a 100-year non-damaging point. The next table shows the result of the basic EAD calculation by Reaches.

Table 16: Matilija Dam Crop Expected Damages by Reaches
Price Levels of FY 2004
500-Year and Less – Annualized Values

Location	Dollars
Reach 1	$0
Reach 2	$13,470
Reach 3	$160
Reach 4	$790
Reach 5	$0
Reach 6	$800
Reach 7	$0
Total	$15,220

These expected crops damages from flooding are not of significant magnitude.

Damage Analysis – Summary

The result of both the Structural & Content damage analysis and the Crop damage analysis for the 500-year flood event or less has a combined annualized damage value of $163,200. Future housing growth in the damage area is assumed to be low. Therefore, the annualized damage value is not expected to increase dramatically due to future housing growth based upon Corps current assessment.

WITHOUT PROJECT CONDITIONS/ENVIRONMENTAL CONDITIONS

Environmental Restoration Analysis

Baseline conditions are without project conditions. Economic analysis will be conducted on the incremental changes to the number of habitats from the resulting restoration alternatives. The types of habitat examined are Riparian Habitat, Steelhead Habitat and Natural Processes (the average of Natural Hydrological Regime and Natural Sediment Regime).

The Riparian Habitat is the combination all the sub-type habitats that occur along a river corridor. Steelhead Habitat used a "best professional judgment" approach as to the quality and the passage of steelhead fish in determining habitat value score. Natural processes involved a consensus review by the Environmental Working Group on important natural processes that affect the quality of the riparian ecosystem.

The baseline condition Habitat Units are shown in the following table. A modified Habitat Evaluation Procedure (HEP) was used to estimate the Habitat Units.

Table 17: Estimated Habitat Units – Baseline Condition

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Target Year	Riparian Habitat	Stealhead Habitat	Natural Processes	Total Habitat Units
0	1032	177	228	1437
5	1029	234	228	1491
20	944	234	228	1406
50	784	234	286	1304
AAHUs	917	231	245	1393

Incremental economic analysis will be based upon the changes from the baseline condition of Habitat Unit numbers. Habitat Unit changes result from the environmental restoration alternatives that are evaluated and reviewed during the with project conditions study phase. The model to be used is the IWR-PLAN program that provides incremental cost analysis to identify the cost effective alternative or combinations of the environmental measures.

WITH PROJECT CONDITIONS/ENVIRONMENTAL CONDITIONS

NED/NER Analysis

Primary purpose of the Matilija Dam Removal Project is habitat restoration. The economic analysis is National Ecosystem Restoration (NER). Flood control in the form of floodwalls and levees are part of the project. Specifically, flood control is incidental and part of the mitigation plan. Although flood damage reduction benefits are part of National Economic Development (NED) it could be used as a deciding factor between equivalent NER plans when the restoration outputs are the same and the total project costs being the same between the alternatives.

The current approach includes the flood control cost (but not the NED benefits) in the cost effectiveness and incremental cost analysis. The Flood control cost for the purpose of Flood mitigation is included in the project cost of the alternatives. Flood mitigation and compensation actions are addressed in the Risk and Uncertainty section.

Project Alternatives

Seven overall alternatives have been developed besides the No Action Alternative which is the without project condition. The study team developed the alternatives with engineering aspect being the most critical element. Each alternative produced both unique and common project costs. Some of the alternatives involved phased constructions. The accounting of phased construction costs is specifically addressed in ER 1105-2-100, Appendix D. pp 17 and D30 – D31. This document states the following:

- Project benefits and costs shall be compared at a common point in time.
- Use the same period of analysis for all alternative plans.
- In cases where alternatives have different implementation periods, a common base year will be established and costs and benefits will be compounded or discounted to that base year.
- If staged installation is proposed over an extended period of time, the installation period is the time needed to install the first phase.
- Benefits accruing during the project construction should be documented and included in the benefit evaluation. These benefits should be brought forward from the time the benefits start to the beginning of the period of analysis, using the project discount rate. Benefits (and costs) first are stated in present worth terms as of the beginning of the period of analysis, and then are annualized.

Alternatives 3a and 3b which are incremental dam removal with slurry transportation of the “Reservoir Area” fines offsite and incremental Dam removal with natural transport of “Reservoir Area” fines respectively have phased construction periods.

O&M Costs are part of the each alternative. O&M costs have various occurrence interval and time periods. The shortest occurrence interval is one year for one time. The longest occurrence interval is 25 years. Since the O&M Costs are spread over time its necessary to apply discount factors to them to get present values. All the costs are then evaluated on the basis of annualized costs over a project life of 50-years.

Description of Alternatives

Alternative 0 is the No Action Alternative. Models and analysis show over time the reservoir behind the Matilija Dam will completely fill with fines and other sediments. When the reservoir is filled, water and fines will over top the Dam. This occurrence is expected to 38 to 40 years. The effect of the Dam will be nullified except for its physical presence.

Alternative 1 calls for the full removal of the Dam and the mechanical transport of the settlement. This alternative will require downstream flood control protection. The contractor can sell the coarse and gravel.

Alternative 2a has the full removal of the Dam and a quantity of the reservoir material slurred to offsite disposal. An amount of flood control protection would be added consisting of floodwalls and levees that would be greater than those of Alternative 1.

Alternative 2b has the full removal of the Dam and natural transport of "Reservoir Area" fines. This alternative 2b has the same amount of added flood control protection as Alternative 2a.

Alternative 3a calls for incremental Dam removal in two phases. The second phase being completed some 60 months after the start of construction for phase 1. "Reservoir Area" fines are slurred offsite as in Alternative 2a. Added flood control protection is the same amount as alternative 2a.

Alternative 3b calls for incremental Dam removal in two phases. The second phase being completed some 54 months after the start of construction for phase 1. The "Reservoir Area" fines are moved downstream through natural transportation. Added flood control protection is the same amount as alternative 2a.

Alternative 4a has full removal of the Dam over a three-year period. The fines are placed upstream in a permanent placement area. Added flood control protection is the same amount as alternative1.

Alternative 4b has full removal of the Dam over a three-year period. The fine materials are placed upstream in a temporary area. Added flood control protection is the same amount as alternative 2a.

Benefits of Alternatives

The following table summarizes the result of the HEP analysis. Shown are the Annual Average Habitat Units (AAHUs) by the Alternatives. The last column shows the incremental Habitat Units that are above the No Action alternative.

Table 18: Alternatives - Habitat Units

rev 6-17-04

Comparison of Environmental Outputs

Alternative	Steelhead Component	Riparian Component	Natural Component	Total Habitat Units	Incremental Habitat Units to Alternative 0
0	231	917	245	1393	0
1	491	1143	368	2002	609
2.a	473	1136	462	2071	678
2.b	473	1136	462	2071	678
3.a	473	1136	462	2071	678
3.b	473	1136	462	2071	678
4.a	493	1140	315	1948	554
4.b	514	1147	464	2125	731

source: EIR/EIS Section- Habitat Appendix , NOTE numbers may not add exactly due to rounding

The incremental increases to Habitat Units are in the Steelhead and Natural Component of the environmental outputs. The percent increase in Habitat Units from the No Action Alternative to the Alternatives ranges from about 20 to 40 percent.

Costs of the Alternatives

The following table is a summary of the engineering cost estimates of the Alternatives. The estimate costs are for construction first costs. These costs do not include O&M costs. The engineering cost estimates for levee costs are at mitigation to current level of protection (or to 100-year FEMA level if the increase in costs are not substantial and thus considered to be an incidental benefit to the project).

Table 19: Alternatives – Construction First Costs

Matilija Dam Removal OMN Costs							
SUMMARY OF COSTS							
FY 2004 (PRICE LEVEL)							
revised 4/30/04							
	Alt. No. 1 full dam remv/mech transp, disp fines,sell aggr	**Alt. No. 2A full dam remv/nat transp, slurry fines offsite**	**Alt. No. 2B full dam remv/nat transp reservoir fines**	**Alt. No. 3A incr dam remv/slurry fines offisite**	**Alt. No. 3B incr dam remv/nat transp fines offisite**	**Alt. No. 4A full dam remv/perm stailization on site**	**Alt. No. 4B full dam remv/temp stailization on site**
I. Construction First Costs							
a. Flood control RE,costs	$12,519,000	$12,641,400	$12,641,400	$12,641,400	$12,641,400	$12,519,000	$12,641,400
b. Rip Rap for downstream slope protection	$52,500	$192,000	$192,000	$192,000	$192,000	$52,500	$192,000
b.2 Rip Rap for for channel						$3,352,500	
c. Mobilization, Demobilization, and Preparatory	$5,000,000	$5,000,000	$5,000,000	$7,500,000	$6,000,000	$5,000,000	$5,000,000
d. Clearing,grubbing,arundo erad,divers wtr, fish reloc.	$1,795,000	$1,930,000	$2,092,350	$2,165,000	$2,227,350	$1,795,000	$1,795,000
c. Excavation includes phase 2	$1,574,500	$1,574,500	$1,574,500	$1,959,500	$1,574,500	$1,574,500	$1,574,500
d. Drilling and blasting	$5,202,400	$5,202,400	$5,202,400	$5,202,400	$5,202,400	$5,202,400	$5,202,400
e. Process concrete,haul, remv metal	$2,063,997	$2,063,997	$2,063,997	$2,063,997	$2,063,997	$2,063,997	$2,063,997
f. Import water fr Casitas	$5,251,050	$5,251,050	$0	$5,251,050	$0	$5,131,050	$5,251,050
g. Dredge / excavate fines	$5,400,000	$5,400,000	$5,720,000	$5,400,000	$6,955,000	$11,640,000	$5,400,000
h. Slurry	$4,162,380	$4,934,865	$0	$4,934,865	$0	$4,934,865	$4,934,865
i. Disposal area, etc incl. Drying sediments	$3,492,000	$3,150,000	$141,500	$3,015,000	$0	$3,297,000	$3,432,000
j. Channel excavation & truck fines	$9,600,000	$0	$0	$0	$0	$0	$3,339,000
k. Site restore	$1,077,500	$1,077,500	$1,077,500	$1,077,500	$1,077,500	$1,070,000	$1,077,500
l. Road repair	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000
m. Disposal Site Closure	$200,000	$200,000	$0	$200,000	$0	$200,000	$200,000
m. Soil Cement wall	$1,366,530	$0	$0	$0	$0	$0	$1,887,000
n. Robles sediment removal/basin/bypass	$4,700,000	$10,400,000	$4,700,000	$10,400,000	$4,700,000	$4,700,000	$4,700,000
o. Wells	$800,000	$800,000	$800,000	$800,000	$800,000	$800,000	$800,000
p. Water loss restitution	$0	$0	$31,200,000	$0	$31,200,000	$0	$0
q. Arundo Eradication Downstream	$5,032,500	$5,032,500	$5,032,500	$5,032,500	$5,032,500	$5,032,500	$5,032,500
q. Contingency for Risk	$0	$0	$2,480,445	$0	$1,144,440	$0	$0
Subtotal Construction Costs	$69,389,357	$64,950,212	$80,018,592	$67,935,212	$80,911,087	$68,465,312	$64,623,212
Contingency 25%	$17,347,339	$16,237,553	$20,004,648	$16,983,803	$20,227,772	$17,116,328	$16,155,803
Planning, Survey, Engineering and Design 10%	$6,938,936	$6,495,021	$8,001,859	$6,793,521	$8,091,109	$6,846,531	$6,462,321
Engineering during contruction 1%	$693,894	$649,502	$800,186	$679,352	$809,111	$684,653	$646,232
Supervision and administration 6.5%	$4,510,308	$4,221,764	$5,201,208	$4,415,789	$5,259,221	$4,450,245	$4,200,509
Total Costs	**$98,879,834**	**$92,554,052**	**$114,026,494**	**$96,807,677**	**$115,298,299**	**$97,563,070**	**$92,088,077**

The range of Construction First Costs ranges from $92.1 million dollars to about $115.3 million dollars

Cost Effective Analysis

The following table accounts for Costs of the Alternatives including O&M costs in present values and annual cost terms. O&M costs range from $0.284 million dollars to $0.436 million dollars in present value terms. The annual cost numbers are based upon a project life of 50 years and a discount rate of 5.625 percent.

Table 20: Alternatives – NER Accounts

MATILIJA DAM REMOVAL FEASIBILITY STUDY NATIONAL ECOSYSTEM RESTORATION (FY 2004 PRICE LEVELS)							
rev 9-1-04							
	Alt. No. 1	Alt. No. 2A	Alt. No. 2B	Alt. No. 3A	Alt. No. 3B	Alt. No. 4A	Alt. No. 4B
Average Annual Habitat Units (AAHU)	2002	2071	2070	2071	2071	1947	2124
Gains beyond No Action (AAHU)	609.0	678.0	678.0	678.0	678.0	554.0	731.0
			Grost Project Costs				
Total Project Construction Costs (First Costs)	$98,879,834	$92,554,052	$114,026,494	$96,807,677	$115,298,299	$97,563,070	$92,088,077
Montoring and Adaptive Management	$4,943,992	$4,627,703	$5,701,325	$4,840,384	$5,764,915	$4,878,153	$4,604,404
Cultural Resources	$988,798	$925,541	$1,140,265	$968,077	$1,152,983	$975,631	$920,881
Total First Costs NER Project							
Interest During Construction (Phase1 only)	$5,376,043	$5,032,113	$6,199,558	$5,101,088	$5,961,246	$8,223,981	$5,006,779
Phase 2 Adjustment for Alt.3 Const. to base year				-$251,618	-$391,290		
Total Gross Investment	$110,188,667	$103,139,409	$127,067,641	$107,465,608	$127,786,153	$111,640,835	$102,620,140
			Annual Costs				
Annual Cost of Total Gross Investment	$6,627,674	$6,203,672	$7,642,917	$6,463,886	$7,686,135	$6,715,019	$6,172,439
Annual Cost of Maintenance (O&M)	$289,265	$433,256	$319,910	$436,483	$319,526	$283,785	$325,594
Total Annual Costs (AAC)	$6,916,938	$6,636,928	$7,962,827	$6,900,369	$8,005,660	$6,998,805	$6,498,033
Average annnual cost per AAHUs	**$11,357.86**	**$9,788.98**	**$11,744.58**	**$10,177.54**	**$11,807.76**	**$12,633.22**	**$8,889.24**
Footnote: No Action Alternative has 1393 AAHU							
Total Gross Investment does not include recreation costs (all alternatives) and betterment costs for desilting basin (Alternative 4b)							

The average annual cost per AAHUs ranges from $8,890 to $12,630.

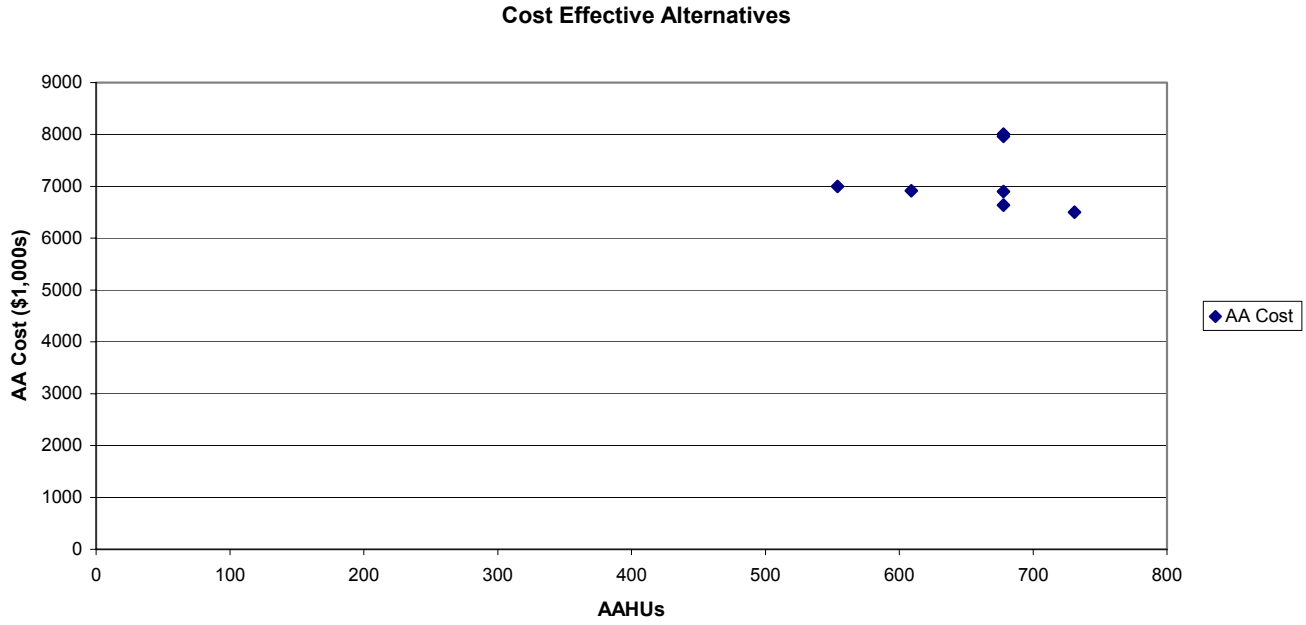
Table 21: Cost Effective Analysis

Matilija Dam Removal Project
Cost Effectivenvess Analysis
(in $1,000s)

Alternatives	AAHU	AA Cost	AAC/AAHU
4a	554	$6,999	$12.63
1	609	$6,917	$11.36
3b	678	$8,006	$11.81
2b	678	$7,963	$11.74
3a	678	$6,900	$10.18
2a	678	$6,637	$9.79
4b	731	$6,498	$8.89

Table 21 shows alternatives in order of habitat units from the lowest to the highest. Alternative 4b has the lowest average annual cost per AAHU. By defination alternatives are cost effective if there are no other alternative that can provide the same output at a lower cost. Therefore, from table 21 there is only one alternative that is cost effective. That alternative is 4b.

Graph 4: Alternatives – AAC/AAHUs



Incremental Cost Analysis

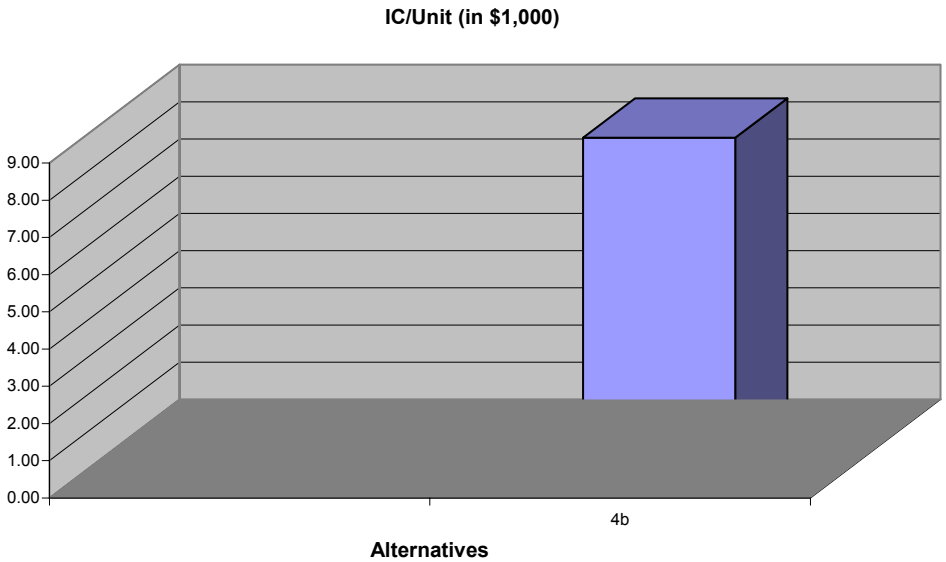
The alternative 4b is the only best buy of the alternatives. The best buy is based upon the lowest incremental average annual cost per incremental increase in output. The following table shows the incremental cost numbers.

Table 22: Incremental Cost

Incremental Analysis						
Alternative	AAHU	AA Cost	Per Unit	Cost Effective	Incremental AA Cost	Incremental Cost per Unit
4a	554	6999	12.63357	na	na	na
1	609	6917	11.35796	na	na	na
3b	678	8006	11.80826	na	na	na
2b	678	7963	11.74484	na	na	na
3a	678	6900	10.17699	na	na	na
2a	678	6637	9.789086	na	na	na
4b	731	6498	8.889193	731	6498	8.89

Alternative 4b is the cost effective (best buy) plan. All the other Alternatives are more costly per unit of output. Alternative 4b provides the greatest output. At this point the incremental analysis ends with Alternative 4b being selected as the only plan remaining in the analysis and is the NER recommended plan.

Graph 5: Incremental Cost Per Unit



Recommended Plan – Cost Revised

The following tables are cost revisions to the recommended plan 4b. The revisions do not change the outcome of the previous section on Incremental Cost Analysis.

Table 23: Cost Summary – Revision Plan 4B

Matilija Dam Removal Costs
SUMMARY OF COSTS -4B ONLY
FY 2004 (PRICE LEVEL)

revised 9-14-04 only on 4b

	Alt. No. 4B full dam remv/temp stailization on site
Construction First Costs	
Flood control RE,costs & LERRD	$23,091,150
Rip Rap for downstream slope protection	$0
Rip Rap for for channel	$0
Mobilization, Demobilization, and Preparatory	$5,000,000
Clearing,grubbing,arundo erad,divers wtr, fish reloc.	$1,902,680
Excavation includes phase 2	$1,890,000
Drilling and blasting	$6,605,500
Process concrete,haul, remv metal	$1,942,684
Import water fr Casitas	$5,322,330
Dredge / excavate fines	$6,300,000
Slurry	$5,080,010
Disposal area, etc incl. Drying sediments	$3,303,100
Channel excavation & truck fines	$3,339,000
Site restore	$1,037,500
Road repair	$122,600
Disposal Site Closure	$200,000
Soil Cement wall	$1,887,000
Robles sediment removal/basin/bypass	$4,650,000
Wells	$800,000
Water loss restitution	$0
Arundo Eradication Downstream	$5,032,500
Contingency for Risk	$0
Subtotal Construction Costs	$77,506,054
Contingency 25%	$19,376,514
Planning, Survey, Engineering and Design 10%	$7,750,605
Engineering during contruction 1%	$775,061
Supervision and administration 6.5%	$5,037,894
Total Costs	**$110,446,127**

Table 24: NER Accounts – Plan 4b Cost Revision

MATILIJA DAM REMOVAL FEASIBILITY STUDY
NATIONAL ECOSYSTEM RESTORATION - PLAN 4B
(FY 2004 PRICE LEVELS)

rev 9-14-04 on 4b only

	Alt. No. 4B
Average Annual Habitat Units (AAHU)	2124
Gains beyond No Action (AAHU)	731.0
Total Project Construction Costs (First Costs)	$110,446,127
Montoring and Adaptive Management	$5,522,306
Cultural Resources	$1,104,461
Interest During Construction (Phase1 only)	$6,004,896
Total Gross Investment	$123,077,790
Annual Cost of Total Gross Investment	$7,402,934
Annual Cost of Maintenance (O&M)	$259,940
Total Annual Costs (AAC)	$7,662,874
Average annnual cost per AAHUs	**$10,482.73**

Footnote: No Action Alternative has 1393 AAHU
Total Gross Investment does not include recreation costs (all alternatives) and betterment costs for desilting basin (Alternative 4b)

Flood Control (Per Alternative 4b Recommended Plan)

Flood control was not the primary purpose to be addressed by this Feasibility Study. The primary purpose of this Feasibility Study is ecosystem restoration. However, flood control measures were determined to be necessary to mitigate for induced flooding impacts associated with all of the restoration alternatives. The key feature of the alternatives, which is the removal of Matilija Dam, results in the deposit of accumulated sediment in downstream areas, which in turn reduces channel capacities and increases potential flooding. To address these induced

flooding impacts, mitigation features were developed, including the addition of or increases to existing levees or floodwalls at a number of sites along Matilija Creek and the Ventura River.

An economic analysis was conducted to quantify the amount of induced flooding resulting from the implementation of the Recommended Plan (Alternative 4b) without providing these mitigation features. The following table shows with-project (but without mitigation) flood damages by flood probability.

Table 25: Matilija Dam - Economic Damages With Project Price Levels of FY 2004

rev. 8-31-04 5b.xls	10-Year Flood	50-Year Flood	100-Year Flood	500-Year Flood
$ in FY 2004				
Residential - SF Structure Value	$0	$5,204,772	$6,240,338	$8,953,406
Residential - SF Content Value	$0	$2,877,529	$3,435,666	$4,850,750
Residential - MH Structure Value	$234,954	$940,549	$1,056,356	$1,206,245
Residential - MH Content Value	$128,262	$507,950	$558,711	$637,272
Residential - MF Structure Value	$13,644	$129,921	$131,486	$253,421
Residential - MF Content Value	$7,445	$72,397	$73,179	$137,591
Commercial - Structure Value	$0	$227,422	$256,306	$364,332
Commercial - Content Value(@res)	$0	$125,197	$139,984	$187,349
Industrial - Structure Value	$0	$11,457	$19,921	$1,903,244
Industrial - Content Value	$0	$11,457	$19,921	$1,903,244
Farms w/buildings Str. Value	$76,056	$324,652	$451,503	$606,352
Farms w/buildings Cont. Value	$45,974	$188,566	$254,917	$336,291
TOTAL	$506,335	$10,621,869	$12,638,288	$21,339,497

These calculations show increases in damages from the baseline conditions**.** The calculations show an increase in damages for the 10-year event of $506,330, 50-year event of $6,850,870, for the 100-year event of $7,646,340, and for the 500-year event of $3,070,950 relative to without project conditions. The EAD calculations for damages are depicted in the next table. The expected damages are by Reaches and are in FY 2004 dollars. Reaches 3 and 4 have large increases in damages. These damages are calculated before any mitigation and assume only the existing level of protection of levees and floodwalls.

Table 26: Matilija Dam - Expected Annual Damages by Reach With Project (Alternative 4b), Without Flood Damage Mitigation Features

Locaction	Dollars
Reach 1	$1,410
Reach 2	$36,132
Reach 3	$406,515
Reach 4	$223,709
Reach 5	$15,545
Reach 6	$0
Reach 7	$0
Total	$683,311

The table above includes the baseline damages. The induced damages of the project are separately shown in the next table.

Table 27: Matilija Dam - Induced Damages by Reach
With Project (Alternative 4b) Without Flood Damage Mitigation Features

Locaction	Dollars
Reach 1	$522
Reach 2	$10,113
Reach 3	$319,899
Reach 4	$194,050
Reach 5	$10,719
Reach 6	$0
Reach 7	$0
Total	$535,302

The table above shows that implementing the Recommended Plan without any mitigation features would result in an increase in expected annual damages in excess of $535,300. The cost of mitigation features developed to address most of the induced flooding impacts totals $15,928,550. This includes the cost of levees, floodwalls, bridge modifications, and the acquisition of several properties. The analysis of induced damages in the above tables does not include the properties at Matilija Hot Springs and Camino Cielo. These properties are being acquired because they could not be protected by levees or floodwalls. The cost of these acquisitions is $4,815,000. . Subtracting the cost of the acquisition from the flood mitigation features leaves a net of $11,113,550. The annualized cost of these remaining features is approximately $668,460. The next table shows the analysis of damages and mitigations by reaches. Reach 3 is economically justified for the planned mitigation features. However, the other reaches are not economically justified for the planned mitigation features. Additional analyses will be conducted during PED.

Table 28: Matilija Dam - Damages and Cost of Mitigations by Reach

LOCATION	ITEM - FEATURE	REACH	ANNUAL	Equalivant Capital or First Cost
Camino Cielo	damages	6		
	mitigation-bridge removal/restoration		($306,757)	($5,100,000)
	damages-mitigations=		($306,757)	($5,100,000)
Meiners Oaks	damages	5/6	$10,719	$178,000
	mitigation-levees		($66,163)	($1,100,000)
	mitigation-ROW (right of way)		($156)	($2,600)
	damages-mitigations=		($55,600)	($924,600)
Live Oaks	damages	4	$194,050	$3,225,000
	mitigation-levees		($78,193)	($1,300,000)
	mitigation-santa ana bridge modifications		($168,415)	($2,800,000)
	mitigation-ROW		($319)	($5,300)
	mitigation-santa ana bridge mod. structure		($159)	($2,650)
	damages-mitigations=		($53,036)	($882,950)
Casitas Springs	damages	3	$319,899	$5,310,000
	mitigation-levees		($24,841)	($413,000)
	mitigation-ROW		($23,457)	($390,000)
	damages-mitigations=		$271,601	$4,507,000
	total damages		$524,668	$8,713,000
	total mitigations		($668,460)	($11,113,550)
	damages-mitigations=		($143,792)	($2,400,550)

Based upon the number and value of structures for the Matilija Hot Springs and Camino Cielo properties, as analyzed with project hydraulic data, it appears likely that the cost of acquisition for these properties is not economically justified. However, acquisition of the properties is included as mitigation for flood control because issue of safety and hydraulic uncertainty remains at these locations. Under the high sediment deposit scenario the properties are severely affected.

It should be noted, that there are some downstream locations where engineering analysis indicates that there could be some induced flooding impacts, but no mitigation features have been developed. These areas are primarily agricultural. Any potential damages would be primarily limited to some increased depth and duration, potentially inducing minor crop damages. During the PED phase, an analysis will be conducted to determine the extent of such impacts, and whether flowage easements or real estate acquisitions will be necessary.

Also, H&H analyses indicate some minor induced flooding to the Ojai Valley Sanitary District Waste Water Treatment Plant. During PED, a determination will be made regarding the extent of induced damages and any necessary mitigation features (most likely floodwalls).

Arundo Removal

The removal of arundo was analysis by reach. Each reach analysis looked at the density by acres and the HEP values. The annualized costs were based upon a discount rate of 5.625 percent and a project life of 50 years. The average annual increase in habitat unit by reach is based on the comparison between the no action plan and recommended plan (alternative 4b). The average annual cost by reach was based upon the initial work in year one to remove the arundo on a reach-by-reach basis, and the O&M cost associated with the control of new arundo growth for years two through five. The initial cost per acre column is the cost for the initial removal of the arundo in the first year divided by the number of acres of arundo by reach.

Table 29: Cost Effectiveness of Arundo Removal

Arundo CE/ICA Summary					
	AAHU Increase by Reach	Avg. Annual Cost by Reach	AA Cost/AA Habitat Unit	AA Cost/Acre	Initial Cost/Acre
Reach 1	11	$23,850	$2,168	$353	$6,016
Reach 2	55	$92,100	$1,674	$313	$5,455
Reach 3	17	$20,700	$1,218	$297	$5,051
Reach 4	55	$77,500	$1,409	$367	$6,392
Reach 5	39	$69,400	$1,779	$141	$2,450
Reach 6	7	$7,800	$1,114	$165	$2,651
Reach 7	45	$67,400	$1,497	$572	$10,000
Total or Average	229	$360,450	$1,574	$315	$4,793

The last line in the table above show total for AAHU increases by reach and for average annual cost by reach.

Recreation

The recreation plan will involve a network of trails and interpretive areas. Trails would involve sites upstream from the dam site, the eastern edge of Matilija Lake, and access to Wilderness Areas. The trails would provide low-impact observation positions for the habitat areas of Matilija Canyon and serve as hiking paths. As for more multi-use of the trails, thought has been given to bikeway trails and connections. A number of interpretive areas have been identified. These areas or sites are the dam site, the geologic landmark of the Hanging Rock, and the northern end of the project area. Other features are the amenities of water and restroom facilities.

Recreation Benefit Analysis

The removal of Matilija Dam offers unique opportunities for recreational experience. Prior to the building of the dam in 1947 the valley was used for fishing, picnics, and hiking. Private development and the building of the dam limited many of the past recreation activities and amenities. The development of the Matilija Dam Ecosystem Restoration Project as planned offer again these and different recreation activities, that were discussed in the main report.

The Corps is required to provide economic justification where the combined monetary and non-monetary benefits exceed the monetary and non-monetary costs. It should be recognized that this analysis is preliminary until Corps and the Sponsor adopt a recreation plan. The recreation benefit analysis is based upon ER 1105-2-100 (April 22, 2000) and Economic Guidance Memorandum 04-03, Unit Day Values for Recreation, Fiscal Year 2004. The methodology of unit day values was chosen because the other methods of evaluating the benefits of recreation using travel cost or contingent valuation do not directly lend themselves to the analysis of these recreation activities at and near the Matilija Dam removal site without the benefit of a survey or historical data.

The use of the Unit Day Values entails estimating the capacity for people and parking at the Matilija Dam removal site, which is the limiting factor for this analysis in determining the benefits at that site. Recreation features will not be constructed until after the dam removal and the establishment of habitats. The establishment of recreation on a more permanent basis is assumed to be 5-10 years from the initial start of the dam removal project.

The access road would be improved as part of the dam removal effort. Future trails will be on paths, roadbeds, and along sediment removal lines. The amount of trails near the dam removal site is expected to be approximately 6,200 feet (1.2 miles) in length with potential for more trails. This area is also a trailhead to the Wilderness Area of the Los Padres National Forest. An extension of a bike path from Ojai city to the dam removal site is expected to bring more visitations to the site. The area further below the dam removal site will also contain trails with the length estimated at 25,000 feet (4.7 miles).

The number of parking spaces at the dam removal site has not been determined or fully analyzed, but the current recreation plan calls for a parking lot of 10 to 20 vehicles. The parking lot would serve both as a drop-off point and a daily usage point. The Matilija Reservoir site contains a little over 440 acres. For the purpose of this analysis ninety percent are expected to visit by vehicles and the remaining ten percent are visitors who hike in or bike in. The National Recreation and Park Association on Recreation Standards provide an estimate of visitors. The number is 40 hikers/day/mile on rural trails. The Dam Removal site has 1.2 miles of trails, which means 47 visitors per day. The area below the Dam Removal site has 4.7 miles, which means 189 visitors per day. The combined numbers of visitors on these proposed trails is 236. The majority of the recreation use at the site is expected to be along the proposed trails.

To derive a value of the visitations, the Corps of Engineers Regulation 1105-2-100 guidance for assigning unit day values (UDV) was utilized. Specifically, Table 1 from the Economic Guidance Memorandum 04-03 provides a method of assigning "points" to general recreation activities and is reproduced in the following table.

Table 30: Guidelines for Assigning Points for General Recreation

Criteria	**Judgment factors =>**				
Recreation experience (1) Total Points: 30 Point Value	Two general activities (2) 0-4	Several general activities 5-10	Several general activities: one high quality value activity (3) 11-16	Several general activities; more than one high quality high activity 17-23	Numerous high quality value activities; some general activities 24-30
Availability of opportunity (4) Total Points: 18 Point Value:	Several within 1 hr. travel time; a few within 30 min. travel time 0-3	Several within 1 hr. travel time; none within 30 min. travel time. 4-6	One or two within 1 hr. travel time; none within 45 min. travel time 7-10	None within 1 hr. travel time 11-14	None within 2 hr. travel time 15-18
Carrying capacity (3) Total Points: 14 Point Value:	Minimum facility for development for public health and safety 0-2	Basic facility to conduct activity(ies) 3-5	Adequate facilities to conduct without deterioration of the resource or activity experience 6-8	Optimum facilities to conduct activity at site potential 9-11	Ultimate facilities to achieve intent of selected alternate 12-14
Accessibility Total Points: 18 Point Value:	Limited access by any means to site or within site 0-3	Fair access, poor quality roads to site; limited access within site 4-6	Fair access, fair road to site; fair access, good roads within site 7-10	Good access, good roads to site; fair access,good roads within site 11-14	Good access,high standard road to site; good access within site 15-18
Environmental Total Points: 20 Point Value:	Low esthetic factors (6) that significantly lower quality (7) 0-2	Average esthetic quality;factor exist that lower quality to minor degree 3-6	Above average esthetic quality;any limiting factors can be reasonably rectified 7-10	High esthetic quality;no factors exist that lower quality 11-15	Outstanding esthetic quality;no factors exist that lower quality 16-20

(1) Value for water-oriented activities should be adjusted if significant seasonal water level changes occur.
(2) General activities include those that are common to the region and that are usually of normal quality. This includes picnicking, camping, hiking, riding, cycling, and fishing and hunting of normal quality.
(3) High quality value activities including those that are not common to the region and/or Nation, and that are usually of high quality.
(4) Likelihood of success at fishing and hunting.
(5) Value should be adjusted for overuse.
(6) Major esthetic qualities to be considered including geology and topography, water, and vegetation.
(7) Factors to be considered to lowering quality include air and water pollution, pests, poor climate, and unsightly adjacent areas.

The point values were assigned based on the quality, relative scarcity, ease of access, and esthetic features of the recreational activity expected at Matilija Dam Removal Site. A higher point value reflects a higher quality recreation experience. The maximum recreation value is 100 points.

The following table evaluates the recreation point value for the Matiija Dam Removal Site.

Table 31: Evaluation of The Unit Day Value – Future

Criteria	Key Variables	Range of Point Values	Assigned Value
Recreation Experience	Number & type of activities	0-30	10
Avaiability of Opportunity	# of similar opportunities nearby	0-18	3
Carrying Capacity	Adequacy of facilities for activities	0-14	3
Assessibility	Ease of access to and whithin site	0-18	6
Environmental	Esthetic quality of site	0-20	8
Total		0-100	30

For the current study the recreation point value is 30. The basis of the assigned values were as follows:

Recreation experience – hiking, bike riding, and picnicking, but not in a particularly high quality setting.
Availability of opportunity – located in a rural and mountainous area where there is competition with other nearby areas for hiking, bike riding and picnicking.
Carrying Capacity – recreation within an environmental restoration site is limited. Parking being another limiting factor. Assumes parking area being from less than one acre to three acres in size.
Accessibility – road to Matilija Dam removal site is narrow with only two lanes for traffic. Some road improvement with the removal project.
Environmental – Improved environmental quality with the restoration of habitats, but not to be unusual or exotic.

The point value is converted into a dollar value using the current Economic Guidance Memorandum on Unit day Values for Recreation (which is revised each fiscal year). In this study the 2004 conversions for the recreation point values are used and shown in the next table.

Table 32: Conversion of Point Value to Dollar Value

General Recreation Values	
Point Value	FY 2004
0	$3.00
10	$3.57
20	$3.94
30	$4.50
40	$5.63
50	$6.38
60	$6.94
70	$7.32
80	$8.07
90	$8.63
100	$9.01

The table for General Recreation Values was used even though the site is rural, an entry point to a wilderness area, a restored environmental habitat, and in a limited access area. The reason for using General Recreation Values is the recreation activities are common. The point value of 30 for the UDV is $4.50. With the average daily visitation rate estimated at 236 persons the daily value is $1,062. The expected number of visitors per year would be for this initial analysis is 86,140. The demand for this recreational opportunity is expected to come from both local and regional populations. The recreation benefits are $3.98 million dollars based upon a discount rate of 5.625 percent and a project life of 50 years. Equivalently, the resulting annualized recreation benefit stream during the 50-year life of the project is $239,200.

The costs for the recreation and its maintenance have been examined. The initial cost estimate for this recreation plan is $1.0 million dollars and the maintenance cost estimate is $91,000 per year. On a present value basis the recreation cost including maintenance cost is $2.51 million. Facilities, roads, parking, and other improvements constructed during the dam removal and transport of fines is incorporated into the recreation plan. This is a cost saving and reduces time in the development of site for recreational activities. The recreation analysis places benefits at $3.98 million dollars on a present value basis. The annualized values are as follows: Benefits equals $239,390 and the Costs equal $150,970. The Benefit-Cost ratio is 1.58. The recreation plan as currently outlined is economically justified based upon a Benefit-Cost ratio greater than one.

RISK AND UNCERTAINTY

General

The removal of the Matilija Dam causes Risk and Uncertainty in regards to the elevation of the water during storm events. This is especially acute in the areas where there are existing levees and where sediments of sands are expected to accumulate both permanently and temporarily. H&H provided analysis in the critical areas of the existing levees and areas where new levees will need to be added to mitigate for induced flooding effects of the dam removal.

The location points that were examined are listed in the following tables. The first table lists existing levees that would need to be improved that are located at Live Oak, Casitas Springs, and Ventura city. The second table lists the new mitigation levees/floodwalls that would be needed for mitigation purposes. A new levee/floodwall for mitigation is located at Meiners Oaks (Hawthorne Acres). The levees to be upgraded are at Live Oak and Casitas Springs.

Table 33: Existing Levees/Floodwalls

Location	Station miles	Status	Bank Side	Levee or wall length- approx
Live Oak	10.13 - 9.40	existing	right	4,490 feet
Casitas Springs	7.85 - 6.84	existing	left	5,300 feet
Ventura city	2.38 - 0.00	existing	left	12,566 feet

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Table 34: Mitigation Levees/Floodwalls

Location	Station miles	Status	Bank Side	Mitigation Levee or wall length- approx
Meiners Oaks	14.40 - 13.45	new	left	5,023 feet
Live Oak- add LV/FW & higher	10.60 - 9.40	upgrade	right	6,512 feet
Casitas Springs- higher LV/FW	7.85 - 6.84	upgrade	left	5,300 feet

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Note: LV – Levees, FW – Floodwalls

Analysis of Risk and Uncertainty

The Risk & Uncertainty analysis was focused on Alternative 4b, since this is both the NER Plan and the locally preferred alternative. H&H has produced water surface profiles for both without and with project conditions for key index locations associated with current levees and where additional (New) levees or floodwalls are needed to mitigate flood damages resulting from this project. The Corps used HEC-FDA Flood Damage Analysis computer program for formulating and evaluating flood damage reduction measures. Simply put the model determines levee or floodwall heights that best accounts for Uncertainty and Risk. Any additional levees or increase in levee heights, which are not required for mitigation for induced flooding, would have to be economically justified or accounted for separately. The standard practice in flood control is to allow additional levee or levee heights based upon standard deviations in addition to the expectation of the water elevation for margin. The memo titled "Guidance on Levee Certification For The National Flood Insurance Program" (CECW-E 25 March 1997) discussed risk-based analysis and criteria for certification for existing and proposed levees. The minimum levee level for FEMA certification corresponds to a 90% chance of non-exceedance for the one percent flood. This essentially means that there is at least a 90 percent computed probability that the levee will contain the flows resulting from a storm event with a one percent chance of occurring in any given year. The upper level for certification corresponds to a 95% chance of non-exceedance. As a practical matter two standard deviations is usually used to identify the additional elevation margin for the corresponding 95% chance of non-exceedance. The addition of freeboard to account for Risk and Uncertainty as practiced in the past provided a safety margin, however such practice has been deemed insufficient from an analytical standpoint, and has the effect of increasing the project costs without properly accounting for the increased benefits.

For the Matilija project, the need is to replace, upgrade, or add protection equal to the without project levels when with project conditions alters the water surface elevations. Also, this analysis looked at requirements for FEMA 100-Year certification at those mitigation locations.

The results of the HEC-FDA are based on the following basic assumptions:

- No freeboard addition.
- Indexed points used to characterize an area or an existing levee for with project mitigation.
- For each indexed point the discharge-frequency function was determined.
- Uncertainty in frequency/discharge functions were calculated using the graphical method, based upon a 68 year period of record.
- Stage discharge error values were provided by H&H. Values for with-project conditions are higher, reflecting the expected impacts of sediment deposition.

The current levels of protections at the index locations are as follows:

Meiners Oaks	100-year protection
Live Oak	plus100-year protection
Casitas Spring	50-year protection.

These levels only apply at the index location and do not apply to the entire reach.

The following table shows the discharge flows.

Table 35: Discharge Flow – In CFS

	Meiners Oaks	Live Oaks	Casitas Springs
2-Year*	6,000	6,200	15,800
5-Year*	11,200	11,400	26,600
10-year	15,000	16,000	35,200
20-Year	18,800	19,800	44,400
50-Year	24,000	24,800	56,600
100-year	27,100	28,300	66,600
200-Year*	30,600	34,800	77,000
500-Year	35,200	36,700	89,000
* values interpolated			

Results

The next table summarizes the results for levee height requirements. The column titled "Mitigation To Current Level" shows the height requirements of the new levees and the additional height requirements for existing levees to maintain their respective without project levels of protection. The column titled "100-Year FEMA Level" shows the height requirements for new levees and the height additions to existing (upgrade) levees to meet FEMA certification requirements (this analysis was based upon meeting a 95% conditional non-exceedance level to be conservative).

Table 36: Heights for Levees/Floodwalls under With Project Conditions

Location	Index Point	Status	Mitigation To Current Protection Level	100-Year FEMA Level
Meiners Oaks	13.7311	new	5 feet	5 feet
Live Oak- add LV/FW & higher	9.5644	upgrade	6 feet	4 feet
Casitas Springs- higher LV/FW	7.3844	upgrade	3 feet	5 feet

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Note for the upgrade levee height is measured from the top of the current levee. For a new levee, the height is measured from the top of the riverbank. Live Oak levee currently has over 100-year flood event protection. Therefore, the mitigation levee would be greater than the 100-year FEMA requirement for levee height. The difference is two feet of levee height (6 feet versus 4 feet). The new levee at Meiners Oaks (Hawthorne Acres) for mitigation is at 5 feet and this meets the FEMA criteria at the indexed point. However, for the Meiners Oaks site, it should be noted breakouts occur further downstream of the indexed point causing water outflow at less than the 10-year event. The levee height based upon this indexed point may or may not be sufficient for the entire levee length. At Casitas Springs the mitigation levee would be 3 feet higher than the current levee. For the Casitas Springs levee to meet the 100-year FEMA criteria the levee would have to be 5 feet higher than the current level height or 2 feet higher that the mitigation levee height.

Further Analysis on Crop Damage

The with project floodplain was reviewed separately for induced crop damages. This was a limited analysis that examined the recommended plan (Alternative 4b). Water surface elevations and floodplain outlines were used. The damage estimates below represent increases over without project condition values shown in Table 15.

Table 37: Matilija Dam - Expected Incremental Crop Damages
Price Levels of FY 2004

Event	Dollars	Acres
10-Year Flood	$32,400	15
50-Year Flood	$34,110	17
100-Year Flood	$34,110	17
500-Year Flood	$1,710	2

The crop damages shown in the table above correspond to an annualized cost (EAD) of $5,000 per year or a first cost of $80,000. This is the induced portion of the crop damages from Matilija Dam removal associated with the recommended plan (Alternative 4b). This cost is part of the overall project cost.