Appendix J.
Desert NWR
Bighorn Sheep Discussion

Desert Bighorn Sheep Population Objectives

Prepared by Bruce Zeller

The refuge-wide desert bighorn sheep population objective, as listed in the Refuge Management Plan, Part II (1987) and draft Sheep Management Plan (1990), is 2000. Based on helicopter survey data gathered during the fifteen year period between 1974 and 1988, the refuge-wide desert bighorn population was at or very near the objective level (see Table 1.).

During the last fifteen years, 1989-2003, the refuge-wide desert bighorn population is approximately 1000 individuals below the objective level (see Table 2.). Therefore, a 100% increase or doubling of the population is required to reach the objective level. Most of the shortfall is accounted for by declines in the Sheep Mountains sub-population and the smaller, more transitory sub-population of the adjunct East Desert Mountains.

Table 1. Fall helicopter survey results by mountain range on DNWR, 1974-1988.

Year	No. of Bighorn Recorded Per Mountain Range					
	Las Vegas	Sheep*	E. Desert	Desert	Pintwater	
1974	111	172	97	70	50	
1975	89	183	83	17		
1976						
1977	79	331	91	102	114	
1978	73	239	41	30	82	
1979	21	403	29	10	75	
1980		436			28	
1981	46	297	65	37	37	
1982	27	146			68	
1983	45	346	49	17	120	
1984		205				
1985	38	436	87	38	94	
1986	34	361	73	29	75	
1987	39	280	19	85	104	
1988	11	215	54	48	104	
Total:	613	4050	688	483	951	
Average:	51.1	289.3	62.5	43.9	79.3	
(1)						
Ave. Est. Pop:	194	1096	174	220	300	Grand Total: 1984

*Smaller sample sizes during 1974, 1975, 1978, 1982 & 1984 are directly correlated to reductions in survey hours. Because no adjustment was made for those years when survey hours were reduced, the average estimated population is skewed downward.

Table 2. Fall helicopter survey results by mountain range on DNWR, 1989-2003

Year	No. Bighorn Recorded Per Mountain Range					
	Las Vegas	Sheep*	E. Desert	Desert	Pintwater	
1989	46	146	15	28	51	
1990	53	146	10	62	67	
1991	33	78	31	46	72	
1992	55	66	25	57	60	
1993	87	61	21	47	92	
1994	39	38	20	28	76	
1995	65	60	19	35	56	
1996	41	37	29	34	67	
1997	34	39	4	26	57	
1998	65	42	14	28	47	
1999	43	70	10	27	64	
2000	70	59	25	8	63	
2001		16	17	72	68	
2002	51	50	13	41	46	
2003	53	57	6	48	67	
Total:	735	965	259	587	953	
Average:	49.0	64.3	17.3	39.1	63.5	
(1) Ave. Est. Pop.:	186	244	48	196	241	Grand Total: 915

*Smaller sample sizes during 1996, 1997, 2001 & 2002 may be partially correlated to reductions in survey hours. Because no adjustment was made for those years when survey hours were reduced, the average population estimate may be skewed slightly downward.

(1)Footnote: Population estimates derived by dividing the average no. of sheep recorded by the observation rate or visibility factor (all ranges = 40%) and the percentage of habitat surveyed (Las Vegas, Sheep & Pintwater Ranges = 66%; Desert Range = 50%; East Desert Range = 90%)

As a result of the biological review conducted in April, 2003, there was a recommendation to establish a population objective for each mountain range/sub-population. It was further recommended that a threshold level (minimum sub-population size) be set for each mountain range. Decline below the threshold level would trigger an "all-out", immediate strategy(s) to reverse the trend.

The suggested objectives and thresholds are presented in the following table. All objectives are based on data presented in Table 1., except the Spotted Mountains. The Spotted Mountains resident herd is a relative young sub-population, established by trans-locations in 1993 and 1996, with only three years of helicopter data. Empirical evidence indicates that small desert bighorn populations, those with fewer than 50 individuals, may be susceptible to extinction (Berger 1990, 1991, Krausman et al. 1993, Krausman et al. 1999). This was the basis for using 50 as the threshold level for all ranges except the Sheep Mountains. Fifty desert bighorn in the expansive habitat of the Sheep Mountains would represent an extremely low/unacceptable density; thus, its threshold was set at a higher level.

Table 3. Population objectives and thresholds by mountain range on DNWR.

Mountain Range	Objective	Threshold
Las Vegas	200	50
Sheep	1000	150
East Desert	100*	50
Desert	250	50
Pintwater	300	50
Spotted	150	50
Total:	2000	

*The average population for the East Desert Mountains in Table 1. is believed to be inflated by high numbers of migrants from the Sheep Mountains. The East Desert Range is relative small with only two man-made water developments; therefore, a more realistic resident, bighorn population objective is 100.

Literature Cited

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Appendix K.
CCP Implementation

The Comprehensive Conservation Plan (CCP) for the Desert National Wildlife Refuge Complex will be prepared following approval of the Final EIS and issuance of the Record of Decision (ROD), which will identify the selected plan. This appendix combined with Chapters 1 and 4, portions of Chapter 2, and Appendix E of the Final EIS will form the basis for the Final CCP. Implementation of the CCP can begin following the issuance of the ROD. Although it is our intent to implement the proposed strategies (projects) by the established deadlines, the timing of implementation may vary depending upon a variety of factors, including funding, staffing, compliance with Federal regulations, partnerships, and the results of monitoring and evaluation. Some strategies, such as those related to habitat restoration, will require the completion of step-down plans and appropriate environmental compliance documents before they can be implemented. This appendix defines how the preferred alternative for each refuge in the Desert NWR Complex (described in Chapter 3) would be implemented if they are identified as the selected plan in the ROD.

During the 15 years following CCP approval, the CCP will serve as the primary reference document for all refuge planning, operations, and management. Appendix E lists the various wildlife and habitat management and visitor services goals, objectives, and strategies for the preferred alternative for each refuge. Completion of any of these actions would however be dependent upon the various factors. These strategies would be implemented with assistance from new and existing partners, including public agencies, tribes, non-governmental organizations, and the public. Consistent public outreach and continued coordination with refuge constituents are essential components of this implementation process. Some of the partnership opportunities to be explored during the 15-year life of this CCP are described below, as are the stepdown plans, monitoring responsibilities, and staffing and funding requirements needed to successfully implement the CCP.

CCPs are intended to evolve with each Refuge, and the Improvement Act specifically requires that these plans be formally revised and updated at least every 15 years. The formal revision process will follow the same steps as those implemented for the initial CCP development process, with a major emphasis placed on public involvement. Until a formal revision is initiated, the Service will periodically review and update the CCP (at least as often as every five years) to address needs identified as a result of monitoring or in response to adaptive management procedures. This CCP will also be informally reviewed by refuge staff while preparing annual work plans and updating the refuge databases. It may also be reviewed during routine inspections or programmatic evaluations. Results of any or all of these reviews may indicate a need to modify the plan. The goals described in this CCP will not change until they are reevaluated as part of the formal CCP revision process. However, the objectives and strategies may be revised to better address changing circumstances or to take advantage of increased knowledge of refuge resources. If revisions to the CCP are required prior to the initiation of formal revisions, the level of public involvement and associated NEPA documentation will be determined by the Refuge Manager.

Monitoring

Monitoring the effects of management actions on the Refuges' trust resources is an important component of the CCP, as is the documentation of the Refuges' baseline conditions. By completing baseline inventories and monitoring specific management actions, Refuge staff can better understand the species, habitats, and physical processes that occur on the Refuges and the ecological interactions that occur between species. Monitoring is an ongoing management activity at each refuge in the Desert NWR Complex and will continue per available funding. Appendix E identifies several new and/or expanded inventories and monitoring actions for each refuge.

Adaptive Management

Adaptive management involves sequential decision making, integrating project design, management, and monitoring to systematically test assumptions. Based on the data and lessons learned, subsequent phases of an ongoing restoration project or a new restoration project with similar objectives can be revised as necessary to maximize project objectives over time. Adequate baseline data, clearly defined and measurable project objectives, a monitoring plan focused on measurable results, and a process for refining and improving current and future management actions are all essential components of a successful adaptive management approach to restoration. Each of these components would be addressed during step down planning, and the details of the adaptive management approach would be integrated into final restoration plans

Step-Down Plans

Some projects such as public use programs and habitat restoration proposals require more in-depth planning than the CCP process is designed to provide. For these projects, the Service prepares step-down plans. Step-down plans provide additional planning and design details necessary to implement the strategies (projects or programs) identified in the CCP. Several step-down plans are proposed for completion following the approval of the CCP. Table 1 lists the step-down plans proposed for each refuge along with the target date for completion.

Compliance Requirements of Plan Implementation

All projects and step-down plans described in the CCP will be required to comply with NEPA and the Improvement Act, as well as a variety of other Federal regulations, executive orders, and legislative acts, which are described in greater detail in Chapter 6 of this document. The EIS is intended to address all proposed actions at the program level; however, some actions once defined in greater detail may require additional analysis and review under NEPA.

Anticipated Costs and Staffing Needs to Fully Implement the CCP

The estimated costs for the various projects described for the preferred alternatives for each refuge are presented in Table 2. These costs are rough estimates and will be refined as more details are available. To fully implement the proposed actions and achieve the goals and objectives of the CCP for the four Refuges, additional staff will be necessary. Table 3 presents the current and future (proposed) staff needs for management of the each refuge.

Potential Funding Sources for Implementing CCP Projects

Many projects included in the CCP may be implemented in full or in part by sources other than the Refuge annual budget. These projects could be funded through partnerships with other local, state, or federal agencies, special legislative appropriations, or grants (i.e., Southern Nevada Public Lands Management Act, National Fish and Wildlife Foundation, Transportation Enhancement Funds). Other potential sources of funding for restoration projects include: the North American Wetlands Conservation Act Grants Program; and the Cooperative Endangered Species Conservation Fund.

Partnership Opportunities

Many programs on the refuges, both existing and planned, are made possible through a variety of public/private, interagency, and tribal partnerships. Chapter 1 of the EIS includes a brief description the existing partnerships at each refuge.

Table 1. Step-down plans proposed for the Desert NWR Complex

Plan	*Target for Completion*
Ash Meadows NWR	
Restoration plan for Crystal Management Unit	2011
Restoration plan for Carson Slough Management Unit	2011
Site restoration plans for Upper Point of Rocks, Jackrabbit Spring, the Warm Springs Unit (North and South Indian Springs and School Springs), Lower Point of Rocks, Lower Kings Pool, Marsh, Big, Fairbanks, Tubbs, Bradford, Crystal, Forest, and North and South Scruggs Springs	Within 15 years
Transportation Plan	2010
Resurfacing plan for main roads	2012
Plan to remove dikes in uplands	2011
Plan for Modification and/or removal of Crystal Reservoir	2011
Data management plan	2008
Environmental Education Plan	2010
Visitor Services Plan	2008
Hunting step-down	Within 3 yrs
Cultural Resources Management Plan	Within 15 yrs
Desert NWR	
Sheep Management Plan	2009
Inventory and Monitoring Plan	Within 15 yrs
Restoration Plan for areas along the s. & e. boundaries	Within 15 yrs
Moapa Valley NWR	
Long-term Water Resources Management Plan	2008
Integrated Pest Management Plan	Within 15 yrs
Inventory and Monitoring Plan	Within 5 yrs
Habitat Management Plan	Within 3 yrs
Pahranagat NWR	
Fisheries Management Plan	Within 3 yrs
Habitat Management Plan	Within 3 yrs
Inventory and Monitoring plan	Within 5 yrs
Water Resources Management Plan	2012
Integrated Pest Management Plan	2009
Spring Restoration Plan	2012
Refugium for endangered and native fish	2012
Interpretive plan	Within 5 yrs

Table 2. Estimated One-Time Project Costs to Implement CCP

Expenditure (Related Strategy)	*Estimated Cost (1000s)*[1]
Ash Meadows NWR	
Conduct baseline inventories on vegetation communities, small mammals, herps, and pollinators (1.1.1)	1,400
Complete a four year baseline inventory and monitoring for endemic fish species and a three year baseline inventory and monitoring for the southwest willow flycatcher (1.1.2)	710
Continue and improve inventory of native species diversity and distribution (1.1.3)	50
Continue and improve inventory of non-native species diversity and distribution (1.1.4)	50
Conduct baseline and periodic monitoring of endangered or threatened bird species (1.1.11)	25
Conduct periodic monitoring of secretive marsh birds and sensitive species of waterfowl (1.1.12)	25
Develop and implement habitat restoration and translocation protocols for target species, including consideration of timing of habitat restoration and genetics (1.3.1)	55
Develop life history and habitat conservation models of target species (1.3.3)	156
Complete and implement Restoration Plans for Upper Point of Rocks, Jackrabbit Spring , and the Warm Springs Unit (North and South Indian Springs and School Springs) (1.3.6)	1,000
Complete and implement the restoration plans for Lower Point of Rocks, Lower Kings Pool, Marsh, Big, and Fairbanks Springs (1.3.6)	1,250
Develop and implement restoration plans for Tubbs, Bradford, Crystal, Forest, and North and South Scruggs Springs (1.3.10)	1,500
Based on outcome of Carson Slough Restoration Plan, develop and implement restorations plans for Longstreet and Rogers Springs (1.3.11)	1,000
Restore Point of Rocks spring outflow channel habitat to known suitability and monitor parameters (ex. temperature, flow, depth, etc.) to inform adaptive management (1.4.1)	175
Perform experimental planting and monitoring on test sites, representative of Refuge habitat (1.5.2)	22
Conduct habitat suitability study for listed plants (ex. Niterwort) (1.5.6)	45
Complete a feasibility study for construction of an on-site greenhouse to supply plants for restoration on the Refuge (1.5.7)	35
Within 15 years of CCP construct a refugium for the Ash Meadows speckled dace if feasible (1.6.3)	335
Within 5 years, complete a feasibility assessment of on-site and off-site refugia for all other Ash Meadows NWR endemic species (1.6.4)	25
Obtain normal color aerial photography on a decadal scale or more frequently if necessary (2.1.1)	
Improve Refuge-wide vegetation map through ground surveys and updating of GIS layers (2.1.2)	380
Obtain 1-2 foot contour data for Refuge to aid in restoration and planning activities (2.1.5)	65
Within 10 years obtain baseline data on spring discharge, flood frequency, and groundwater elevation for seventeen springs identified in the Refuge Biological Assessment (2.2.4)	85
Conduct an assessment of berms, ditches, dams, impoundments, and reservoir basins (2.3.1)	45
After assessment initiate removal of dams, impoundments, and unnecessary roads within the Warm Springs, Jackrabbit/Big Springs, Upper Carson Slough, and Crystal Springs units to restore natural hydrology on a landscape scale (2.3.2)	3,000
Restore natural average and range of variability, flood frequency, water quality and water table elevation for open water at Peterson Reservoir and Horseshoe Reservoir (2.3.4)	22
Restore Crystal Spring outflow to historic channel, through the administrative area, when the	500

[1] A variety of funding sources could be used to pay for project costs, including appropriated funds (annual refuge budget), Southern Nevada Public Lands Management Act, National Fish and Wildlife Foundation, and Transportation Enhancement Funds

Expenditure (Related Strategy)	*Estimated Cost (1000s)*[1]
office/visitor center is relocated (2.3.5)	
Conduct a study to evaluate nutrient input to streams from roads (2.3.9)	55
Implement the plan for the modification or removal of Crystal Reservoir (2.3.10)	
Install temporary fish barriers until bass eradication is complete at Big and Jackrabbit springs (2.3.12)	80
Inventory, assess, and mitigate landscape disturbances including graded lands, mines, fences and other disturbances (2.3.13)	145
Within ten years, reduce salt cedar and Russian knapweed distribution by 75 to 95% of the 2006 distribution on 4,000 acres of Refuge land of salt cedar (2.4.2)	
Replace or add gates on service or fire roads and sign them (2.6.12)	2.5
Add 11 to 15 road gates to prevent unauthorized use of roads and resource damage (2.6.15)	7.5
Develop a Resurfacing Plan for main roads through and on the Refuge that considers the restoration of slough hydrology (2.6.16)	85
Complete the Refuge Transportation Plan (2.6.19)	213
Conduct a study to obtain historic plant distribution through pollen analysis (2.7.4)	175
Restore historic hydrology and revegetate mesquite bosques and dunes along spring channels and in former agricultural fields (2.8.2)	11,000
Rehabilitate 30-45% of old agricultural fields by controlling invasive species and installing native plants (2.8.7)	1,500
Develop and implement plan to remove dikes in uplands	100
Complete a study to obtain biological and geomorphic data to inform demolition and restoration plan for Crystal Reservoir (2.11.1)	254
Establish conservation agreements or acquire in-holdings from willing sellers (2.12.2)	9,000
Conduct a literature review of aquatic invasive species ecology, trophic interactions and eradication treatments, for detrimental species (3.1.1)	3
Conduct experiments on Refuge habitat and species impacts and trophic interactions due to aquatic invasive species (3.1.2)	33
Conduct a study of crayfish ecology on Refuge (3.1.4)	34
Conduct laboratory and field experiments on eradication/control techniques (3.1.5)	33
Study exclusion methods to restrict movement of non-native fish (ex. large mouth bass, green sunfish, etc.) into native fish habitat (3.1.6)	12
Complete studies and analysis of historic data to link uplands, alkali meadows, and springs habitats (3.3.2)	35
Conduct studies to obtain basic life history information for endemic and listed plant species (3.3.3)	60
Conduct taxonomic studies of Refuge plant species (3.3.4)	384
Install a weather station within each of the three major drainage basins (3.4.1)	135
Complete a study to obtain core samples from old spring mounds, Carson Slough, etc. (3.4.2)	45
Conduct tree ring studies to determine growth patterns over long periods of time (3.4.3)	207
Conduct studies of past pollen and spore distribution (palynology studies) (3.4.4)	176
Conduct a comprehensive Refuge terrestrial species inventory (3.5.2)	1,200
Conduct bat studies (3.5.3)	96
Complete a study to obtain baseline information on reptiles and amphibians (3.5.4)	381
Conduct a one-year assessment on the relationship between coarse woody debris and terrestrial invertebrates and continue monitoring if feasible (3.5.5)	33
Conduct a study to assess contribution of invertebrates associated with coarse woody debris to terrestrial macrofauna diet (3.5.6)	25

Expenditure (Related Strategy)	*Estimated Cost (1000s)*[1]
Evaluate dust impacts to listed plants through two-year studies (lab and field) and generate recommendations for road management (3.6.2)	45
Complete a study to determine the historic fire regime for Ash Meadows prior to broad establishment of invasive species (3.7.6)	100
Identify and archive existing datasets, including hard copy only data (ex. maps, photos, diaries, etc.) (3.8.3)	75
Contract a feasibility study for location and design of an on-site research facility (3.9.2)	65
Complete an assessment of visitor education needs and opportunities (4.1.3)	3
Develop an outreach Plan to support the Carson Slough Restoration Plan (4.1.12)	8
Develop a an educational video on the endemic fish and other wildlife of Ash Meadows NWR (4.1.13)	45
Design and construct boardwalks to follow Kings Pool Stream from parking lot to Kings Pool, with a pool overlook (4.2.1)	700
Design and construct interpretative displays for new boardwalks to be installed at Point of Rocks (4.2.2)	144
Design and construct boardwalk to the Longstreet Cabin and an overlook for the Longstreet Spring pool (4.2.3)	132
Improve Point of Rocks and Longstreet Cabin parking areas (4.2.5)	91
Conduct a study of Refuge visitation to determine the number and purpose of visits (4.2.7)	35
Improve signs on Refuge boundary (4.2.8)	360
Develop multi-lingual interpretative materials and construct new interpretive facilities at Fairbanks Springs (4.2.11)	35
Design and construct other interpretive facilities identified in the Interpretive Plan (4.2.12)	4,500
Develop and implement a comprehensive Visitor Services Plan by 2009	25
Improve existing roadways and parking areas to good condition as described in the Ash Meadows Refuge Roads Inventory (2004) (4.2.15)	2,500
Contract for a feasibility study for location and design of new headquarters/visitor contact station building (4.6.2)	145
Contract for construction of the new facility (4.6.3)	3,600
Compile all existing baseline data on cultural resources sites, surveys, and reports within, and near, the Ash Meadows NWR. And create digital, GIS, and hard copy databases, maps, and a library (5.1.5)	15
Prepare evaluation criteria and conduct a cultural resource inventory at all public use areas, roads, impacted areas, and other destinations on Ash Meadows NWR and areas that would be affected by Refuge projects (5.2.1)	544
Inventory, evaluate, mitigate adverse effects and stabilize samples of cultural resources on Ash Meadows NWR using a research design prepared in consultation with appropriate tribes and the scientific community (5.2.3)	65
Conduct a study of ethnobotany and traditional plant use locations on Ash Meadows NWR in consultation with appropriate tribes (5.2.4)	80
Update Refuge brochures and interpretive signs with appropriate cultural resources information (5.3.8)	20
Identify and evaluate cultural resources subject to looting/vandalism, erosion, or deterioration and implement steps, including barriers and signs to reduce these threats and preserve the resources (5.4.1)	35
Total	**38,596**
Desert NWR	
Determine connectivity between sub-populations and their habitats on- and off-Refuge using	50

Expenditure (Related Strategy)	*Estimated Cost (1000s)*[1]
historical records, random sightings, and radio-tracking data. (1.1.9)	
Remove highly flammable vegetation around catchments as needed to protect from wildfires. (1.1.11)	50
Evaluate and adjust as necessary the current population monitoring methodology to determine adequacy for trend analyses. (1.1.12)	25
Construct additional rainwater catchments if existing sources are determined to be inadequate. (1.1.13)	50
Conduct a radio telemetry study to assess bighorn sheep mortality factors, particularly mountain lion predation, home ranges and habitat utilization/abandonment, and other research priorities. Coordinate radio telemetry with Air Force so that an appropriate band can be assigned to prevent transmission problems or equipment failure. (1.1.15)	100
Collect blood and fecal samples to determine general health of herd, diet composition and nutrient uptake, and genetic diversity. (1.1.16)	50
Develop and implement a Sheep Management Plan in cooperation with NDOW. The Plan would be flexible and address a number of issues such as management of water developments, herd health, predator management, habitat management (prescribed fire) and population management (translocations). (1.1.18)	100
Develop survey and mapping data using GIS tools and following the standards provided in the USFWS WH8 Promises Team report regarding biotic and abiotic data layers. (2.1.4)	50
Develop and implement an inventory and monitoring plan in coordination with FWS Endangered Species Program, NDOW, DOD and academic institutions. (2.1.5)	50
Establish permanent, representative sample plots in each major plant community on the refuge. At each site, conduct baseline inventory of plant and animal species composition and abundance. Repeat inventories every five years. (2.1.6)	250
Construct and maintain a steel post and cable fence along the southern boundary. (2.2.9)	2,000
Where necessary, fence and maintain the eastern boundary using a steel post and cable construction method. (2.2.12)	2,000
Develop and implement plan to close illegal trails and rehabilitate damaged habitat along the southern boundary. (2.2.14)	500
Use prescribed fire and naturally ignited fires to restore vegetation characteristics representative of a natural fire regime (assume helicopter ignition, 2,000 ac/year for five years) (2.3.2)	100
Work with partners to fill data gaps in fire ecology of Desert NWR plant communities. (2.3.4)	50
Work with the Air Force to update the MOU as required by Public Law 106-65. (3.1.1)	50
Survey and rectify the RNA boundaries with accurate legal descriptions and ground markers. (3.2.1)	50
Conduct photographic reconnaissance and documentation of all RNAs. (3.2.2)	25
Develop cultural resources interpretive and environmental education materials in coordination with the Native American tribes. (4.1.7)	25
Develop live "sheep cam" at water development and stream video through website and to visitor contact station/center. Apply for SNPLMA funds, or other appropriate sources to develop the webcam. (4.1.8)	50
Develop and install interpretive panels and signs at designated entry point(s). (4.1.9)	50
Develop and install a permanent environmental education/interpretive display at a prominent public venue such as McCarran International Airport. (4.2.1)	25
Develop and distribute a Desert Refuge video in the community. (4.2.3)	45
Evaluate potential sites and construct blinds for wildlife observation and photography. (4.3.3)	10
Improve and maintain Mormon Well and Alamo Roads to fair condition based on the 2002 Refuge Road Inventory. (4.3.4)	10,000
Map existing trails using GPS and develop trail guide. (4.3.5)	5

Expenditure (Related Strategy)	*Estimated Cost (1000s)*[1]
Use post and cable fencing to designate specific parking turnouts along Alamo, Mormon Well and Gass Peak Roads. (4.3.6)	5
Construct an entrance sign and information kiosk at the east end of Mormon Well Road. (4.3.7)	35
Compile all existing baseline data on cultural resources sites, surveys, and reports within, and near Desert NWR and create secure digital, GIS, and hard copy databases, maps, and library. (5.1.2)	30
Prepare evaluation criteria and conduct a cultural resource inventory at all public use facilities and areas that would be affected by Refuge projects. (5.2.1)	500
Inventory, evaluate, and nominate Traditional Cultural Properties and sacred sites to the National Register, in consultation with culturally affiliated Tribes. (5.2.2)	150
Inventory, evaluate and mitigate adverse effects and stabilize samples of cultural resources on Desert NWR using a research design prepared in consultation with culturally affiliated Tribes and the scientific community. (5.2.3)	65
Conduct a study of ethnobotany and traditional plant use at locations on Desert NWR in consultation with culturally affiliated Tribes. (5.2.4)	80
Create a cultural resource layer in a NWR complex GIS database that aids in the identification, planning, monitoring, and interpretation of cultural sites. (5.2.5)	25
Coordinate with the Consolidated Group of Tribal Organizations to identify potential critical/priority cultural sites on the non-military overlay of the Desert Refuge. Develop a cooperative program to survey and record these sites. (5.3.3)	50
Work with culturally affiliated Tribes on projects to restore habitats of important native plants and to harvest (for traditional non-commercial purposes) native plant foods. (5.3.4)	25
Consult with culturally affiliated Tribes and other stakeholders to design and implement educational materials, programs and activities that would be used to address traditional or sacred resources, and to increase awareness on- and off-Refuge about the sensitivity of cultural resources to visitor impacts and the penalties for vandalism. (5.3.6)	50
Identify and evaluate cultural resources subject to looting/vandalism, erosion, or deterioration and implement steps, including barriers and signs to reduce these threats and preserve the resources. (5.4.1)	35
Create and implement a cultural resources site stewardship volunteer program. (5.4.4)	25
Total	**16,835**
Moapa Valley NWR	
Continue channel restoration on the Pedersen Unit by planting native species. (1.1.1)	2
Complete restoration of the spring heads and channels on Apcar Unit. (1.1.2)	450
Restore native overstory, mid-level and understory vegetation (using local seed and/or seedlings) to riparian corridors, transitional upland sites and any disturbed or newly exposed areas. (1.1.3)	2
Develop strategies to remove non-native fish species, including mollies and mosquito fish, from Refuge streams in coordination with the USFWS Endangered Species program and NDOW. (1.1.15)	2
Inventory Refuge habitat consistent with the Moapa Dace Recovery Plan. (1.2.2)	5
Develop a GIS-enabled species inventory program, beginning with Moapa dace inventory data. (1.2.3)	10
Develop a long-term water resources management plan for the Refuge by 2009. (1.3.5)	50
Purchase and install water monitoring equipment. (1.3.7)	10
Develop and implement an Integrated Pest Management Plan to control and eradicate invasive species encroachment. (1.4.9)	50
Monitor habitat changes, maintain and continue improvements for restoration efforts and other landscape improvements, and provide adequate level of monitoring and maintenance for invasive species control and fire management. (1.4.13)	50

Expenditure (Related Strategy)	*Estimated Cost (1000s)*[1]
Conduct baseline inventories of federally listed, proposed, candidate and species of concern on the refuge; conduct baseline inventories of aquatic habitat for invertebrates and amphibians to determine species composition and abundance; and inventory existing upland habitat for migratory birds, mammals, and reptiles. (1.5.1)	50
Develop a long-term inventory and monitoring plan for federally listed, proposed, candidate and species of concern on the Refuge. (1.5.5)	50
Prepare step down habitat management plan for lands acquired within the proposed expansion area. (1.6.1)	100
Complete volunteer needs assessment, create position descriptions, and coordinate with outdoor recreation planner to recruit, hire, and train volunteers. (2.1.1)	10
Develop interpretive and environmental education materials. (2.1.6)	50
Erect a Refuge entrance sign near Warm Springs Road. (2.1.8)	2
Develop regionally focused cultural resources environmental education and interpretation materials for self guided tours. (2.1.15)	25
Confer with the Moapa Band of Paiutes to incorporate their history and native plant and animal species knowledge as part of the interpretive program at the Refuge. (2.1.16)	5
Coordinate the installation of a permanent environmental education display at the Moapa Valley Community Center or other suitable public venue. (2.1.17)	3
Construct an overlook trail with interpretive panels and shade structure on top of the hill on the Plummer unit for viewing the Refuge and the Moapa Valley. (2.1.18)	100
Design and install new interpretive panels. (2.1.19)	100
Total	**1,126**
Pahranagat NWR	
Assess the effectiveness of rotenone treatments to control carp and encourage growth of submerged aquatic vegetation. (1.1.6)	2
Implement a geotechnical engineering study of Upper Pahranagat Lake to evaluate levee integrity and water loss through the lake bottom. (1.1.10)	25
Develop a rainfall-runoff analysis for Upper Pahranagat. (1.1.12)	40
Develop and implement a habitat management plan to improve quality of existing open water habitat for waterfowl, waterbirds, shorebirds and other migratory birds. (1.1.14)	318
Control spread of bulrush at Middle marsh by chemical and mechanical means using the Integrated Pest Management (IPM) Plan protocol. (1.2.5)	100
Investigate methods to increase efficiency of water delivery from Upper Lake. (1.3.2)	318
Continue limited IPM efforts in existing 112-acre grassland habitat to contain spread by knapweed and reduce its extent. (1.3.6)	331
Determine population status, distribution and demography of Pahranagat Valley montane vole on the Refuge. (1.3.7)	10
Control salt cedar and other invasive species on 215 acres near Lower Pahranagat Lake and the Pahranagat Wash/Lower Lake area and restore Lower Pahranagat Lake edge with native plant species. (1.4.1)	331
Develop and implement a species inventory and monitoring plan to identify species composition, relative abundance, seasonality, health and distribution of waterfowl, waterbirds and shorebirds. (1.4.1)	469
Survey existing groundwater wells and repair or cap as appropriate. (1.5.3)	97
Install a new pump in Well No. 3 and monitor for flow to document beneficial use of allocation and support the water right. (1.5.4)	10
Install a flume or weir at the outflow of Lower Pahranagat Lake to assist in development of the water budget. (1.5.5)	10

Expenditure (Related Strategy)	*Estimated Cost (1000s)*[1]
Install and monitor flow meters and data loggers on each of the three ground water wells located on the Refuge. (1.5.6)	6
Develop a Refuge-wide water budget (1.5.7)	164
Install gages and data logging equipment at springs adjacent to Middle Marsh. (1.5.8)	6
Determine the status of ground water wells of record, and repair and/or abandon as appropriate, and apply for change(s) in point of use with Nevada Division of Water Resources by 2006. (1.5.11)	164
Determine the appropriate water restoration delivery system changes, prioritize restoration and develop an implementation strategy. (1.5.12)	212
Investigate the feasiblility of planting native grasses between Upper Pahranagat Lake and Middle Marsh, to control invasives such as knapweed and provide forage for sandhill cranes, waterfowl and geese. (1.6.3)	10
Complete and implement an IPM Plan. (1.7.2)	10
Use mechanical methods and prescribed fire to reduce fuels in the cottonwood/willow areas of Upper Pahranagat Lake and north Marsh. (2.1.1)	7
Secure (apply for, re-apply for) additional water rights to provide necessary water for establishment of new willow wetland habitat. (2.1.2)	4
Conduct wetland habitat vegetation surveys that include percent cover, density, age, and structure. (2.1.7)	4
Monitor the response of migratory birds, the southwestern willow flycatcher in particular, to the wetland establishment efforts. (2.1.9)	4
Restore wetland habitat on the east side of Upper Pahranagat Lake and North of the North Marsh. (2.1.10)	10
Conduct fish, invertebrate, bird, mammal and plant inventories of each spring head. (2.2.2)	40
Investigate historic photos and other records to determine pre-development characteristics of springs. (2.2.3)	10
Prepare a springhead and channel restoration plan in coordination with NDOW and USFWS Endangered Species Program. (2.2.4)	50
Implement springhead and channel restoration. (2.2.5)	500
Install physical barriers to prevent vehicle traffic in closed areas. (2.3.4)	6
Plan and design a refugium on the Refuge in coordination with NDOW and FWS-ES (2.4.1)	106
Construct a refugium for the roundtail chub on the refuge (2.4.2)	100
Post and maintain designated hunting area signs on Refuge and provide hunting information to the public through brochures, fact sheets and maps. (3.1.4)	4
Update the Fisheries Management Plan for the Refuge in coordination with NDOW. (3.2.2)	10
Improve and maintain existing restroom facilities for visitor use at Upper Pahranagat Lake. (3.2.9)	10
Assess the effects of increased water withdrawals from Upper Pahranagat Lake and North Marsh for wetlands management in Middle Marsh and Lower Pahranagat Lake on sport fisheries. (3.2.10)	6
Design and construct a wildlife viewing trail system possibly along historic farming and ranching roads and trails. (3.3.3)	10
Construct photography and observation blinds along the trail route. (3.3.4)	20
Develop and implement an interpretive plan for the Refuge by working with partners. (3.4.3)	20
Develop Refuge-specific environmental education materials. (3.4.4)	20
Develop signs, such as "least-wanted" posters, for invasive plant species. (3.4.5)	4
Construct a new visitor contact station and office space at refuge headquarters unit. (3.4.8)	2,000
Construct interpretive walking trail that connects Upper Pahranagat Lake with the Headquarters Unit. (3.4.9)	10
Focus outreach effort on six major Refuge System events: International Migratory Bird Day, the	3

Expenditure (Related Strategy)	*Estimated Cost (1000s)*[1]
Junior Duck Stamp Program, and the National Wildlife Refuge Week, Public Lands Day, Earth Day, National Fishing Day. (3.5.2)	
Compile all existing baseline data on cultural resources sites, surveys, and reports within, and near, Pahranagat NWR and create secure digital, GIS, and hard copy databases, maps, and library. (4.1.2)	20
Prepare evaluation criteria and conduct a cultural resource inventory at all public use facilities and Areas that would be affected by Refuge projects. (4.2.1)	50
Inventory, evaluate, and nominate Traditional Cultural Properties and sacred sites to the National Register, in consultation with culturally affiliated Tribes. (4.2.2)	150
Inventory, evaluate, mitigate adverse effects on and stabilize samples of cultural resources on Pahranagat NWR using a research design prepared in consultation with culturally affiliated Tribes and the scientific community. (4.2.3)	200
Conduct a study of ethnobotany and traditional plants use locations on Pahranagat NWR in consultation with culturally affiliated Tribes. (4.2.4)	60
Create a cultural resource layer in the NWR complex GIS that aids in the identification, planning and monitoring, and interpretation of cultural sites. (4.2.5)	25
Identify and evaluate cultural resources subject to looting/vandalism, erosion, or deterioration and implement steps, including barriers and signs to reduce these threats and preserve the resources. (4.4.1)	150
Create and implement a site stewardship volunteer program to assist in site monitoring, delivery of educational and interpretive literature and programs, and to promote cultural resources conservation in neighboring communities. (4.4.4)	25
Total	**6,271**

Table 3. Estimated Annual Salary and Non-Salary Operation and Maintenance Costs to Fully Implement CCP[2]

Position (grade)	Quantity	Unit	Unit Cost[3]	Total Cost
Desert NWR Complex				
Project Leader (GS-14)	1	FTE	$140,424	$140,424
Deputy Project Leader (GS-13)	1	FTE	$118,838	$118,838
ORP/Volunteer Coordinator (GS-11/12)	1	FTE	$99,934	$99,934
Supervisory Fish and Wildlife Biologist (GS-12/13)	1	FTE	$118,838	$118,838
Fisheries Biologist (GS-9/11)	1	FTE	$83,376	$83,376
Wildlife Biologist (GS-9/11)	1	FTE	$83,376	$83,376
Botanist (GS-9/11)	1	FTE	$83,376	$83,376
Fish Facility Manager (GS-11/12)	1	FTE	$99,934	$99,934
Archeologist/Tribal Coordinator (GS-11)	1	FTE	$83,376	$83,376
SNPLMA Coordinator (GS-13)	1	FTE	$99,934	$99,934
Administrative Officer (GS-9/11)	1	FTE	$83,376	$83,376
Administrative Assistant (GS-5/7)	1	FTE	$56,334	$56,334
Administrative/Office Assistant (GS-5)	1	FTE	$45,477	$45,477
Fire Management Officer (GS-11/12)	1	FTE	$99,934	$99,934
Assistant FMO (GS-9/11)	1	FTE	$83,376	$83,376
Seasonal Range Technician (GS-06)	0.5	FTE	$50,697	$25,349
Engine Captain (GS-6/7)	1	FTE	$56,334	$56,334
Forestry Technician (GS-5/6)	3	FTE	$50,697	$152,091
Supervisory Law Enforcement Officer (GS-11/12)	1	FTE	$99,934	$99,934
Refuge Law Enforcement Officer (GS-5/7/9)	4	FTE	$68,915	$275,659
Refuge Law Enforcement Officer (GS-5/7/9)	1	FTE	$68,915	$68,915
Information and Education Specialist (GS-11/12)	1	FTE	$99,934	$99,934
Environmental Education Specialist (GS-9/11)	1	FTE	$83,376	$83,376
Ash Meadows NWR				
Refuge Manager (GS-12)	1	FTE	$99,934	$99,934
Fish and Wildlife Biologist (GS-9/11)	1	FTE	$83,376	$83,376
Engineering Equipment Operator (WG-8)	1	FTE	$65,651	$65,651
Fish and Wildlife Biologist (GS-9/11)	1	FTE	$83,376	$83,376
Park Ranger (Visitor Services) (GS-9)	1	FTE	$68,915	$68,915
Laborer (WG-5)	1	FTE	$55,795	$55,795
Wildlife Refuge Specialist (GS-9/11)	1	FTE	$83,376	$83,376
Biological Technician (GS-5/7)	3	FTE	$56,334	$169,002
Administrative/Office Assistant (GS-5)	1	FTE	$45,477	$45,477
Desert NWR				
Refuge Manager (GS-12)	1	FTE	$99,934	$99,934
Wildlife Refuge Specialist (GS-9/11)	1	FTE	$83,376	$83,376
Engineering Equipment Operator (WG-8)	1	FTE	$65,651	$65,651

[2] Note: Costs could be funded through both appropriated (annual refuge budget) and non-appropriated sources (see end of table for key)

[3] Note: Salary costs based on OPM's FY2008 salary table for "Rest of US" (at step 5 of highest grade) and includes 25% for benefits and 10% for overhead (awards, travel, equipment, etc)

Environmental Education Specialist (GS-9/11)	1	FTE	$83,376	$83,376
Visual Information Specialist (GS-11)	1	FTE	$83,376	$83,376
Biological Technician (GS-5/7)	2	FTE	$56,334	$56,334
Laborer (WG-5)	1	FTE	$55,795	$55,795
Administrative/Office Assistant (GS-5)	1	FTE	$45,477	$45,477
Moapa Valley NWR				
Refuge Manager (GS-11)	1	FTE	$83,376	$83,376
Engineering Equipment Operator (WG-8)	1	FTE	$65,651	$65,651
Fish & Wildlife Biologist (GS-7/9)	1	FTE	$68,915	$68,915
Pahranagat NWR				
Refuge Manager (GS-11)	1	FTE	$83,376	$83,376
Engineering Equipment Operator (WG-8)	1	FTE	$65,651	$65,651
Wildlife Refuge Specialist (GS-9/11)	1	FTE	$83,376	$83,376
Youth Conservation Corps Team Leader (GS-5)	1	FTE	$9,620	$9,620
Youth Conservation Corps Team Members	4	PTE	$2,026	$8,104
Biological technician (GS-5/7)	2	FTE	$56,334	$56,334
Environmental Education Specialist (GS-9/11)	1	FTE	$83,376	$83,376
Administrative/Office Assistant (GS-5)	1	FTE	$45,477	$45,477
Total (current positions)	**36.5**			**$3,388,871**
Total Proposed (all positions)	**57.5**			**$4,222,972**
Estimated Non-Salary Operation and Maintenance Need				$1,386,669

Normal font = paid with appropriated funds
Italic font = paid with non-appropriated funds
indented = new position