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Title:

LANL Site-wide Water Conservation Program Plan

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LANL Site-wide Water Conservation Program Plan

"Use and manage water and related resources so that at the national, regional, and local levels, environmental, social, economic, and cultural values can be supported indefinitely."

(from "Water in the West: Challenge for the Next Century," 1998)

EXECUTIVE SUMMARY

In early summer of 1999, a report was written on behalf of the Department of Energy (DOE) entitled *"Statement of Findings for Water Quantity Issues at Los Alamos National Laboratory."* The report was transmitted to the Laboratory (LANL) by means of a memo (DOE/AOO-LAAO: LMPO:1SF-001, 9/10/99) from the Department of Energy–Los Alamos Area Office (LAAO). Subsequently, a "Water Working Group," comprised of LANL, Los Alamos County (LAC) and LAAO personnel, was formed to research and recommend a path forward in response to the issues presented.

This resulting Water Conservation Program Plan is the result of nearly two years of data-gathering, evaluation, analysis and thought-provoking exchange. The Plan follows the suggested outline from the United States Environmental Protection Agency (USEPA or EPA) Manual on Water Conservation Plan Guidelines. In the following pages the reader will find responses, in varying degree of detail, to the issues raised in the DOE memo, specifically:(1) consistency of data, (2) a single, relatively small, interdisciplinary group, (3) other methods of cooling, (4) re-use of treated wastewater, (5) working with the State Engineer's office for return flow credits, (6) strengthening the interaction and communication with other groups, such as Jemez-y-Sangre, (7) addressing the San Juan-Chama Project Water use issue, and (8) developing a lessons-learned approach.

The key recommendation resulting from this Report is to establish an Interim Water Conservation Committee and an Acting Water Conservation Officer. These entities would be tasked with producing the plans recommended in this report, ensuring ongoing activity for maintaining the plans, and developing further recommendations for establishment of a long-term committee or office approach to water conservation at Los Alamos National Laboratory.

ACKNOWLEDGEMENTS

This document is the result of countless hours and numerous meetings involving a variety of individuals, both inside and outside of Los Alamos National Laboratory (LANL). Thanks are given to the following individuals:

The those who gave of their time, energy and expertise over the past two years: Bob Beers, D'Ann Bretzke, Sherry Evans-Carmichael, Patricia Vardaro-Charles, Ed Hoth, Claire Kerven, Gilbert Montoya and David Padilla. Steve Fong and Chuck Pergler for their input and insights from the Department of Energy's view, and Tim Glasco who so ably represented Los Alamos County. Your involvement was truly invaluable;

To those that 'weighed in' at critical junctures and mentored with a 'hands-off, quiet voice' approach: Matt Johansen and Doris Garvey; thank you both for your words of wisdom and your example of professionalism. This goes to show that someone is always watching;

A special note of thanks to Dick Burick, Randy Parks, Tony Stanford, and Bev Ramsey for the initiation and impetus in forming the working group and providing continual guidance; and to Tom Starke and the E in ISM folks for recognizing the importance of water conservation, and its role at LANL;

And last but not least, Bill England, a consummate master of the intricacies of the formatted page.

S. Hanson: sp. ed.

TABLE OF CONTENTS

TABLES

CHARTS

FIGURES

ACRONYMS

AF	Acre-Foot or Feet
AFY	Acre-Feet per Year
CCF	Central Computing Facility
COCs	Cycles of Concentration
C & T	Conveyance and Transfer
CY	Calendar Year
D&D	Decommission and Demolition
DLD-ops	Deputy Laboratory Director - Operations
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
E-ESO	Environment Division – Environmental Stewardship Office
ESH	Environmental, Safety, and Health Division
ESH-ID	Environmental Safety and Health - Identification
FWO	Facility and Waste Operations Division
FWO-UI	Facility and Waste Operations – Utilities and Infrastructure
FWO-WFM	Facility and Waste Operations - Waste Facility Management

FY	Fiscal Year
LAC	Los Alamos County
LANL	Los Alamos National Laboratory
LAWPS	Los Alamos Water Production System
LDCC	Laboratory Data Communication Center
LEDA	Low Energy Demonstration Accelerator
LIR	Laboratory Implementing Requirement
MG	million gallons
MGY	million gallons per year
NPDES	National Pollutant Discharge Elimination System
NMED	New Mexico Environment Department
RLW	Radioactive Liquid Waste
RLWTF	Radioactive Liquid Waste Treatment Facility
ROI	Return on Investment
SCC	Super Computing Center
SJ-C	San Juan-Chama
SOP	Standard Operating Procedure
SWEIS	Site Wide Environmental Impact Statement
SWS	Sanitary Waste System
SWSC	Sanitary Waste System Consolidation
TA	Technical Area
TSD	Treatment Storage and Disposal Facility
TSTA	Tritium Salt Test Assembly
U.S.	United States
w/	with
w/o	without
WAC	Waste Acceptance Criteria
WETF	Weapons Evaluation Test Facility
WPF	Waste Profile Form
WMC	Waste Management Coordinator

1.0 INTRODUCTION

Los Alamos County (LAC or County) is situated in an area with resource limitations, particularly water. New Mexico is at the forefront of Western water concerns and a growing debate is over water rights, prioritization of water use, and quantity of water available. The Federal Government, various states, and the nation of Mexico will become more involved in water-rights issues in relation to the New Mexico water flows. The situation could become even more serious, should New Mexico go into a drought cycle. The issue is simple: the County and the Laboratory are located in a region that may not have adequate water resources to sustain both County and LANL growth without careful and insightful planning (Pergler, 1999).

This Water Conservation Program Plan is a response to the 1999 memo received from LAAO and addresses the following issues, specifically:

1. <u>Consistency of data</u> – Every effort was made to gather valid data and understand the interactions between the Site Wide Environmental Impact Statement for LANL, the Los Alamos County Conveyance and Transfer Environmental Impact Statement, the Mitigation Action Plan, Jemez-y-Sangre Regional Water Data, and various other water-related documents, plans and projects, much of which has been condensed and presented herein as the best-to-date factual data.
2. <u>A single, relatively small, interdisciplinary group</u> – The idea of a single point-of-contact for water data was one of the primary concepts guiding the Water Working Group and its successor, the Water Conservation Committee, as described in the Goals and Plans section of the report.
3. <u>Other methods of cooling</u> – Alternative cooling methods, such as air-cooling, were discussed, but a thorough evaluation has not been attempted.
4. <u>Reuse of treated wastewater</u> – This prospect was discussed and plans made to follow up on the suggestion of utilizing municipal waste from the Western Area portion of Los Alamos County to enhance the performance of the LANL Sanitary Wastewater Treatment Plant (TA-46) and then use the resulting water for in the cooling towers.
5. <u>Working with the State Engineer's Office for return flow credits</u> – The practicality of this endeavor was briefly discussed but not pursued, pending further discussion with other concerned groups
6. <u>Strengthen interaction and communication with other groups, such as Jemez-y-Sangre</u> - Plans have been made to both ensure that good communication takes place and that all information is consistent before being presented.
7. <u>Address the San Juan-Chama Project Water use issue</u> – Working Group representatives from Los Alamos County discussed the potential use of this water and developed a "what-if?" scenario should that water no longer be available.
8. <u>Develop a lessons-learned approach</u> – This approach is incorporated into each of the goals and plans discussed in this report.

2.0 CONSERVATION AND USAGE PLANNING GOALS

List of Conservation Goals and Their Relationship To Supply-side Planning

LANL has a target goal of 1662 acre-feet per year (AFY) (SWEIS, DOE/LAC C&T agreement), with no immediate prospect of increasing that quantity without agreement or contracting for additional water from the County. In recent years, the Laboratory has used 75-90% (1246–1500) of the target level AFY. Water demand for new projects such as the Strategic Computing Complex (SCC), Low Energy Demonstration Accelerator (LEDA), along with increased power plant operation, and enhanced Los Alamos Neutron Science Center (LANSCE) operating cycle, may require water beyond recent usage levels. In order to implement all these projects without a dramatic increase in LANL water use, ways of more efficiently using existing water will have to be found. However, there are limits to conservation and efficient operation. Once the Laboratory is running the TA-3 and TA-53 towers at five to six cycles of concentration (COC), no more significant savings can be realized. In the event the Laboratory is limited to 1662 AFY in perpetuity, the mission growth will be limited by that quantity.

3.0 CONSERVATION PLANS AND GOALS

3.1 PLANS

1. Emergency and Drought Management Plan

Deliverable: Produce a plan that is updated annually and evaluates LANL and County emergency and drought-condition scenarios.

Milestone(s): (a) gather water data from CY 2000; (b) gather current conditions data; (c) confer with those assessing flood issues and drought potentials; (d) gather information on current water production system condition; (e) draft due to FWO-DD by 5/02.

1a. Water Use Data

Deliverable: Gather the necessary information required to fully understand the current situation (i.e., Gap Analysis).

Milestone(s): (a) gather information from FWO-UI; (b) identify gaps; (c) assemble database of information currently available at LANL.

2. Water Usage Criteria

Deliverable: Develop definitive procurement criteria for fixtures, drinking fountains, landscaping, personal cooling units, etc., for new facilities and facility refurbishments.

Milestone(s): (a) identify criteria for specification; (b) address procurement LIR; (c) evaluate in relation to the Engineering Manual.

3. Engineering Design Criteria

Deliverable: Propose design criteria for water systems, irrigation systems, waste systems, and reuse systems for upgrading current and any new planned facilities.

Milestone(s): (a) identify where this information would be entered; (b) evaluate current standards.

4. Planning Guidelines

Deliverable: Develop comprehensive guidelines to ensure all future projects have assessed their impact against LANL water conservation goals. These guidelines will also ensure that all facilities and projects are using the same methodology in their planning.

Milestone(s): (a) evaluate LIRs for language; (b) evaluate inclusion into ESH-ID process; (c) address Expense, Capital, GPP, LI project scenarios.

3.2 GOALS

Short-term Goals

1. Convene an Interim Water Conservation Committee (6-10 individuals) to lay the groundwork for achieving all listed plans and goals. It is anticipated that this team would exist for 6-9 months.
2. Appoint an Acting Water Conservation Officer to chair the Water Conservation Committee.

Long-term Goals

1. Appoint Water Conservation Officer – an individual, initially out of FWO Division, appointed as the LANL POC for the data and plans addressed herein. This individual would interface with other LANL groups, County groups, Regional groups, and DOE on water conservation/usage/planning issues.
2. Achieve Zero Sum Game – using the above-mentioned tools, strive to achieve a balance where impact to the LANL mission is minimized, without increasing water consumption above the target level of 1662 AF.
3. Develop Tiered Rate – confer with the County to develop a rate structure that would allow costs to ***increase*** if water consumption exceeds the 1662 AFY **and** causes undue hardship on the County system.

   NOTE: The rate structure currently does not allow for tiered water rates to LANL. A Federal Acquisition Regulation requires that the government pay no more than any other customer of the same class. A tiered rate would therefore be required of both the County *and* of LANL for it to be imposed. This type of rate is more properly imposed on distribution customers rather than bulk-rate customers. Currently, there are only two bulk-rate "customers" -- LANL and the County distribution system. LANL may want to impose a tiered-rate structure on itself, in order to promote water conservation, but as such, cannot be imposed by the County.
4. Develop Educational Program – in conjunction with training that includes education on water conservation in the arid Southwest. Poster campaign, signs, classroom, service opportunities, etc., would all play an important part in the overall program.

3.3 DESCRIPTION OF COMMUNITY INVOLVEMENT IN GOAL DEVELOPMENT

With water conservation projects now being implemented, LANL is able to operate current and planned facilities without a significant increase from its recent past levels of water use. If the Laboratory significantly increases operation of present facilities or constructs additional ones, its historical water usage could be exceeded. Although the County, which supplies water to the Laboratory, has some unused water rights, a significant increase in Laboratory or County water usage could exceed current water resources. Consequently, it is in both the Laboratory's and the County's interests to pursue an aggressive, cost-effective, water-conservation and gray-water-reuse program. It is also in their joint interest to develop additional water resources to accommodate future growth. Water use and planning is the responsibility of the Utilities and Infrastructure group in the Facility & Waste Operations Division (FWO/UI). Although the Laboratory has no formal water conservation program, this group tracks water use and manages improvements and repairs that reduce water usage at the Laboratory (Pergler, 1999).

4.0 WATER SUPPLY/USAGE SYSTEM(S) PROFILES

Inventory of Facilities, Production Characteristics, Water Use

4.1 SUPPLY

Water levels have been measured in wells tapping the regional aquifer since the first exploratory wells were drilled by the U.S Geological Survey in the late 1940s (McLin et. al., 1998). The annual production and use of water increased from 231 million gallons per year (MGY) in 1947 to a peak of 1,732 MGY in 1976. Water use has declined since 1976 to 1,286 MGY in 1997 (McLin et. al., 1997; McLin et. al., 1998). Trends in water levels in the wells reflect a plateau-wide decline in regional aquifer water levels in response to municipal water production. The decline is gradual and does not exceed 1 to 2 feet per year for most production wells (McLin et. al., 1998). When pumping stops in the production wells, the static water level returns in about 6-12 months. Hence, these long-term declines are not currently viewed as a threat to the water supply system (McLin et. al., 1998).

The firm rated capacity of the Los Alamos water production system is 7,797 gpm, or approximately 4,100 MGY (DOE, 1998). The firm rated capacity is the maximum amount of water that can be pumped immediately to meet peak demand. Peak water demand for the area was established to be 7,300 gpm (DOE 1998). In October 1975, the New Mexico Office of the State Engineer approved DOE's request to combine surface and ground water rights into a total right of 5,541.3 AFY, or approximately 1,806 MGY. Generally, the water tanks have a combined terminal storage of 35-40 million gallons (MG) (DOE/LAC 1998). Under drought-like conditions, daily water production alone may not be sufficient to meet water demands and the terminal storage supply must be relied upon to make up the difference. Of notable interest is the fact that the consumption of 1,501 MGY in 2000 (Glasco, 2001) occurred during a year of drought and with a major fire disaster (albeit the town was evacuated and normal operations of LANL were not restarted for a significant period of time).

Current fire protection guidelines call for a minimum terminal storage supply of 10 MG (DOE/LAC, 1998). However, the Water Service Contract between the County and the DOE calls for achievement of a safety factor of 2 with regards to fire protection needs; i.e., to maintain a terminal storage reserve of 20 MGY (DOE/LAC, 1998). Therefore, the capacity of the water delivery system is adequate to meet both peak demand and total utilization of water right.

On September 8, 1998, the DOE transferred to the County of Los Alamos its contract rights to 1,200 AFY of San Juan-Chama Project waters, a component of the Colorado River Storage Project. These waters may be used to furnish water for municipal, domestic, and industrial uses and for other beneficial purposes (DOE/ERDA, 1977). During periods of scarcity, when the actual available water supply may be less, the County share would be reduced proportionately with the other users. Conversely, during periods of abundance, when the actual available water supply may be more, the right would be increased proportionately among all users.

San Juan-Chama Project waters are stored, via contract with the Middle Rio Grande Conservancy District, at El Vado Lake, in an amount not to exceed 9,587 acre-feet, and also at Abiquiu Reservoir up to a maximum of 1,125 acre-feet via contract with the City of Albuquerque.

Table 4-1: Summary Table
Production Capacity and Water Rights (Source: Pergler, 1999)

Firm Rated Capacity of the Los Alamos Water Production System (LAWPS)	7,797 gpm 4,100 MGY
Peak Water Demand	7,300 gpm
LAWPS Water Right (Ground and Surface Water)	5,541.3 acre-feet per year (1,806 MGY)
Los Alamos County San Juan-Chama Project Water Contracted Right	1,200 acre-feet per year (391 MGY)
Maximum Storage of San Juan-Chama Project Water	
El Vado Lake	9,587 acre-feet (3,126 MGY)
Abiquiu Reservoir	1,125 acre-feet (367 MGY)
Los Alamos Water Tank Storage	35-40 MGY
Fire Protection Minimum Terminal Storage Requirements	10 MGY (20 MGY for a safety factor of 2)

On September 8, 1998, the DOE leased the water production system to the County of Los Alamos; leased the entire water right of 5,541.3 acre-feet; and sold, granted and conveyed all of the DOE's right, title, and interest in and to San Juan-Chama Project water in the amount of 1,200 acre-feet, or approximately 391 MGY (DOE, 1998). The lease agreement "shall terminate on the earlier of the 7th day of September, 2001, or upon delivery by the Government of a quitclaim deed conveying the Leased Premises to the Lessee." (Pergler, 1999).

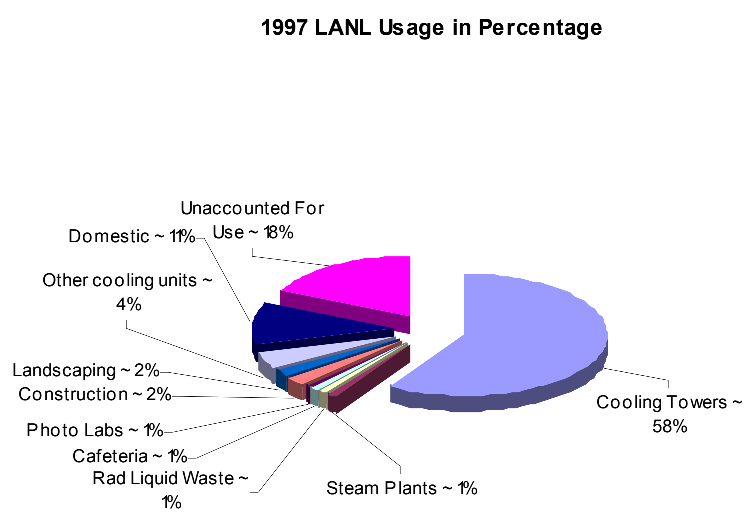
On September 5, 2001, the Government officially conveyed to the County 70 percent of the DOE water right (3,878.91 acre-feet) and leased to the County the remaining 30 percent (1,662.39 acre-feet). Per agreement, DOE would have purchase rights from the County for 30 percent of the total water right. A Water Service Contract (DE-AC04-98AL78907) by which the County supplies water to LANL went into effect in 1998 with lease of the system. Under Article A of this agreement, *"The County shall furnish all labor, materials, tools, equipment, facilities, transportation, pumping energy and incidentals necessary to provide water supply service to the points of delivery. Water supply service means traditional utility service which includes supply, transmission, coordination, operation, maintenance, and any other functions required for reliable service."* No limitation of quantities to be provided to LANL is included in the Contract, only an estimate of required quantities. However, for planning purposes, the 1662.39 AFY water right owned by DOE and leased to the County serves as a good target quantity under which LANL should remain. The table of estimated quantities in the Water Service Contract shows LANL projected to exceed 1662 AFY by 2008.

4.2 USAGE

In FY99 and FY00, the Laboratory used ~1368 AFY and 1325 AFY, respectively. Approximately 60% of Laboratory water flows into cooling towers. Without the cooling-tower-water efficiency upgrades, this flow may increase to as much as 70% by 2005 due to new facilities being built. About half of this water is evaporated; the remainder is released into the surrounding canyons through National Pollutant Discharge Elimination System (NPDES)-permitted outfalls. The cooling-tower conservation project, funded by the Nuclear Weapons/Facilities and Infrastructures group, will reduce the total amount of water used in cooling towers even as the new Strategic Computing Complex (SCC) comes on line in 2002. Other conservation and gray-water-reuse projects described in this plan could reduce water usage further and ensure that future LANL initiatives are not limited by water availability.

Water is consumed at LANL for a variety of purposes, including cooling tower uses, domestic use, landscaping, and temperature control. The water eventually is discharged in the form of sanitary effluent, industrial effluent, and evaporation or leakage losses. The water-supply system and water balance for the Laboratory are shown below (Bretzke et. al., 2000).

Figure 4-1:



The Laboratory's point-source discharges of wastewater are regulated, primarily, by the Clean Water Act, which requires an NPDES outfall permit for wastewater released to waterways. Laboratory operations are designed to produce effluent that remains within the limits specified by the NPDES permit. Most of the Laboratory's wastewater ends up as NPDES-regulated effluent or is evaporated. Non-NPDES uses include construction water and landscaping.

4.3 Condition Assessment

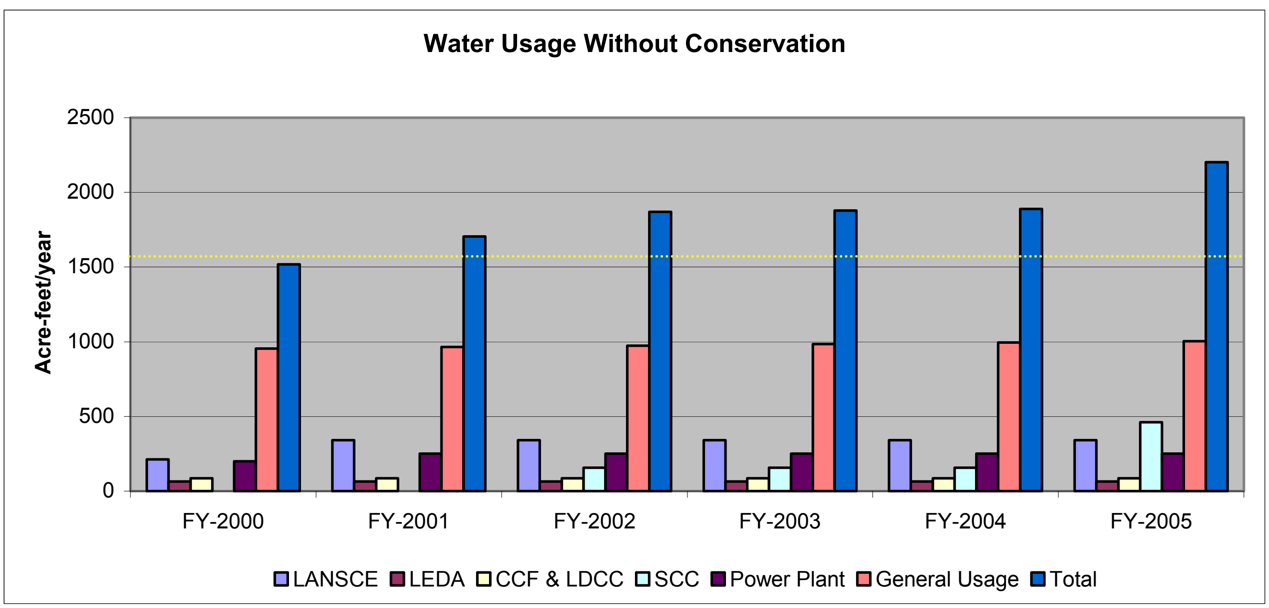
The state of the water distribution and collection systems for LANL has not been adequately assessed in several years. Due to the fact that the infrastructure is anywhere from 10 to 50 years old, there are varying "states of disrepair" in the systems.

5.0 DEMAND FORECAST

5.1 LANL

The Laboratory's water use is projected to increase due to increased demands of existing cooling towers, the construction of new cooling tower systems, and the increase in LANL general water use. The largest cooling towers provide cooling for the Strategic Computing Complex (SCC), the Low-Energy Demonstration Accelerator (LEDA), the Central Computing Facility (CCF), the Laboratory Data Communication Center (LDCC), the Los Alamos Neutron Science Center (LANSCE), and the Power Plant. Table 2 provides the current and projected water usage rates for these cooling towers through FY2005. General Usage values (the sanitary and industrial water consumption) have been provided to give the total estimated water consumption for LANL.

Chart 5-1: Effects of No Conservation



Source: LANL Cooling Tower Project (Bretzke, et. al., 2001)

5.2 LA County

For the purposes of estimating future the County water use, the following information or data was considered or used. The information is summarized in Tables 3 and 4.

From 1991 through 1997 the County baseline water use averaged approximately 960 MGY/year.

Three sources of information were used to determine the estimated water use per dwelling unit (du = house, apartment, mobile home, etc.) of 0.10 MGY/year/du (Cook 1999).

The average commercial water usage per business unit (bu) was calculated from usage data obtained from the County Utilities Department (LAC, 1998). The average business unit water usage is 0.50 MGY/yr/bu (Cook, 1999).

County water usage is calculated from the formula: Number of dwellings and business units x Average unit water usage = Water usage.

Table 5-1: Los Alamos County Planned, Approved, Under Construction, or Recently Constructed Residential Developments

Name of Residential Development	Number of Units/Water Requirements
Ponderosa Estates	167 units*/16.7 MGY/year
Los Pueblos Road	24 units/2.4 MGY/year
Western Perimeter or Quemazon	421 units/42.1 MGY/year
Arrowhead Subdivision	21 units/2.1 MGY/year
2500 Central Avenue	30 units duplexes/3.0 MGY/year
White Rock School Site	104 units (School Board Approved but no plans given to Planning and Zoning Commission. Primarily single family and townhouses)/10.4 MGY/year
Canyon Rim Site	33 units primarily duplexes/3.3 MGY/year
Dormitory Housing – Loma Vista	55 townhouses/5.5 MGY/year
Caballo Peak	40 units/4.0 MGY/year
Research Park Phase I	8-10 office buildings/17 MGY/year
Total Development	**903-905 Total Units/106.5 MGY year**

*55 units have been completed and are assumed to be included in the 1998 water use data.

There are an additional 224 units (North Mesa - 75 units and Middle School Site - 149 units) that could be candidates for future construction but are considered speculative for the purposes of this report. Recent County election results rejected the development of 168 apartments at the Canyon Road site.

Pergler: PC 1999. Information verified by Nancy Cerutti, Principal Planner Los Alamos County. April 29, 1999.

Table 5-2: Land Tracts Proposed for Conveyance and Transfer (C&T)*

Land Tract Name	Water Requirements (some tracts have two scenarios)
Rendija Canyon Tract	126 MGY/year
DOE Los Alamos Area Office Tract	20 MGY/year or 3 MGY/year
Miscellaneous Site 22 Tract	No change
Miscellaneous Manhattan Monument Tract	No change
DP Road Tract	20 MGY/year or 21 MGY/year
Technical Area 21 Tract	35 MGY/year
Airport Tract	100 MGY/year
White Rock Y Tract	No change
TA-74 Tract	No change
White Rock Tract	81 MGY/year or 2 MGY/year
Total Development Water Use Range	**0 – 383 MGY/year or 0 – 286 MGY/year**

*Information taken directly from the C&T EIS.

Using actual data from the years 1985 through 1998 (data is missing for years 1988 and 1990) and assuming full build-out as specified in Tables 2 and 3 above (including both scenarios), the water right would have been exceeded for all years except 1997 and 1998.

A third component of the County's growth development is the Los Alamos Comprehensive Plan (LAC 1997). There are five area plans within the Comprehensive Plan:

- DP Road/Airport Area Plan
- Range Road Area Plan
- White Rock Area Plan [the University Campus component was withdrawn from this plan when DOE did not include these lands as part of the C&T process (Pergler, 1999a)]
- The two other plans, Downtown Draft Area Plan and Research Park Area Plan, were not available for review as they have not been prepared or are at a very preliminary draft stage. However, the County Assistant Administrator for Intergovernmental Relations stated that the Downtown Draft Area Plan basically addresses street improvements (Pergler, 1999). The Research Park Area Plan Technical Report (LAC, 1997) is available and has been used in this analysis.

5.3 Adjustments To Demand (Known/Measurable)

There are no known adjustments to the current and future anticipated demands at this time. Due to the dynamic nature of the type of business LANL is engaged in, there will be some adjustments to the facts and figures provided in this document. Every effort has been made to gather the most recent data and anticipated needs and forecasts for both LANL and the County.

5.4 Uncertainties ("What-If" Scenarios)

The following list provides some of the more 'high impact' uncertainties that can be assumed:

1. Prolonged drought conditions produce greater demand on well-water supply.
2. Contamination is found in one or more wells, requiring shutdown.
3. Unanticipated, catastrophic failure of one or more of the wells.
4. Surface-water supply (SJ-C) development is not economically feasible.
5. Surface-water supply (SJ-C), if developed, is found to be contaminated and cannot be used for consumption without extensive treatment.
6. Politics precludes the development of the surface water supply.

6.0 PLANNED FACILITIES: IMPROVEMENTS PLANNED FOR WATER SUPPLY/DISTRIBUTION SYSTEM

The County has plans to utilize the San Juan–Chama Project waters, probably through use of a collector well(s) ("Ranney Gallery") within the Rio Grande alluvium. However, it should be noted the City of Santa Fe has the same plans and has estimated it will take a minimum of seven years to accomplish (Pergler, 1999). Other contract holders of San Juan-Chama Project water are also developing plans, especially Albuquerque, to further exploit San Juan-Chama water. Coupled with population growth forecasts there may not be enough water to supply Northern New Mexico's future water demand solely from San Juan-Chama Project water. Use of San Juan-Chama water will become even more of an emotional, technical, and political debate in the coming years. Thus, dependency on this water supply source to meet the future water requirements of DOE and the County may not be a prudent planning strategy.

Area below White Rock for potential surface water supply

6.1 CURRENT AND FUTURE WATER-USE FACILITIES PLANNED

Most of the forecasted facilities are listed in the Demand Forecast above. Other facilities that are known to be in the planning stages are:

a. Several GPP office-type buildings

b. Nuclear Materials Research Park

c. Reconfiguration of TSTA to TA-16

d. Upgrading of Power Plant Capability

e. Replacement of RLWTF

f. Additional construction activities shown in Appendix E.

6.2 PLANNED REMOVAL OF CURRENT USAGE FACILITIES

Facilities currently planned for D&D:

a. CMR
b. Removal of temporary office buildings
c. Removal of TA-21 facilities (including TSTA)
d. Decommissioning of TA-50-1 RLWTF
e. Higher efficiency Power Plant equipment is anticipated to use less water.

6.3 PLANNED REUSE/RECYCLE FACILITIES AND INFRASTRUCTURE

The County and LANL are currently evaluating the diversion of approximately 200 AFY of domestic wastewater, from the portion of the County known as Western Area, to augment the flow to LANL's sanitary wastewater treatment facility (SWSC). This project would accomplish two major objectives: (1) providing another source of food for the microorganisms at the SWSC facility, and (2) providing LANL with an additional 200 AFY of recyclable water. An engineering study is underway to further develop the engineering design, routing, and cost of this project. It is estimated that the water can be used within LANL facilities for cooling tower makeup (Kerven, 2000).

The current capacity of the SWSC plant provides 340 AFY, raising the total to 540 AFY with the addition of this project. The cooling towers within Technical Area 3 utilize nearly 405 AFY of water per year. Any excess water available from this project can either be used in other areas, such as boiler makeup, or discharged to the environment through outfall 001 located at TA-3.

7.0 WATER CONSERVATION MEASURES

Review Of Current Measures Implemented Or Being Implemented

Although the County, which supplies water to the Laboratory, has some unused water rights, a significant increase in Laboratory or County water usage could exceed current water resources. Consequently, it is in the Laboratory's and the County's interest to pursue an aggressive, cost-effective, water-conservation and gray-water-reuse program. It is also in their joint interest to develop additional water resources to accommodate future growth. Water use and planning is the responsibility of the Utilities and Infrastructure group in the Facilities and Waste Operations Division (FWO/UI). Although the Laboratory has no formal water conservation program, this group tracks water use and manages improvements and repairs that reduce water usage at the Laboratory.

The County of Los Alamos discharges approximately 1 MGD from the Bayo Sewage Treatment Plant and 0.35 MGD from the White Rock Facility (LAC, 1997). A portion of both the Bayo Sewage Treatment Plant and White Rock Sewage Treatment Plant effluent is used for landscape watering; i.e., the Los Alamos Golf Course and White Rock Overlook Park areas, respectively (Pergler, 1999).

7.1 DISCUSSION OF LEGAL/REGULATORY BARRIERS TO PLANNED GOALS

The only known regulatory barrier to a comprehensive water conservation plan that might seek to implement water reuse in the strictest sense is the barrier to direct recycling. It is currently illegal to reuse treated effluent in 'gray-water' systems in public facilities. This precludes the use of treated effluent for certain potential uses.

There is discussion at the State level concerning lowering the values that are in place for irrigation using reclaimed water. If the New Mexico Environment Division does indeed lower the acceptable values, the County could end up using more potable water for irrigation than is currently used.

7.2 SECONDARY GOALS/PLANS NEEDING FURTHER ANALYSIS

Use of San Juan–Chama Project Water: County plans and the impact on LANL operations need further scrutiny to assess impacts, both positive and negative, on LANL programmatic mission needs.

Infrastructure Assessment: A more intense study or Gap Analysis needs to be performed to determine the level of detail necessary to understand the current condition of LANL infrastructure and its impact on funding determinations.

8.0 BENEFIT AND COST ANALYSIS

Estimates of Total, Annualized, and Unit Cost (Per Gallon) of Planned Improvements and Additions

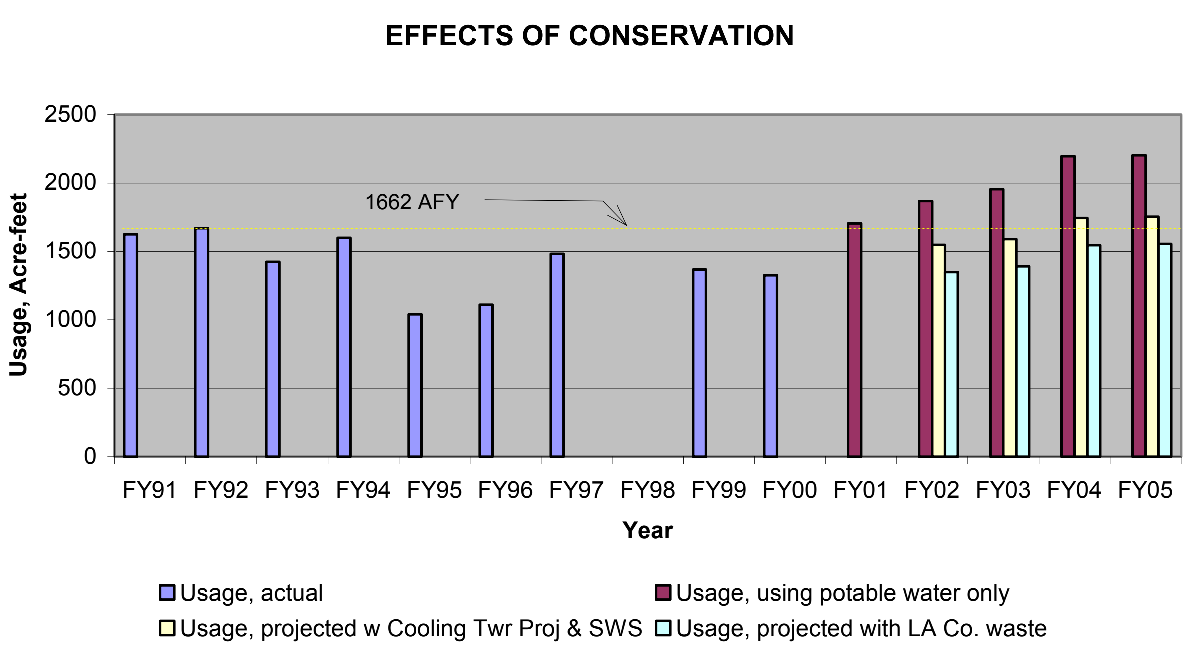
Cost estimates needed for:

- infrastructure improvements
- recycle/reuse facilities
- facility improvements/retrofits/refurbishments
- cost to new facilities to include water conservation enhancements
- costs to develop plans and documents
- cost of training programs.

As various plans are developed by the Water Conservation Committee, a greater ability to account for costs already incurred, as well as those anticipated for planned projects, will become available. These costs will be used in calculating financial determinations such as: Return on Investment (ROI) and life-cycle costs.

8.1 ESTIMATE OF ANTICIPATED WATER SAVINGS

Chart 8-1: Effects of Water Conservation – Total Usage



Sources: Actual: LAC: (Pergler, 1999)
Projected w/ Cooling Tower Project: (Bretzke, et. al., 2001)

Projected w/o Conservation: (Bretzke, et. al., 2001)

Projected w/ LAC waste: (Kerven, 2001)

8.2 COST-SAVINGS BASED ON INCREASING CYCLES OF CONCENTRATION

Example: If we were to improve to an average of 5 cycles of concentration,

MU = 434.5 + (434.5/4) = 543.125 AF

for a water savings of 325.88 AFY (~22% of Total)

Annual cost savings: 328.88 AF x $707.12/AF ~ **$230K/yr.**

8.3 LIFE-CYCLE COST ANALYSIS

This aspect of the Water Conservation Plan has been delegated to out years, due to the fact that much of the information is not yet available. This is proposed to be a function of the interim committee, then performed on a 1-2 year update cycle by the Water Conservation Officer.

8.4 COMPARISON OF DISTRIBUTION/USAGE-SIDE COSTS VS. SUPPLY-SIDE COSTS

This aspect of the Water Conservation Program Plan is not yet available, as information was not available from LA County. There are decisions to be made in the near future that will have a direct impact on this calculation. The decision to proceed with San Juan/Chama surface water production would be an example of an activity impacting this calculation.

9.0 CONSERVATION MEASURE SELECTION

9.1 SELECTION CRITERIA (See Appendix D for matrix explanation)

Conservation Measures are selected according to the following criteria:

- beneficial impact to mission
- technical feasibility
- best management practice
- positive impact to neighboring community(ies), region, state
- alignment with DOE Conservation goals
- cost (ROI)
- management/program support.

9.2 IDENTIFICATION OF SELECTED MEASURES

The following measures have been determined to meet several or all of the selection criteria:

1. Cooling Tower Project (treatment plant and chemical optimization)
2. Use of LA County Municipal waste at the SWSC Plant
3. Installation of water meters at major LANL distribution system sections
4. Installation of water meters at selected LANL high use facilities
5. Facility Water Audits.

9.3 DISCUSSION OF RECOMMENDED MEASURES (NOT YET SELECTED)

The following measures are recommended by this group for management to initiate in the near future:

1. Definitive Engineering Standards – more concise/measurable guidelines in all planning documents

2. Divisional goals – determination, documentation and assessment of water conservation goals by each LANL Division
3. Real-time modeling/decision making – utilization of data in concert with accurate modeling that will enable those decision makers to determine their projects impacts against stated risks and goals. This type of real-time analysis will enable planners to foresee any potential conflicts with previously stated goals and targets.
4. Data Repository – development of a water resource database that has all available, up-to-date information that will ensure only one figure is used for all planning, design, information dissemination activities.

9.4 STRATEGY/MILESTONES FOR IMPLEMENTING MEASURES

The Water Conservation Team will develop an Implementation Plan by January 2002.

10.0 RESOURCE INTEGRATION AND FORECAST MODIFICATION

Modification of Water Demand/Supply Forecasts To Reflect Effects of Conservation Measures

Initially, it is believed that comparison with one or more of the current models, EPA model and "I-think," is the best approach for two reasons: (1) these models are available to us and will allow us to identify gaps in data, and (2) by using these models, we will be able to select the model most closely resembling our situation and allow us to "bridge the gap" through iteration.

10.1 DISCUSSION OF EFFECT OF CONSERVATION ON AGREEMENTS WITH LA COUNTY

Planning: Chuck Pergler, DOE/TetraTech, has been in contact with LA County personnel concerning their plans. Pursuant to receipt of forthcoming information, an update to this section will be included.

Revenue: Depending on the scenario followed, there appears to be the possibility of significant impact on the revenue generated for LA County from water use at LANL. A Memo of Understanding may be a possible means by which any adverse impact to LA County planning and/or revenue generation could be addressed. It is expected that any discussions with LA County will be pursuant to LA plan distribution and LANL impact analysis.

11.0 IMPLEMENTATION AND EVALUATION STRATEGY

Method of Implementing Conservation Plan

Initially, the plan will be available to all divisions with instructions for addressing conservation issues. The long-term strategy fits in with Section 3.0, Conservation Plans and Goals. A Strategic Plan, that will embody the strategy necessary for implementing conservation measures at LANL, will be produced by the Water Conservation Team. Evaluation of effectiveness will be the duty of the Water Conservation Officer.

11.1 METHOD OF EVALUATING EFFECTIVENESS OF PLAN (FEEDBACK/LESSONS LEARNED)

Tracking – will be performed by the interim team, and by the Water Conservation Officer on a regularly scheduled basis thereafter.

Formal Assessment Plan –is to be initiated by the Water Conservation Team and turned over to the Water Conservation Officer for implementation and verification.

11.2 CERTIFICATION OF PLAN

LANL management is seen as the owner of this Conservation Plan. In specific, this plan falls under the auspices of the Deputy Laboratory Director – Operations (DLD-Ops) and the Facility and Waste Operations (FWO) Directorate.

Appointment of the methodology of certification of this plan is their direct responsibility. This certification can be done either in-house (within LANL) or through an outside engineering firm.

12.0 REFERENCES

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13.0 APPENDICES

Appendix A: Assessment Methodology

Appendix B: "What-If" Scenarios – Water Usage Charts

Appendix C: Water Conservation Calculation and Opportunities

Appendix D: Measure Selection Criteria Discussion and Matrix

Appendix E: Future Construction Activities

APPENDIX A: Assessment Methodology

Aspect Definition: Resource Use

General Information

Los Alamos is in a semi-arid, high-desert biome with little surface water and limited rainfall. Water is drawn from a series of deep wells into the Rio Grande Aquifer, which is recharged at an unknown rate by the Rio Grande and tributary rivers. The water level in the aquifer has been falling regionally for many years, and growing populations threaten to accelerate this depletion.

Location of Activity Impact

Location of Impact	Description	Scenarios Considered	Type
Global	Beyond the US	None	N/A
Regional	Use of resources outside the LANL site	Depletion of aquifer water	Normal
Local	On LANL site	None	N/A

Magnitude of Activity		Probability of Occurence	
Normal Scenario		*Abnormal Scenario*	
High	Volume -- >10% of water use	**High**	Occurs at least once per yr
Medium	Volume -- 1–10% of water use	**Medium**	Occurs once every 1–10 yr
Low	Volume -- < 1% of water use	**Low**	Occurs only >10 yr

Scale of Impact Definitions and Examples		High	Med	Low
1. Permanent:	Use of water in sufficient quantity to irreversibly deplete the resource in less than 100 yr	1000	100	10
2. Significant:	Use of water in sufficient quantity to deplete the resource in 100 to 500 yr	100	10	1
3. Moderate:	Consumption of water in volumes sufficient to require regulatory controls	10	1	0.1
4. Minimal:	Consumption of water at a rate that does not have measurable impact on the environment	1	0.1	0.01
5. No Impact:	Negligible or no impact on the environment	0.1	0.01	0.001

APPENDIX B: "WHAT-IF" SCENARIOS – WATER USAGE CHARTS

(Bretzke, et. al., 2001)

Table B-1: Current (FY00-01) and Future Water Consumption Estimates

Cooling Tower	Estimated Water Consumption (AFY) by FY (@ 50% Cooling Tower Efficiency)					
	FY-00	**FY-01**	**FY-02**	**FY-03**	**FY-04**	**FY-05**
LANSCE	213	340	340	340	340	340
LEDA	64	64	64	64	64	64
CCF & LDCC	85	85	85	85	85	85
SCC	0	0	156	156	156	462
Power Plant	200	250	250	250	250	250
General Usage	955*	965*	974*	984*	994*	1004*
Total	**1517**	**1704**	**1869**	**1879**	**1889**	**2203**

Source: Majority of Info from Carlson / Bretzke, Cooling Tower Project Final Report, 9/01
Some increase is expected due to Research Park, ICON facility, etc.

Table B-2: Expected Efficiencies

Cooling Tower / Area of Usage	FY02 without Efficiency Project (in AFY)	FY02 with Efficiency Project (in AFY)
LANSCE	340	227
LEDA	64	43
CCF & LDCC	85	57
SCC	156	104
Power Plant	250	167
Sanitary Water Reuse	156	(340)*
General Usage	974	974
Total	**1713**	**1232**

* Assumes 100% usage of SWS water in FY02

Table B-3: Effect of Altering Cycles of Concentration

Cooling Tower	Today	Future @ 2 COCs **(AFY)**	Future @ 5 COCs **(AFY)**
CCF (SM 285)/LDCC (SM1837)	68	68	42.5
Power Plant Towers	62.0	62.0	39.0
SCC	0.0	315.0	197
LANSCE (without LEDA)	419.5	419.5	262.2
Total	**549**	**864.5**	**540.7**

APPENDIX C: WATER CONSERVATION CALCULATION AND OPPORTUNITIES

The following calculation is from "Drew Principles of Industrial Water Treatment", 7th ed., pgs 122, 123:

E = Evaporative water loss, as a percent of the circulation rate

W = Windage and drift water losses, as a percent of the circulation rate

B = Water lost by bleedoff (blowdown, and other losses to waste) as a percent of the recirculation rate

M = Makeup water needed, as a percent of the recirculation rate

C = Cycles of concentration (usually determined by analysis of chloride ion in water, as ppm)

Since makeup is water added to compensate for other water losses, and for simplicity's sake the windage has been added to the Evaporation, the calculation for determining the amount of makeup water needed is:

Equation C.1: $M = E + W + B$

or, when adding W to E:

Equation C.2: $M = E + B$

Also, since the amount of makeup needed is governed by a cooling tower's operating cycles of concentration, the material balance for water around the tower gives:

Equation C.3: $B = E/C-1$ or $E = B \times C-1$

Assuming a current average of 2 cycles of concentration for our Cooling Towers – (actual: 1.6 - 2.5)

Makeup (M) = total maximum anticipated amount of water used in Cooling Towers ~ 869 AF (Bretzke, 2001)

Average Cycles of Concentration (C): 2

rearranging equations above:

Evaporation (E) = Blowdown x (Cycles –1)

Blowdown (B) = Evaporation / (Cycles – 1)

M = E + B; where E includes drift and B includes other small losses (i.e., – overflows, etc)

Applying value for Cycles gives: $M = E + B \times (2-1) = E + B$

Using equation C.3 gives: $E = B \times (2-1) = B$; therefore, $M = 2 \times B$; or $2 \times E$; or $M = E/2$

Applying values for M shows: $M = 869$ AF $= 2 \times E$; $E = 434.5$ AF at 2 cycles of concentration

Assuming E to stay fairly constant over time, the following table can then be calculated:

Table C.1: Effects of Increasing Cycles of Concentration

Evaporation Rate (ACY)	Blowdown at Cycles of Concentration					
	2	3	4	5	6	7
434.5	434.5	217.25	144.83	108.63	86.9	72.42

OTHER WATER-SAVING OPPORTUNITIES:

- Greater use of recycled water within LANL (estimate 1-2% savings). Responsible party – FWO-UI
- Use of LA Co. Municipal wastewater for current and future water needs at LANL (est. 0.25 MGD = 280 AFY ~ 19%). Responsible Parties – FWO-UI / E-ESO
- "Sustainable Design" of new facilities: water-saving fixtures, reuse of gray water, low water use vegetation in landscaping, use of 'natural' space cooling vs. water cooled. Responsible Party – FWO-SEM
- Complete Reuse / Recycle: potential water uses are irrigation, cooling, recreation, fire suppression, recharge. Responsible Party - FWO-WWTA.

TOTAL POTENTIAL SAVINGS:

- • Current projections: 25 – 30% per year
- Use of "Creative Thinking": 40 – 50% (closed-loop, zero blowdown, xeriscaping, etc)

ADVERSE IMPACTS:

- Increases in water costs to LANL: LA Co. has a 'baseline fixed cost' of producing water – water costs **could** approach historical values
- Increases in facilities construction cost to incorporate "sustainable design" concepts and engineering
- Increases in infrastructure costs
- Possible increases in maintenance costs.

APPENDIX D: MEASURE SELECTION CRITERIA DISCUSSION AND MATRIX (EX.)

The following is one of several methodologies that could be used to assess and rank various projects. The rankings would then be followed up for implementation in subsequent fiscal years. Conservation Measures are selected according to the following matrix criteria. Scores determine which projects to implement by means of filling out the table below on each project. Using the following criteria, fill out table D:1 below with the intensity levels determined for each criteria. Intensity levels are found using table D:2 below, when applying Impact and Importance levels for each criteria:

- Mission – how the proposed project supports or enhances the overall mission of LANL
- Technical – is the project feasible/achievable? Is the proposed project sound in its engineering approach? Does the proposed project enhance scientific / engineering understanding of the problem or solution?
- BMP – best management practice: does the project promote the BMP approach to a solution? Is there sound reasoning for this project?
- Acceptance – is there general acceptance for this project? Is this project supported by line and program management? Is this project supported by those potentially affected by its implementation?
- Stakeholder – does the major stakeholder have full buy-in on this project? Do other local and regional stakeholders have full buy-in on this project?
- Cost – ROI and Life-cycle costs. Do these costs support the decision made on this project? Are all costs accounted for, including the appropriate overhead and tax costs?

Table D.1 Project Rank

Project:	Mission	Technical	BMP	Acceptance	Stakeholder	Cost	Total Score
#1							
#2							
#3							

Impact Levels:

Minor – minimal effect on surrounding environment and operations. Typically confined to one area and relatively easily controlled.

Local - effect is localized in the sense that some impact is felt on surrounding environment and operations. Careful consideration and cooperation is needed to implement project while minimizing adverse effects to those in immediate area.

Global – effect is essentially site-wide, or impacts more than one TA or FMU. Significant cooperation is needed to ensure minimization of effects of implementation.

Importance:

Minimal – project is usually one of process improvement or enhancement and implemented with little or no impact to surrounding operations. Not a big player in the 'grand scheme' or mission essentials.

Serious – project is needed by one or more users to continue or enhance operations. Will have some significance in mission of LANL, but may affect only a few users.

Critical – project is absolutely necessary to ensure mission of LANL is not adversely affected. May not be a 'high visibility' type project, but the potential impacts are severe if not implemented.

Table D:2 Numerical Score of Project (Intensity Level)

Impact	Minor	Local	Global
Importance			
Critical	7	8	9
Serious	6	5	4
Minimal	1	2	3

APPENDIX E: FUTURE CONSTRUCTION ACTIVITIES (HIGH PRIORITY ONLY)

Priority	Facility
H	Strategic Computing Facility (SCC)
H	CMR Replacement
H	Advanced Hydrodynamic Facility (formerly PRISM)
H	DAHRT - PHASE I
H	ATLAS
H	CMIP
H	TMSE
H	CMR Upgrades
H	West Road Connector to Mercury
H	Fire Suppression Yard Main Replacement (TA-55)
H	NMSSUP, Phase I FY99 OPC
H	NISC
H	APT Project (LANL Portion)
H	Fire Protection Improvements (FPI)
H	TA-53 Isotope Production Facility
H	AROE
H	Short Pulse Spallation Source (SPSS)
H	Spallation Neutron Source Line Accelerator
H	Cooling Tower Replacement, TA-3-22
H	Electrical Infrastructure Safety Upgrade Program
H	Satellite Parking/Intersection
H	TA-50 RLW Tank Replacement
H	Decontamination & Volume Reduction System
H	TA-53-64 Cooling Tower
H	Waste Water Collection Lines
H	WETF - Roof Upgrades
H	Central Health Physics Calibration Laboratory
H	NMSSUP, Phase IIa
H	TA-50 RLW Treatment System
H	Facilities Improvements Technical Support Bldg.
H	Electrical Infrastructure Safety Upgrade - SM-43
H	Bldg. 430 Tempered Water, HVAC, & Elec. Sys. Upgrades
H	Communication Operation Bldg.
H	TA-53-62 Cooling Tower Replacement
H	Natural Gas Line (Gas Line Replacement to TA-15)
H	Water Well Replacements
H	Ventilation Upgrade, Lujan Center