CHAPTER 5
PLANNING APPROACH AND METHODOLOGY

The planning approach and methodology for Water Plan 2020was guided by the existing water system policies and an analysis of the appropriate level of service to be provided by the water system operation to the people of Kauai. Water system policies are established by the Board of Water Supply. The level of service for the water systems incorporate both policy considerations as well as engineering standards and planning criteria that are used to guide the Department in evaluation of needed improvements to the water systems. Because of the link between Water Plan 2020 and policy considerations involving the Board of Water Supply, Board input and direction was needed throughout the project.

Interaction with the Board was accomplished throughout the preparation of Water Plan 2020 by conducting a series of five Board Workshops that focused on various aspects of the project. In addition to the plan being developed interactively with the Board, a substantial public involvement process was conducted, consisting of several rounds of public meetings and community outreach. The purposes of the public involvement process were to obtain public input to the plan and to inform the public about the planning process, the Department's water systems, infrastructure and funding requirements, and the key discoveries of Water Plan 2020.

There were four major tasks involved in the development of Water Plan 2020:

- System Documentation: Collect and analyze the water system planning, engineering and water quality data; identify service area characteristics, policies and level of service requirements, and develop population projections, and the associated water demands for each water system.
- System Analysis: Evaluate the water system components, including the distribution, storage, and supply systems. Review the system water quality conditions and future requirements and document the system operations and maintenance.
- Capital Improvement Program: Develop the capital improvement, rehabilitation, and replacement plan.
- Create a 20-year financial plan and a 5-year rate study that focuses on the implementation of Phase I of Water Plan 2020.

WATER SYSTEM POLICIES

Water System Policies guide the development and financing of the water system infrastructure required to provide water service throughout the service area. Board policies may impact many areas of planning including service areas, system redundancy, development, and system sizing. Current DOW water system policies are described and documented in the *Rules and Regulations, Department of Water County of Kauai*, (effective November 20, 1976 and as amended). Water system policies also include Board policies that are established from time to time by the Board. There are also, administrative (engineering based) procedures of the Department, and the *Water System Standards* (1985 and as amended) that guide the actions of the DOW.

LEVEL OF SERVICE

Level of Service (LOS) standards are the collections of water system standards and planning criteria that guide the development of new facilities and improvements to existing facilities. Level of Service standards establish criteria for evaluating and planning sources of supply, fire protection, storage, transmission and distribution systems, pump stations, treatment, and system redundancy.

The DOW planning and design standards are incorporated in the *Water System Standards*, State of Hawaii, adopted in 1985 as amended or updated. These standards provide specific criteria for each of the major water suppliers on the islands of Kauai, Oahu, Maui, and Hawaii. Prior to these standards, the DOW designed and planned around standards presented in *A General Plan for Domestic Water/Island of Kauai*, 1972, prepared by the State of Hawaii Department of Land and Natural Resources and *The Standards Specifications For Waterworks Construction* (1963 or later,) and the requirements of the State Department of Health.

Through the Water Plan 2020-evaluation process, several modifications have been recommended to the 1985 water system standards. The proposed changes have been made to reflect higher levels of service and better alignment with historical water use and service patterns. The most significant changes to the level of service criteria include:

- Minimum main size of 6-inches for all the DOW installed construction and
- Determination of maximum day supply based on 24-hour/day pumping for source and booster pumping capacity.

Another area that is currently being reviewed by DOW and coordinated with the County Fire Department is the minimum fire flow requirements. There are various locations in the DOW water systems that are either rural or are isolated service areas. Particularly in agriculture zoned areas, the water systems were not sized to accommodate fire flows. However, continued development has attracted other uses and additional densities, creating the need for these systems to provide some level of fire protection. DOW and the Fire Department are developing alternative approaches to providing fire protection including DOW/Fire Department Memorandum of Agreement (MOA) regarding DOW off-site and fire department on-site fire code requirements needed for fire protection in agricultural and rural areas. It is anticipated that an approach will be adopted during 2001.

Table 5.1 presents a summary of the current DOW water standards. The system planning included a review of the DOW adopted level of service in comparison with two other standards, the Washington State Water System Design Manual and the 10 State Standards. These comparisons demonstrate that the DOW's standards for water service are typical of industry standards in the United States.

Table 5.1
Level of Service

Governing Agency	**Department of Water, County of Kauai**	Revisions/Recommendations
References	**Water System Standards,** 1985 State of Hawaii (as amended or updated) **Rules and Regulations,** 1976 Kauai Department of Water (as amended or updated)	

Source Capacity	Comply with Hawaii Revised Statues (Chapters 177 and 178), DLNR Chapter 166 Title 13, department requirements for location, yield, size, spacing, etc. Consult with Manager. Standards for Total Pump Capacity apply: Meet the maximum day demand with an operating time of 16 hours. The largest pumping unit shall be considered out of service (stand by). [WSS, p. 38]. **REVISED – See Revisions/Recommendations**.	DOW **pumping capacity** standard has been revised in Water Plan 2020 to supply maximum day demand over 24 hour pumping period with the largest unit out of service.
Number of sources	No information provided	A minimum of two sources or a backup intertie is recommended.
Fire Flows	Land Use — Flow (gpm) /duration (hours)/Hydrant Spacing (feet) Agriculture — 250/1/500 Rural/Residential R-2 (2 units/acre) — 500/ 1/500 R-4 (4 units/acre) — 750/ 2/ 500 R-6 (6 units/acre) — 1000/ 2/ 500 R-10 (10 units/acre) — 1250/ 2/ 350 R-20 (20 units/acre) — 1500/ 2/ 350 Resort RR-10 (10 units/acre) — 1500/ 2/ 350 RR-20 (10 units/acre) — 2000/ 2/ 350 Schools, Apts., Small Bus. — 2000/ 2/ 350 Light Industry — 3000/ 3/ 350 Heavy Industry — No criteria specified [WSS, p. 36 as amended]	The Kauai Fire Department has indicated that they do not have sufficient capacity in all areas for fire protection. They have also requested a maximum hydrant spacing of 250 feet. The Hawaii Insurance Bureau uses the ISO formula for calculation of fire flow, but does not recommend that this be used as a minimum standard in all areas. It is used to evaluate a water supply system and provides a benchmark to grade water systems. The DOW has expressed difficulty complying with the fire flow requirement for schools in cases where the schools are small, single room facilities. Other utilities have addressed this by determining school fire flow based on size, such as square footage or maximum student capacity.
Minimum Pressure	Minimum residual pressure = 20 psi at the critical (nearest fire hydrant) during fire flow and MDD [WSS, p. 37, *clarification provided by the DOW*.]	
Maximum Velocity	6 fps for distribution mains without fire flow. None specified for mains with fire flow. [WSS, p. 37]	
Reservoir Capacity	Meet max day demand + fire flow for duration of fire, reservoir ¾ full at start of fire (incoming flow from pumps is credited to this volume, one max size pump out of service). [WSS, p. 38]	
Reservoir Sizing, General	Reservoir should be sized to ensure reliable supply of water, maintain adequate pressure, and economical water distribution system. Standard Tank Sizes = 0.02, 0.05, 0.1, 0.2, 0.25, 0.3, 0.5, 1 MG (tanks >1MG are sized in 0.5 MG multiples). [WSS, p. 21] Where there are more than two reservoirs in a single system, the required tank size is based on the combined volume. [WSS, p. 38]	
Reservoir Capacity	Two reservoir-sizing criteria exist. Reservoir must meet the larger of the two: ■ Meet max day demand + fire flow for duration of fire, reservoir ¾ full at start of fire (incoming flow from pumps is credited to this volume, one max size standby pump). ■ Meet max day consumption, full at the start of a 24-hr period not including source input to reservoir. [WSS, p. 38]	

Governing Agency	**Department of Water, County of Kauai**	Revisions/Recommendations
References	**Water System Standards,** 1985 State of Hawaii (as amended or updated) **Rules and Regulations,** 1976 Kauai Department of Water (as amended or updated)	

Average Demand	Zone — Average Daily Demand (ADD) Residential Single Family/Duplex — 500 gallons / unit Multi Family Low Rise — 350 gallons / unit Multi Family High Rise — 350 gallons / unit Commercial — 3000 gallons / acre Comm/Industrial Mix — 500 gallons / acre Comm/Residential Mix — 3000 gallons / acre Resort — 350 gallons/ unit Light Industry — 4000 gallons / acre Schools, Parks — 4,000 gal/acre + 60 gal / student [WSS, p. 35-36 as amended]	**Demand Forecast Methodology for *Water Plan 2020*:** **Single Family Residential** Number of Single Family Units multiplied by the 1995-1999 average single-family water use per unit per day in each service area. **Multi-Family/Resort** Number of (Multi-Family Units + Visitor Units) multiplied by the 1995-1999 average multi-family/resort water use per unit per day in each service area. **Commercial** Number of commercial square feet multiplied by the 1995-1999 average commercial water use per square foot per day in each service area. Commercial square footage includes the following categories included in the Kauai General Plan Update; Commercial, Shopping Center, Office, and Hospital. In service areas where no historical commercial water use existed an island wide average of 0.25 g/sq ft/day was used. **Industrial** Number of industrial square feet multiplied by the 1995-1999 average industrial water use per square foot per day in each service area. **Agriculture** All service areas with the exception of Kilauea-Waipake-Kalihiwai are projected to grow 20% between 2000 and 2020. Kilauea-Waipake-Kalihiwai is projected to grow 43% between 2000 and 2020 based on 1995 1999 historical data. The 1998-1999 fiscal year, historical agriculture water use on a service area bases is used as the starting point for these calculations. **Government** Number of government employees multiplied by the 1995-1999 average number of government employees on a capita per day basis in each service area. Governmental includes the following categories included in the Kauai General Plan Update: County, State, and Federal Employees, Public School Students, Private School Students, Private School Employees and College Students.

Governing Agency	**Department of Water, County of Kauai**	Revisions/Recommendations
References	**Water System Standards,** 1985 State of Hawaii (as amended or updated) **Rules and Regulations,** 1976 Kauai Department of Water (as amended or updated)	

Max and Peak Demand	ADD (MGD) for entire water system — Maximum Daily Demand (MDD) Maximum Daily Demand — 1.5 x Average Day [0.1-0.5] ADD (MGD) for entire water system — Peak Hourly Demand (PHD) Peak Hourly Demand — 3.0 X Average Day [WSS, p. 37as amended]	**Maximum Day and Peak Hour Demands for *Water Plan 2020*:** The maximum day demand (MDD), based on the DOW standard of 1.5 times ADD applies to all service areas. A peak hour demand (PHD) factor of 3.0 times ADD applies to all service areas.
Distribution Capacity	Distribution capacity shall equal the max daily demand + the required fire flow. It shall also provide peak hour demand without fire flow. [WSS, p. 34, 37]	
Minimum Pressure	Minimum Residual Pressure = 40 psi at peak hour flow, [WSS, p. 37] The DOW will attempt to maintain pressure, but does not accept responsibility for maintaining pressure in water mains.	
Maximum Pressure	Maximum Static Pressure or pumping pressure (whichever is greater) = 125 psi [WSS, p. 37]	
Main Sizes	Land Use — Minimum Pipe Size Urban/ Rural/ Residential — 6-inches Business/ Multi-Family — 8-inches Agricultural — 2-inches or determined by the DOW These apply to any subdivision where the DOW does not require fire protection. **REVISED – See Revisions/Recommendations.**	The DOW adopted a change to **minimum 6" main for all the DOW Projects** Recommend modifying wording to "Minimum size of mains shall be determined by hydraulic analysis. Main sizes shall not be less than…"
Backflow Prevention	Air Gap or Reduced Pressure Principle Backflow Preventer devices are required for all facilities except as noted below: [WSS, p. 25-28] Fire Systems w/o Chemical Addition — None Required Irrigation Systems without Fertilizer or Chemical Addition — Vacuum Breaker or Double Check Valve Swimming Pools — Pressure Vacuum Breaker, Double Check Valve, RPBP, Air Gap	The DOW plans to update the Water System Standards by requiring RPBP or AG for Fire systems w/o Chemical Addition and irrigation system w/o fertilizer or chemical addition. RPBP will be required for swimming pools.
Redundancy/ Reliability	No information provided	Recommend adding policy similar to Washington State or 10 States with allowances for small cul-de-sacs developments (5-6 homes). Include requirement for developer provisions for future tie-ins.
Future Conditions Requirements	Pipes shall have the capacity of serving potential / additional customers. Provisions for construction by developers and the DOW refunds to developers are addressed in the Rules and Regulations, Part 3, Sections III and IV.	The DOW has instituted several interim policies to restrict additional water use on existing lots due to limitations in the water system. This applies to Additional Dwelling Units, in particular.
Minimum Number of pumps	Two pumping units. The standby should be equal to largest pumping unit. [WSS, p. 24]	
Max number of power outages at Sources	No information provided	It is not necessary to apply a standard for maximum number of outages. Existing power and backup provisions are adequate for most areas. Review water system information and operational reports for any areas with frequent water outages where power supply issues may need to be addressed.

Flow meters	Required at all pump stations and additional locations designated by the Manager. No information Is provided for flow monitoring at sources. [WSS, p. 24]	
Additional Instrumentation	Indicating and recording instruments required for suction and discharge pressures, flow rates, water level in reservoirs/wells, hour meters, volt meters, and other important pump station parameters are required. [WSS, p. 24]	
Disinfection	No information provided. The Safe Drinking Water Act establishes treatment requirements.	The DOW applies chlorine for maintenance of the distribution system. Chlorination is not required for disinfection of the DOW sources. Therefore, the minimum chlorine residual requirements do not apply. However, maintenance of the chlorine residual is recommended to maintain water quality in the distribution system.
Chlorinators	Two, minimum chlorinators shall be located at source pump stations. At least one chlorinator shall be standby and equal to the largest chlorinating unit. [WSS, p. 24]	Because the DOW has many wells, which use similarly sized chlorinators, the DOW should consider keeping chlorinators in storage at base facility, rather than having redundant at each site. Standby chlorine cylinders are not stored at well sites due to fire code restrictions.

SUPPLY ANALYSIS EVALUATION CRITERIA

Two planning horizons along with current conditions have been analyzed to assess the adequacy of the water supply on the island. Using the demand forecasts developed during this study, projected supply requirements have been calculated for 2020 and 2050. With a few exceptions the individual service areas are not interconnected and must rely on local sources to provide domestic and emergency water. This makes it very important that reliable high quality water supply is available on a localized basis. As part of the Water Plan 2020 effort, the level of service criteria for sources of supply has been revised in an attempt to become consistent with similarly sized water purveyors throughout the United States. The revised level of service criteria for sources requires that a service area be capable of providing Maximum Day Demand (MDD) within a 24-hour period with the largest source out of service.

The actual location of a water source within each service area is important in relation to other sources, facilities, and demand. Many service areas span very diverse topography from coastal plains at sea level to ridges and hilltops at several hundred feet elevation. A service area may contain adequate supply on an overall basis, but may not include the pumping or transmission capacity to transfer the water to higher elevations. Supply was analyzed for each service area on a pressure zone basis. Initially a mass balance was set up identifying the demand and source or sources of supply within each zone. This is essentially the difference of the total supply with the largest source out of service and demand within a zone. Unless significant piping restrictions exist, excess supply from an upper pressure zone can be transferred to lower zones. However, excess water in lower zones cannot be utilized in upper zones unless adequate booster pump station capacity exists.

STORAGE EVALUATION CRITERIA

The storage analysis is based on the DOW level of service criteria. Two level of service criteria exist for storage tanks/reservoirs. Storage requirements are based on the larger of the two criteria. The storage sizing criteria are as follows:

Criteria 1: Fire Suppression Storage: provide Maximum Day Demand (MDD) plus fire flow, with the reservoir three quarters full at the start of the fire. Incoming supply from sources can be credited to this volume with the largest source out of service. This criteria is also referred to as Fire Flow Storage

Criteria 2: Equalizing and Emergency Storage: provide Maximum Day Demand with the tank full at the beginning of a 24-hour period, not including any sources of supply. This criteria is also referred to as Maximum Day Storage.

The criteria listed above result in two calculations being made for each pressure zone to identify which produces the larger storage requirement. The first criterion is dependent on identifying the highest fire flow requirement in the pressure zone. The storage volume generated by criterion one is then compared to three-quarters of the available tank volume within the zone and by adding the flow rate of all but the largest source. The second criterion is based solely on the volume of water that is required to supply maximum day demand for a 24-hour period starting with full tanks. No sources of supply are added to the second criterion. In most pressure zones the second criterion generates a larger storage volume. The exception occurs in zones with low demands, but high fire flow requirements.
Due to the long usable life of storage facilities, the identification of new storage was calculated to take into account the requirements at 2020. Significant increases in storage volume requirements are calculated for a number of pressure zones. New storage was sized to meet 2020 criteria. In many situations, storage tank projects have already been identified by the DOW at specific sizes and were not modified. In these cases, additional storage was recommended, as needed. Due to limitations in transmission capability or geographically isolated portions of a system, proposing one localized storage facility was not practical in all systems; and tank projects were recommended at two or more locations in order to meet total volume requirements, while ensuring the ability to deliver the water within the system.

TRANSMISSION AND DISTRIBUTION EVALUATION CRITERIA

The transmission and distribution systems were evaluated relative to the current and future capacity to provide for peak hour and fire suppression flows and pressures. To perform this analysis, a water system computer model was prepared and calibrated for each of the 13 DOW water systems. The models were calibrated with DOW input based on actual field testing of fire hydrants and pressure recordings from various areas in the water systems. Each water system was analyzed for existing conditions, 2010 demands, and 2020 demands. System deficiencies were noted in working sessions with DOW and the consultant team. Proposed system improvement alternatives were developed and analyzed using the models to determine the most appropriate alternative to eliminating the system deficiency. The improvement alternatives were identified and compiled on a list by each system.

PEAK HOUR ANALYSIS

The hydraulic models were run at peak hour flows for 2000 and 2020 demand conditions. Nodes with pressures less than 40-psi were identified and the reasons for the inadequate pressures determined. Typically, high elevation (relative to the tank serving the node) was the reason for the less than 40-psi pressures. The model results were compared with the DOW listing of low service pressure areas and found to match well.

FIRE FLOW ANALYSIS

As part of the model calibration process, the hydraulic models were run to simulate fire flow demands at a few selected fire hydrants (the number of hydrants varied with the size of the system) within a water system. The fire flow modeling used actual fire flow test data measured during the DOW field tests. Although these runs were primarily for calibration purposes, the results frequently indicated those areas within a water system that may not be able to meet fire flow standards.

Land use zoning classifications were identified within each system and fire flow demands and specific hydrants were linked to the different zoning uses. The models were then run using the 2020 max day demand plus the fire demand at specific hydrants to determine if the available fire flow met the standard at those hydrants. The hydrants were chosen in areas where the zoning required higher fire flow demands or in areas where it appeared that existing small diameter mains were not adequate for fire flow purposes. There are many areas that are currently zoned for agricultural/open use that have small mains and are not able to convey the required 250-gpm-fire flow.

PUBLIC INVOLVEMENT APPROACH

Throughout the course of the project, the Board of Water Supply was the primary advisory group involved in formulating Water Plan 2020. Their involvement and continued interaction during this process were key elements to the plan. Successful completion of the project could not have happened without the commitment and dedication by the Board. Also key to Water Plan 2020 was the development of a substantial public involvement program. The methods and approach for establishing a public involvement program for Water Plan 2020 were based on developing three major themes for the public:

- Awareness about Water Plan 2020, its purpose, potential outcomes, and how to participate in
- the planning process.
- Communicate the achievements, discoveries and future challenges faced by the Department of Water. Sharing information and obtaining public questions and comments
- Keeping the general public briefed on project findings through outreach meetings, media briefings, public meetings, a public hearing and a wide variety of communication methods such as print, radio and television. Develop public involvement program:

The Water Plan 2020 media campaign is outlined in Table 5.2 and Table 5.3

Table 5.2
Water Plan 2020 meetings

Audience	Number of Meetings	Description
Board of Water Supply	**5**	Kickoff Meeting/Orientation of Project System Policy Forum Level of Service and Improvement Financing and Rate Workshop Final Adoption Plan Public Hearing
DOW Small Business Advisory Committee	**2**	
State Small Business Regulatory Review Board	**3**	
DOW Employees	**8**	Division Presentations Internal and External Communication
County of Kauai		
Mayor	**2**	
County Council	**3**	
Administration	**3**	
Legislators	**2**	
Public Meetings: North, South, West, East locations	**6**	
Community Outreach		
Local Business Associations	**5**	West Kauai Business East Kauai Business North Shore Business Contractors Association
Chamber of Commerce	**1**	
Neighborhood Associations	**4**	Koloa Community South Shore Property Owners
Lions Clubs	**2**	Kapaa East Kauai Koloa North Shore West Kauai
Rotary Clubs	**5**	West Kauai Poipu Beach Kauai Kapaa Hanalei Bay
Kiwannis Clubs	**1**	
Senior Citizens	**8**	
Farm Bureau	**3**	
Hotel/Resort Association	**1**	
Government Agencies And Large Water Users	**2**	DAGS DOT Harbors DOT Hwys PMRF Wilcox Hospital
West Side Water Shed Council	**1**	
Department of Education	**5**	Niihau School Waimea Canyon Kapaa Middle Kapaa High School Koloa Elementary
Total Water Plan 2020 Meetings	**71**	

Table 5.3
Communication Methods

Water Plan 2020 Media Support	Description
PowerPoint Presentation	Visual Aids for Outreach/Public Meeting Water Plan 2020 Flyers and Brochure
Public Service Announcements (PSA)	Hoike Community Bulletin Board Garden Island Calendar Radio Garden Isle Teleommunications
Press Release	Garden Island Honolulu Advertiser Star Bulletin Radio
Customer Newsletter	Public Meeting Announcements System Needs Rate Structure
Website	PowerPoint presentation posted Customer feedback
Radio and Television Interviews	KKCR Radio Program
Television	Mayor's Hoike Program County Council Presentation – Hoike Programs
Community Relations and Public Involvement	Water Conservation Education Community Outreach program

CHAPTER 6
IMPROVEMENT PROGRAM

Identification of Capital Improvements needed by the DOW water systems was a major focus of Water Plan 2020. As discussed in the previous chapter, many needed improvements were identified through the planning approach by consideration of level of service requirements and the source, storage and transmission evaluation criteria. Level of service considerations provide basic information about current and future water system deficiencies, but level of service alone will not address many water system needs, particularly those improvements needed to maintain the existing water system infrastructure. The DOW was aware that there are many existing facilities that are presently in need of renovation or replacement, due to the age and current physical conditions. Evaluation of the capital requirements associated with aging infrastructure became a significant element of Water Plan 2020.

To address the water system infrastructure needs for both new facilities and renovation and replacement of existing facilities, Water Plan 2020 focused on defining an island-wide Capital Improvements Program. Development of this program involved:

- Project Identification and Evaluation
- Project Prioritization within each Water System, and
- Island-Wide Improvement Program Prioritization and Scheduling

This chapter describes how the DOW developed the capital improvement program, starting with the identification and evaluation of individual projects, then describes the methods used for project prioritization, and finally identifies how all of the individual projects were compiled into a phased capital improvement program. The overall program, as updated periodically, will guide the DOW's capital improvement project execution over the next 20 years. A Board workshop was conducted so that the DOW could obtain Board input and direction on the plan's capital improvement program. The capital improvement program cost information also allowed the DOW to identify revenue needs for implementation of the needed improvements for the next 20 years.

PROJECT IDENTIFICATION AND EVALUATION

The identification of capital improvement projects began with the source, storage and transmission evaluations from the water system planning based on the level of service criteria. From those evaluations, the DOW determined that there are present and future deficiencies in source, storage and distribution capacity of the current water systems. In addition to the planning evaluations, the DOW also obtained input on the actual conditions of current facilities from their staff, primarily with the Operations Division. Based on system operations information, the staff identified proposed improvements based on the following guidelines:

- Pipelines with frequent failures or leaking pipe joints
- Poor facility access due to flooding, erosion, or deterioration of roadway conditions
- Safety
- Distribution mains traversing "cross country"

Projects were identified to address these considerations, and were included in the system project improvement list.

Source and storage needs identified through the level of service source and storage evaluations indicate current and projected capacity deficiencies in the various water systems. These results are identified in Tables 6.1 and 6.2.Table 6.1

Table 6.1

Source Needs by Water System

	Supply Needed, gpm	
Water System	**Year 2000**	**Year 2020**
Waimea-Kekaha	0	200
Hanapepe- Eleele	0	0
Kalaheo	0	0
Lawai-Omao	0	0
Koloa-Poipu	0	0
Puhi-Lihue-Hanamaulu	1,730	0
Wailua-Kapaa	700	0
Anahola	300	0
Moloaa	0	0
Kilauea-Waipake-Kalihiwai	400	0
Anini	0	0
Hanalei	200	0
Wainiha-Haena	100	0
Island-wide Total	3430	200

gallons per minute (gpm)

Table 6.2
Storage Needs by Water System

	Storage Capacity Needed, gallons	
Water System	**Year 2000**	**Year 2020**
Waimea-Kekaha	600,000	500,000
Hanapepe- Eleele	0	40,000
Kalaheo	500,000	0
Lawai-Omao	250,000	0
Koloa-Poipu	500,000	1,000,000
Puhi-Lihue-Hanamaulu	0	0
Wailua-Kapaa	2,150,000	0
Anahola	0	40,000
Moloaa	15,000	0
Kilauea-Waipake-Kalihiwai	650,000	0
Anini	0	0
Hanalei	100,000	0
Wainiha-Haena	210,000	0
Island-wide Total	**4,975,000**	**1,580,000**

As indicated in the previous section, the transmission and distribution systems were evaluated using a hydraulic model to determine the current and future capacity to provide for peak hour and fire suppression flows and pressures. Based on these analyses, proposed system improvement alternatives were developed and compiled for each system. In addition, the transmission and distribution networks were analyzed for the following conditions:

- Pipelines installed prior to 1960 (40+ years of age)
- Galvanized steel pipes (most are old, in poor condition and also have limited capacity)
- Polyvinyl Chloride (PVC) pipe installed prior to 1972 – 73 (most are small diameter and thin walled)
- Areas with dead-end mains
- Pipeline diameters below 6-inch

Based on these analyses, additional proposed projects were defined in each of the water systems.

The result of the project identification efforts was a list of needed projects for each water system The DOW and the consultant team defined each project for planning purposes, including a project description and an estimated cost that would be used for tentative budgeting purposes. The project definitions described the location and attributes of the project in summary form. Projects were tracked using a Microsoft Access database to manage information on each individual project.

Part of the project definition process was to evaluate and classify each project by category and to determine how well the project would address the need for improvement within the water system. The evaluation was needed to choose between alternative projects that address the same condition, as well as to serve as a basis for prioritization of projects. Classifications were developed that addressed certain funding restrictions, such as restrictions on use of bond funds or facilities reserve charge funds for certain types of projects. The project evaluation consisted of developing:

- Evaluation criteria for prioritizing the projects and the overall program
- Project type classifications:
  - CIP: Capital Improvement Project
  - CRP: Capital Rehabilitation Project – in kind replacement
  - CRPL: Capital Replacement Project – replace with additional capacity
- Prioritized project list by water system

PROJECT PRIORITIZATION WITHIN EACH WATER SYSTEM

A Prioritization Process was developed to provide a methodology for establishing the DOW project priorities. It is not unusual for a water system to develop a series of project improvements that exceed the utility's annual revenue plan. Consequently, a phased improvement implementation plan needs to be developed that meets the utility's ability to fund and staff an improvement program. The approach used in Water Plan 2020 was a two-part process:

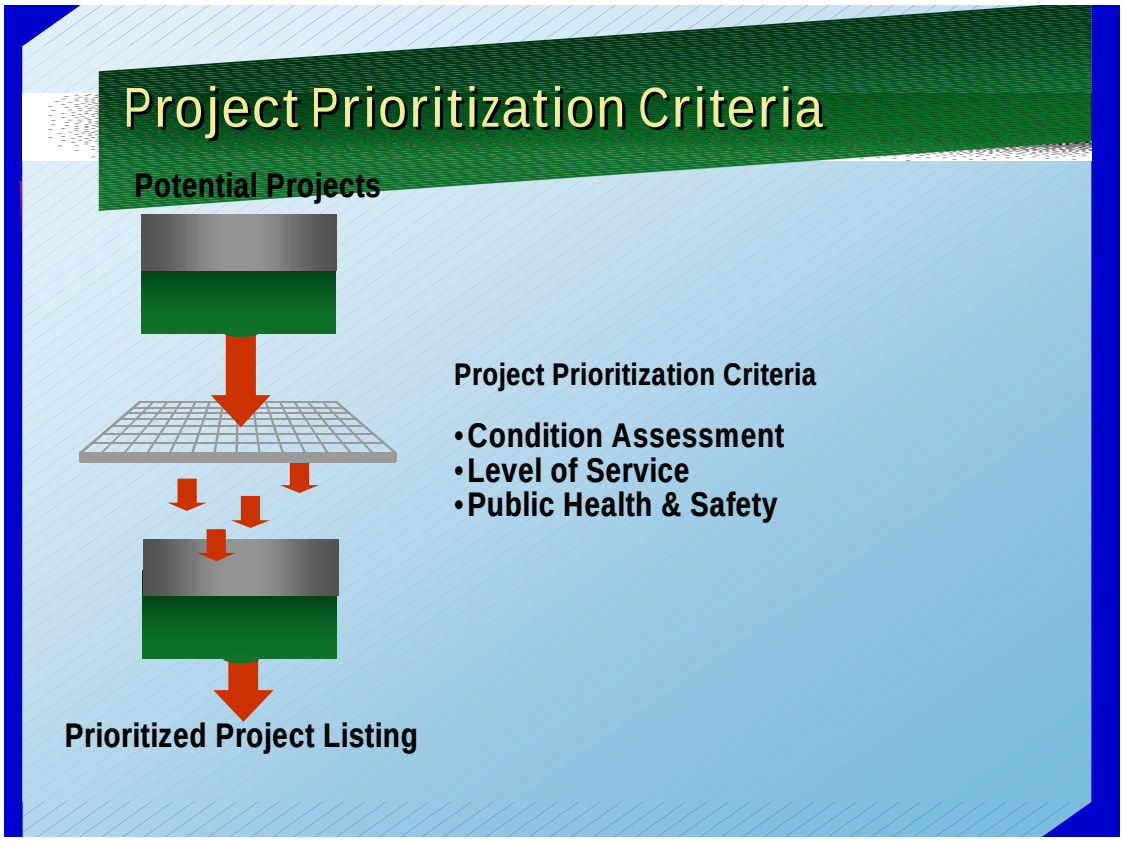
1. Prioritize the projects by water system
2. Develop an island-wide Implementation Program

The first step in the overall Capital Improvement Program prioritization process was to define and develop agreement on the project prioritization criteria. The project prioritization criteria were drawn from other similar water system CIP development. The major criteria used in prioritizing the proposed improvement projects included:

- Condition Assessment
- Public Health & Safety
- Level of Service

The prioritization process started from the un-prioritized list of projects that had been developed within each water system. Prioritization within each water system was intended to screen the projects within the system to evaluate which projects would be the most urgent within that system. The prioritization process is illustrated in Figure 6.1.

Figure 6.1
Project Prioritization Criteria



Once the criteria were identified, the next step was to define the criteria and establish a rating system. The proposed criteria definitions were discussed and each assigned a rating of high, medium, low, and not applicable. Following the criteria definitions and preliminary rating it was necessary to quantify each of the high, medium, and low ratings numerically so that projects could be assigned a ranking. Each project was then ranked in each criteria, based on quantification of high, assigned a point range of 8 to 10; medium, point range is 4 to 7; the low point range is 1 to 3; and not applicable is assigned zero points.

The following table 6.3 lists the project criteria, rating, and definitions.

Table 6.3
Project Evaluation Criteria

Criteria	Rating	Definition
Condition Assessment	High 8-10	Remaining useful life of 6 or less years. (e.g. – Historical water main break history indicate high rate of breaks, Mechanical equipment reaching end of manufacturer's recommended service life) or tank rehab, although the tank itself has useful beyond 6 years, painting, access etc. need to be rehabbed. Note this category will also include Facilities currently in the design and construction stage. DOW has already identified these projects as a high priority.
	Medium 4-7	Remaining useful life of 7 to 20 years (e.g. – Recently repaired facility)
	Low 1-3	Remaining useful life greater than 20 years (e.g. Newly constructed or rehabilitated facility).
	0	Criteria do not apply to proposed project.
Public Health and Safety	High 8-10	Supports significant increased water quality, fire protection, and public health and safety benefits. Regional system benefit is provided as opposed to only local. (e.g. Mercury contamination of wells)
	Medium 4-7	Enhances water quality, fire protection, and public health and safety benefits for a specific area or neighborhood provides additional reliability and redundancy. (e.g. – Provide additional fire hydrants)
	Low 1-3	No measurable benefits (e.g. No directly measurable benefit)
	0	Criteria do not apply to proposed project.
Level of Service (Conforms to adopted DOW level of service criteria)	High 8-10	Project provides immediate increased water service opportunities for a significant number of customers. (e.g. Known area of significant customer complaints or permit denials due to inability to provide required service)
	Medium 4-7	Provides near-term (5 to 10 years) water service demands (e.g. Future area of customer complaints and permit denials)
	Low 1-3	Provides long term opportunities to meet future system expansion and capacity improvements (e.g. – Provide regional system benefit or economic development opportunities)
	0	Criteria do not apply to proposed project.

The list of proposed improvements projects for each of the 13 DOW water systems were evaluated according to the project prioritization criteria. Initially, DOW reviewed each project to ensure that it was needed to improve or rehabilitate the existing system and a project type was assigned. Prior to finalizing each list a review was done to correct any deficiencies. The projects were then rated using the defined project criteria, condition assessment, public health and safety, and level of service.

A prioritized project list, with rating, was developed for each of the 13 DOW water systems. Prior to finalizing each list, a review was done to correct any discrepancies. The project listing used the database to track and manipulate the project rankings. In order to proceed with the next step of developing an overall Improvement Program, all the projects would need to be evaluated across the entire Kauai water system.

ISLAND-WIDE IMPROVEMENT PROGRAM PRIORITIZATION AND SCHEDULING

The preceding effort resulted in the development of prioritized lists of projects within each water system; to complete the island-wide capital improvement program it was necessary to convert these individual system lists into a comprehensive program. Inherent in this programming is additional prioritization, to determine on an island-wide basis which projects should be tackled first. Not all projects could be accomplished immediately, and the objective of the programming was to establish a CIP program that equitably addresses the needs of the DOW's water systems during the next 20 years.

To accomplish this programming, the DOW started with the scoring associated with each project based on the three prioritization criteria (Condition Assessment, Health and Safety and Level of Service). In addition to the overall scoring that each project received from the prioritization, there were additional Programming Criteria that were used to assign projects into phases of the 20-year program.

Based on the prioritization scoring, projects were initially assigned to improvement phases in the following order:

- Must do now: Rating 27 points +
- Phase 1 (2002 to 2006): Rating 22 to 26 points
- Phase 2 (2007 to 2011): Rating 18 to 21 points
- Phase 3 (2012 to 2021): Rating under 18 points

Programming criteria were also used in the overall CIP program development. The programming criteria are identified under the classifications of 1) Strategic Initiatives and 2) Financial and Funding Strategies. Strategic initiatives consisted of several considerations, including:

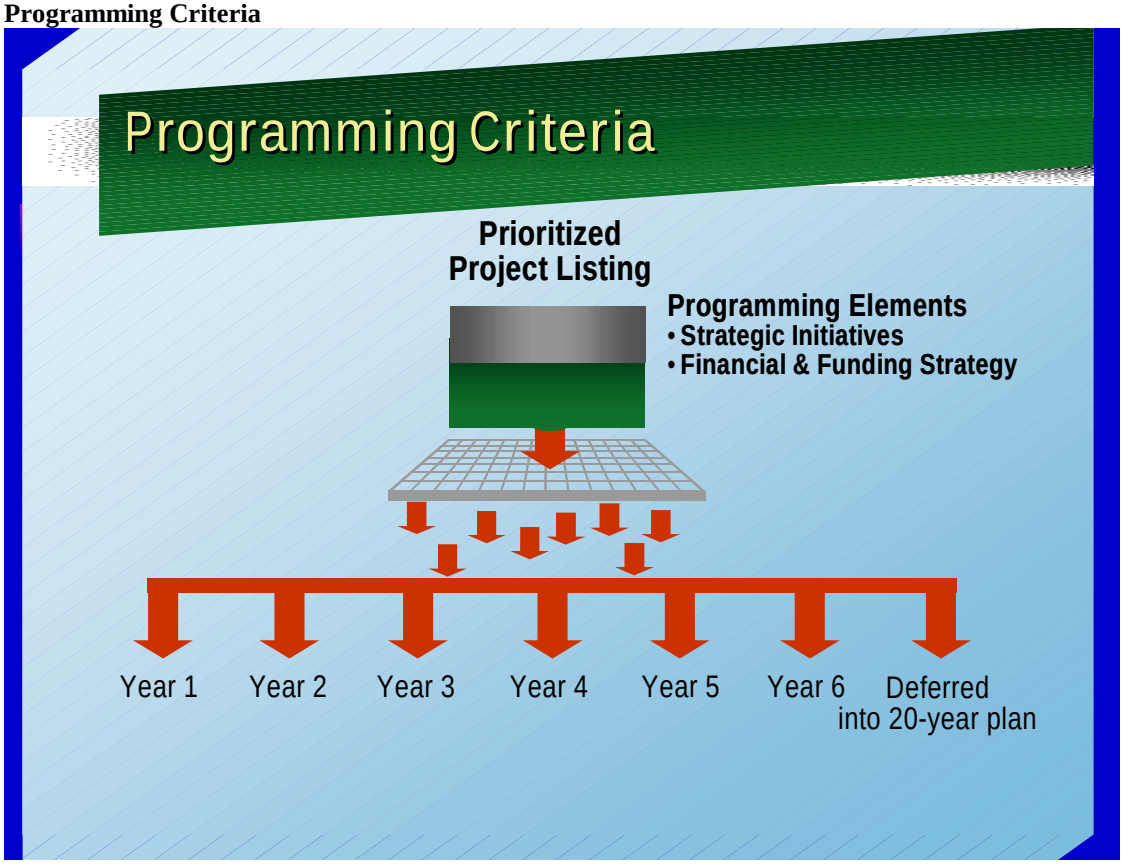
- Geographic distribution of projects around the island
- Addressing "must do projects"
- Complementary projects or projects than achieve other management priorities
- Reality check
- Schedule and project sequencing considerations.

Financial and Funding strategies generally pertained to projects where supplemental funding is available, for example from state of federal grants, or projects where private sector funds may be available on a cost sharing basis. Many supplemental funds are time sensitive, and must be expended within a specified time frame. The DOW assigns priority to completion of projects with supplemental non-DOW funds within the mandated time frame so as to not

loose such funding. An additional funding consideration of Water Plan 2020 was that projects that are currently funded by the Department would be continued through project completion.

Several iterations were done to balance projects across the CIP phasing for funding purposes, with special attention given to projects that qualified in the "must do now" categories. DOW also included all improvement projects currently funded in the first phase.
The process by which the prioritized list of projects from each water system were integrated into the island-wide program is illustrated in Figure 6.2. As this figure shows, the result of this programming was an island-wide CIP program that assigns a schedule on which the projects are to be completed over the duration of the 20-year program.

Figure 6.2
Programming Criteria



STRATEGIC INITIATIVES

Strategic initiatives involved various management considerations that collectively contributed to the overall scheduling of projects. Geographic distribution of projects around the island was identified as an important aspect of the overall program development, partly to ensure equity in the administration of the improvement program. Some projects also were identified as "must do" projects. Complementary projects included projects that might be accelerated somewhat because the project could be completed in conjunction with another public works project being completed by others. Another consideration in the scheduling of the program was the application of a "reality check". The programming was done in several iterations, and

the reality check was completed at the end of each iteration to identify whether some important project or projects were being lost, and to evaluate whether the DOW could realistically complete the projects in the sequence identified. Scheduling and sequencing of the project execution was also considered in the programming. For example, some projects could be consolidated with other similar projects for more efficient project execution.

The “must do” projects have several elements that DOW considered covered the following projects:

- Projects strategic to the utility,
- Projects where the remaining useful life is less than 5 years for a pipeline or other facility, as identified by DOW operations division input,
- Projects that have already been funded and are on-going or soon to begin and
- Projects needed to address water quality compliance issues or significant safety issues.

These projects will be included as top priority projects for the overall program development and funding consideration.

The Reality Check was conducted after completing the program prioritization iteration for each of the projects and was objectively reviewed by DOW to confirm the need for the projects listed in Phase 1. The review included other projects that may have been overlooked and need to be included in Phase 1. The Reality Check also considered total dollar volume for each phase. The reality check was also tested against ability of DOW staff to implement the projects. Currently DOW can implement approximately $5 million in total projects on an annual basis with the existing staffing. During the Reality Check, DOW moved 6 to 10 projects with operations concerns and small number of projects from Phase 3 into the Phase 1 project. An example of these types of operations projects would be permanent power generators at tank sites. Small projects were funded as well.

SCHEDULING

After completing program prioritization iterations, the DOW reviewed the program schedule, and identified an annual schedule for projects identified to be completed during the first five years of the program (Phase 1) Project cost estimates and funding projections over the project life were developed for the Phase 1 projects. These final schedule and funding details were used to project the CIP needs on an annual basis during Phase 1. The project schedules were adjusted to allow the projects to be completed on a schedule that levelized to the extent possible the funding needs over the first five years.

The project phasing CIP was developed with the following durations:

- Phase 1: 2002 to 2006
- Phase 2: 2007 to 2011
- Phase 3: 2012 to 2021

Two other considerations DOW used during the Program Prioritization was the ability to fund the CIP in any given year and the potential rate impacts, and DOW's staff capacity to manage multiple CIP projects. Both of these concerns impacted the final improvement program development and the pace at which the projects can be implemented.

FINAL PROGRAM SELECTION

The final program selection followed the process approach outlined above. The following tables are a comprehensive summary of the 20-year DOW Improvement Program:

- Table 6.4: Improvements by Phase
- Table 6.5: Improvements by Fund Type (CIP, CRP, CRPL)
- Table 6.6: Improvements System-wide by Project Type

Table 6.4
Water System Summary - Improvements by Phase

WaterSystem	Number of Projects	Total Cost (in millions)	Phase 1 FY 01-06 (in millions)	Phase 2 FY07-11 (in millions)	Phase 3 FY12-21 (in millions)
Kekaha-Waimea	29	$9.7	$4.9	$5.1	$5.2
Hanapepe-Eleele	14	$11.4	$2.1	$0.1	$9.3
Kalaheo	12	$10.3	$2.5	$3.7	$4.1
Lawai-Omao	12	$7.3	$1.7	$3.4	$2.3
Koloa-Poipu	18	$12.6	$3.2	$4.2	$5.2
Puhi-Lihue-Hanamaulu	33	$24.0	$9.4	$7.3	$7.3
Wailua-Kapaa	37	$37.7	$19.9	$6.0	$11.8
Anahola	9	$5.2	$2.7	$0.0	$2.5
Moloaa	2	$0.4	$0.4	$0.0	$0.0
Waipake-Kilauea-Kalihiwai	18	$11.9	$3.3	$4.5	$4.1
Anini	2	$1.6	$0.0	$0.0	$1.6
Hanalei	9	$4.8	$0.8	$2.1	$1.9
Haena-Wainiha	14	$5.9	$1.0	$1.7	$3.3
Total		**$148.1**	**$51.7**	**$38.0**	**$58.5**

Table 6.5
Improvements by Fund Type

FundType	Number of Projects	Total Cost (in millions)	Phase 1 FY01-06 (in millions)	Phase 2 FY07-11 (in millions)	Phase 3 FY12-21 (in millions)
CIP	46	$51.8	$24.6	$6.0	$21.3
CRP	74	$20.0	$9.1	$4.9	$6.1
CRPL	89	$76.3	$18.1	$27.1	$31.1
TOTAL	**209**	**$148.1**	**$51.7**	**$38.0**	**$58.5**

Note:
CIP: Capital Improvement Projects
CRP: Capital Rehabilitation Projects
CRPL: Capital Replacement Projects

Table 6.6
Improvements by Project Type

Project Type	Number of Projects	Total Cost (in millions)	Phase 1 FY01-06 (in millions)	Phase 2 FY 07-11 (in millions)	Phase 3 FY12-21 (in millions)
SOURCE	54	$26.3	$19.7	$4.6	$2.1
STORAGE	42	$25.6	$9.9	$3.7	$12.0
PIPELINE	98	$82.9	$19.5	$28.7	$34.7
BOOSTER PUMP	7	$2.0	$1.0	$1.0	$0.0
OTHER	8	$11.3	$1.5	$0.0	$9.8
TOTAL	**209**	**$148.1**	**$51.7**	**$38.0**	**$58.5**

Note: Other Projects Include Access Roadway Improvements

PROJECT IMPLEMENTATION PLAN

Implementing a program of this magnitude is a challenge for most water utilities. DOW has carefully considered their current project execution capability benchmarked based on current workload. As a result, DOW has determined that during Phase 1 they need the ability to implement, on average, $11.0 million of capital projects annually. The following presents an overview of DOW's approach to implementing the capital program identified in the previous section.

The Phase 1 projects will be grouped by complexity, i.e. pipeline replacements, water quality improvements, etc. The complexity grouping will provide DOW with the process needed to implement the projects. Less complex projects can follow a standardized approach such as:

- Design-Using in-house design staff, or a consultant selected from a pre-qualified roster, implement the design using standard details and contract documents.
- Bidding and Award-Simplified bidding and compensation procedures to competitively hire a contractor for project construction.
- Construction-Establish standard project guidelines for construction management and progress review, billings and payments.

The purpose of a standardized approach is to minimize the administrative process and schedule needed from the time of project development through construction.
More complex projects may require a selection process for design support services and additional time for contract bidding and award. Maintaining as much of the standardized approach being used for the less complex projects will be beneficial in accelerating the schedule and managing the overall project.

In preparation for the upcoming capital implementation, DOW is currently evaluating their process approach to project implementation. This includes both a staffing and organizational review to increase efficiency. The process review will assist DOW in developing the needed staff and organizational modifications required to implement these projects in the time frame committed to in Water Plan 2020. The proposed modifications may require Board action at a policy level for implementation.

The initial evaluation for the project implementation plan indicates that DOW needs to increase staffing in several areas. It is recommended that DOW proceed with following hires over the next 18 months:

- 2 – Project Engineers
- 2 – Accountants
- 2 – Construction Inspectors
- 1 – Information System Analyst

Other staffing will be needed by DOW to maintain operations as well. These additional staff have been included in the water rate study revenue requirements.