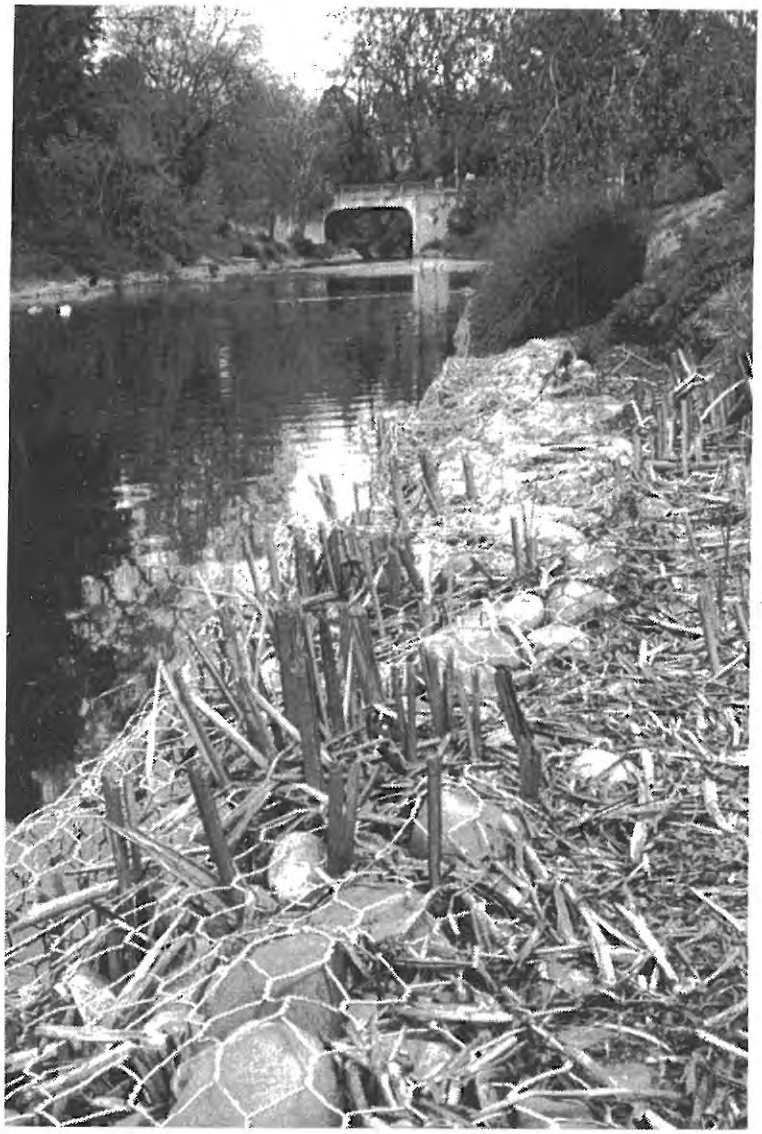
Arboretum Waterway Improvement Plan University of California, Davis



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EXECUTIVE SUMMARY

The Waterway Improvement Plan (WIP) takes an ecological and cultural approach to establishing the Arboretum Waterway as a vital part of the campus' larger landscape. The WIP seeks to improve the quality of water in the Waterway in order to enhance its function as a center for campus activities, an attraction for off campus visitors and as a central feature of the Arboretum itself. The WIP proposes to introduce sizable new flows into the Waterway, move water through the Arboretum and reuse the water for campus landscape irrigation. In this new form, the Waterway would become a metaphor for the interplay between modern society and water in California: water is mined, reclaimed, stored, conveyed, and reused.

The WIP has been developed after several months of meetings involving community members and a multi-disciplinary campus committee. Input from the wider Davis community will continue to be an important part of the implementation process.

Two tiers of recommendations are proposed to realize these goals, the first to take place over approximately 18 months, the second over three years. These may be summarized as follows:

SHORT TERM (TIER 1)

1.1 Redirect reclaimed water from new waste water treatment plant on a westerly course through the Arboretum Waterway, eventually returning it to South Fork of Putah Creek.

1.2 Pump ground water from east end of Arboretum through the Waterway and use this for campus irrigation at the west end.

1.3 Evaluate the efficacy of allowing seasonal water level variations as a means of improving water quality.

1.4 Construct weirs at various locations along the Waterway to ensure proper flow directions, maintain high water levels in high-use areas during summer months and improve flood control.

1.5 Pursue the idea of reconnecting the east end of the Arboretum Waterway to the existing Putah Creek channel under the Southern Pacific Railroad tracks as part of the current Greenway/bikeway project.

1.6 Establish interpretative signage.

1.7 Begin planning and implementation of a demonstration wetland that will biologically filter nutrients within the water and improve water quality for possible irrigation use.

1.8 Plan fishpond to demonstrate quality of reclaimed water.

1.9 Initiate a program to identify amount and use of anticipated increases in reclaimed water.

1.10 Building on the findings and recommendations of the Darby Report (Darby and Conners, UC Davis, 1991), conduct an updated inventory of nutrient sources and initiate a year-round, ongoing water and sediment sampling program.

1.11 Develop and implement a regular waterfowl management program.

1.12 Explore possible means of skimming the Waterway on a regular basis.

1.13 Encourage public input and participation, and establish informational and educational programs about the Waterway.

1.14 Appoint a committee and project manager to oversee the first two years of Waterway Improvement Plan.

The Arboretum is a valued and beautiful part of the campus landscape.Photo by L. Griffith

MEDIUM TO LONG TERM (TIER 2)

Other strategies for improvement of water quality will require more time, approximately three years, to plan and implement. Through a partnership that includes the Associate Vice Chancellor - Facilities, the Arboretum Director and appropriate campus researchers and staff, this phase of the project would include:

2.1 Build one or more fishponds at the headwaters of the new water source to demonstrate and monitor quality and clarity of treated waste water.

2.2 Evaluate Tier 1 mitigation measures and develop long-term policies for sustained water quality.

2.3 Encourage campus involvement with the Arboretum Waterway as a research and education resource.

2.4 Ask the Arboretum to consider canopy development as a way of reducing ultraviolet availability and the heating of water.

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ACKNOWLEDGMENTS

This report summarizes a year-long investigation into ways to make the Arboretum Waterway a more healthy and attractive part of the campus landscape. This effort was guided by an ad hoc Committee under the leadership of Robert Powell, Faculty Assistant to the Provost (1996-1999) and Professor of Chemical Engineering and Materials Science. Funding was provided by the Office of the Provost. Research coordination and publication was provided by the Center for Design Research. We would like to thank all the people who participated in this lengthy process.

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Additional interviews with the following campus and Davis community officials further increased our understanding of related water quality issues and opportunities:

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INTRODUCTION

HISTORICAL SETTING

For centuries, Putah Creek has been the lifeblood of the Davis region. Before European settlement in the middle of the last century, the Creek was the focal point of the Patwin Indian culture. During the drier seasons, the Patwins lived on the Waterway, relying on the abundant vegetation, fish and wildlife. When they migrated to higher land during the rainy winter season, they brought with them starch flour made from valley oak acorns that grew prolifically along the creek. This flour provided their staple diet throughout the winter.

This interaction between Native Americans and the natural environment was permanently altered with the arrival of European immigrants in the mid 1800's. While Native American Indians manipulated the environment and sculptured the "natural" landscape, they nevertheless worked with, rather than against, natural processes. In contrast, the European settlers attempted to control natural processes and consequently altered the landscape in a

Native American Patwin tribe used the Putah Creek habitat for medicines, food, shelter and ccraft materials incluiding basket weaving. Photo curtisy of UC Davis Arboretum Library

dramatic, and often negative, manner. Before European settlement, winter floods were considered part of the regenerative process of the Valley. With the arrival of Euro-American settlers, these winter floods were perceived as 'disasters.'

Even after Putah Creek was diverted to the man-made South Fork, the Arboretum occassionally flooded. Photo curtisy of UC Davis Arboretum Library

In the case of Putah Creek, the great flood of 1864 and the extreme climatic variations of the region resulted in the Creek's diversion in the early 1870s from its original course to the south, away from Davisville. Ironically, this man-made "South Fork" now represents the "natural" riparian resource for the region. Over the last several years, there has been increasing interest in restoring and conserving this natural resource. The WIP committee believes a stronger connection between the North and South Fork would be beneficial not only to the health of the Waterway itself, but as an open space corridor connecting campus with the Davis community.

ARBORETUM WATERWAY

Aerial view of Arboretum looking east. photo by M. Francis

In 1905 the University of California, Berkeley started an agricultural research institute in Davisville near Putah Creek. By 1922, the University Farm had evolved into a fully accredited independent university: UC Davis.

As part of the original University Farm, the North Fork of Putah Creek served as the main conduit for the campus drainage system and provided an open space amenity for public recreation. Students, faculty, and members of the public used the North Fork as a natural refuge from the summer heat and the urban environments of campus and the Davis core area. Unfortunately, the waterway was also used as a garbage dump. In reaction to its general degradation, concerned citizens declared their interest in preserving the existing riparian habitat and requested the University to protect the area and demonstrate stewardship for the natural environment and public health. In 1936, the Arboretum was established to conserve riparian habitat, heritage oaks, and provide educational and recreational opportunities. On February 29, 1936 the first official planting activity was held in the UC Davis Arboretum.

In 1932, Cal Aggie Day students volunteered to clean and improve the UC Davis Arboretum. Photo curtisy of UC Davis Arboretum Library

The creation of the Arboretum was not enough to arrest the decline of the health of the Waterway itself. Beyond the control of the campus and the local community, several government projects further isolated the North Fork of Putah Creek from a natural water source. The Monticello Dam project created Lake Berryessa, permanently inundating the upper portions of the Putah Creek watershed and muting winter flows in the lower portions. In addition, the Army Corps of Engineers designed and implemented large levees to channel flooding from the lower Putah Creek watershed to the Yolo Bypass. The levee system isolated the former North Fork and disrupted the fluvial process, forcing the river to incise a deeper channel and erode its bank. More recently, the construction of Highway 113 bisected the remnant North Fork of Putah Creek and connected the two segments with a metal culvert and standpipe in case of the rare flood. Monticello Dam, the levees and the highway project thereby completed the near total isolation of the original main channel of Putah Creek from its historic headwaters and created a new urbanized watershed comprising the UC Davis campus east of Highway 113 and south of Russell Boulevard.

To improve campus drainage efficiency and allow for future campus growth in previously flooded regions, the Waterway underwent a major expansion during the late 1960s. The 1968 Osmundson, Staley and Arbegas redesign of the Arboretum welcomed the design opportunities along the new Waterway and unified the landscape with a general planting design by Danielson. While the design creates a picturesque landscape that frames a two-mile section of the former Putah Creek beautifully, the summer algae blooms and green-tinged water continue to remind us of our need to better understand and steward the altered riparian system centered within the Arboretum.

Water quality is seen as a major problem with the existing waterway. Photo by L. Griffith

The original main channel of Putah Creek remains to this day a centerpiece of the Arboretum and the campus. Its character has changed dramatically from when it was the original Putah Creek. Today, it can no longer be considered a part of the original watershed. Indeed, it does serve as the drainage for a watershed, but that watershed is the central part of the campus, As such, in this

report, the term, "Arboretum Waterway" is used to identify the body of water currently occupying the old channel. Its role as the drainage channel for the campus is central to its function of protecting the campus from winter floods. It also fulfills several other vital functions for the campus including conservation, recreation, education and research.

The isolation of the Arboretum Waterway from its original water source has left the water stagnant and unsightly. Going back over thirty years, it is clear that many campus researchers with experience in water quality issues foresaw what the Waterway would become. There have been several efforts over the intervening years to address water quality issues. Recommendations have varied, from the addition of algae suppressing chemicals, to the use of both biological and mechanical filtration systems. The 1991 Darby Report is the most thorough scientific investigation into the water quality of the UC Davis Arboretum Waterway. Based on a year's worth of water sampling data and thorough research, the report recommended that an improved maintenance program be implemented which would deal with pest control, nutrient inflows, drain/fill practices, sediment removal and flushing strategies. Inspired by the Report's recommendations, the dredging projects of 1997-98, which were funded by the Office of Administration, removed over three million gallons of sediment, decreased nutrient sources and increased flood control capacity of the Waterway. However, we have not fully ventured beyond the functionalism of the flood control and capitalized on a wonderful opportunity to transform the Waterway into a managed environmental system that is attractive throughout the year and complements the Arboretum itself.

With future campus development along its southern bank and the increased visibility and exposure of the Waterway, the unsightly and pungent green water must be improved. In the critical eyes of the public, such degradation fosters negative perceptions of UC Davis' public image and its role as steward of the land and public health. It is not, indeed, surprising that the 1999 Waterway Improvement Committee identified the algae blooms as the first major problem to address.

The Waterway Improvement Plan will provide the infrastructural foundation for a healthy Waterway and help better develop and implement the Arboretum Master Plan which is currently in development. A partnership between the Arboretum and the Office of Administration- Facilities-will establish a strong foundation for coordinating better involvement from other campus departments, and greatly enhance the use of the Arboretum Waterway as an outdoor research and teaching venue.

CURRENT PROBLEMS & OPPORTUNITIES

PROBLEMS

- The Waterway is largely perceived as unattractive. People often refer to the water as "ugly" or "smelly". It is a common source of jokes as well as serious concern from members of the campus community.
- The Waterway has little water movement and significant algae buildup during summer months.
- An overpopulation of mallard ducks within the Waterway could be a source of disease transmission to other waterfowl communities.

Mallards ducks are seen by some people as major problem in the UC Davis Arboretum. Photo by L. Griffith

- The rock and wire gabions and concrete gunite banks are falling apart and are aesthetically unpleasant.
- Trash, leaf litter and other floating debris make the Waterway an unsightly centerpiece of the University's landscaping.

Leaf litter contributes to the Arboretum's water quality problems.
Photo by L. Griffith

CONCEPTUAL ISSUES

- The Arboretum Waterway is physically isolated from natural stream flow.
- When water does flow, it is to the west through the Arboretum, not to the east as it did historically.
- The Waterway is full yearround whereas historically the water levels varied seasonally.

The south fork of Putah Creek is a dynamic natural river system.
photo by L. Griffith

OPPORTUNITIES

- In February 1998, Kathleen Socolofsky was hired as the first full-time UC Davis Arboretum director.
- With a new waste water treatment plant scheduled to open in late 1999, there is an opportunity to revitalize flows in the Waterway by redirecting reclaimed water.
- The potential uses for high quality reclaimed water are many, including irrigation of campus landscape.
- Building on the Arboretum's Strategic Plan of 1998 and the increased support from the campus administration, staff members of the Arboretum are working on a Master Plan that promises to make it a more valuable open space within the California Central Valley.
- With the recent completion of Aggie Village Homes and the Davis Commons development as well as a proposed demonstration garden, the Arboretum is expanding its programs and visibility.

- The Arboretum Waterway presents an educational opportunity to communicate the ecological importance of water and engage the public as stewards of the environment.
- The new Center for the Arts, to be sited next to the Arboretum, is under final design development. This will greatly increase the visibility and recreational use of the Arboretum.
- The City of Davis and UC Davis are enlarging their open space system into a greenway of interconnected developed and natural open spaces connected by bicycle and pedestrian paths (Francis, et al, 1988). The Waterway is a central feature of this evolving system connecting the UC Davis campus with the greater community and natural areas within the watershed.
- To better connect South Davis and downtown, the City of Davis is currently building a bike path along the remnant river channel of Putah Creek between the east end of the Arboretum and Interstate 80.
- Community awareness is currently very high due to the recent dredging projects and Waterway design workshops.

The Arboretum can be connected as a seemless part of the city's greenway open space system similar to Boulder Colorado.
photo by M. Francis

ARBORETUM WATERWAY DESIGN WORKSHOP

A planning workshop with 40 members of the Davis community was held at Putah Creek Lodge on May 7, 1999 to explore alternatives for improving the Waterway. Participants included Arboretum staff, members of the Friends of the Arboretum, campus planners, faculty with expertise in design, engineering, and ecology, environmental specialists, city officials, students, and residents (See Appendix B for participant list).

The workshop provided an opportunity for the campus and community members to discuss possible solutions to the Waterway. photos by Sara Richards

Three diverse conceptual plans were proposed to stimulate group participation and discussion on water quality solutions for the Arboretum Waterway. The three intentionally divergent alternatives represented the culmination of the Committee's understanding and process thus far.

- The Experimental Alternative: This approach proposed to use the Waterway as a living lab to test various strategies for improving water quality.
- The Incremental Alternative: While maintaining existing infrastructure, this option proposed minor alterations be made to the Waterway in gradual phases, based on established theories for improving water quality.
- The Living Waterway Alternative: This was more of a conceptual plan for the Arboretum Waterway, dealing with the restoration of natural flow directions and open space links.

After a brief introduction of the 10-member WIP Committee and a summary of its work to date, Committee Chair Bob Powell began an informal discussion with the group, asking them to list general goals and objectives for any proposed alteration to the Waterway. (See Appendix A for Workshop Agenda.) The suggestions reflected the diverse interdisciplinary background of the participants. It was generally acknowledged that any Waterway improvement plan must be a flexible design able to incorporate educational and ecological messages as well as meet realistic maintenance and implementation costs. The group also expressed concern about issues beyond the scope of the WIP such as bank erosion and other issues related to the Arboretum landscape. With these comments in mind and a general understanding of the three alternatives, three small groups were formed to discuss in detail the issues related to each alternative for two hours and then report findings to the reconvened larger group. Afterwards, several participants enjoyed a canoe paddle through the Arboretum Waterway.

In summary, the group was skeptical about the Experimental Alternative primarily because it offered no clear vision or course of action other than scientific experimentation. The group wanted a definitive plan to improve water quality that was financially realistic and practical. While participants supported the idea of using reclaimed water from the new waste water treatment plant, they were concerned about public perception if water quality did not noticeably improve. Ultimately, the group decided that certain aspects and elements from the Incremental and Living Waterway Alternatives could be combined to create a successful Waterway improvement plan.

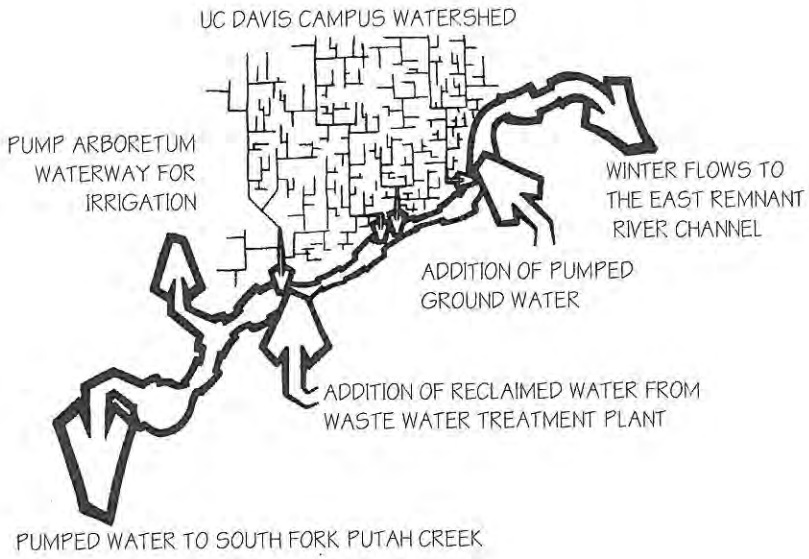
VISION

The Arboretum Waterway is a defining feature of the campus that embodies local ecology and cultural history. The vision of the Waterway Improvement Plan is to improve water quality and the health the aquatic ecosystem while maintaining the traditional role of flood control. The Committee believes that we now have an opportunity to determine if such a vision can be realized. It is important to recognize that this involves first and foremost a successful effort to improve the water quality, but this is not all. The Waterway can potentially serve as the landscape feature that connects the campus with the city, which can be expanded into other parts of the campus and which can be integrated in a comprehensive way with architectural projects. Many of these ideas are beyond the scope of this report. However, at different points we touch upon them and provide some long-range views in the concluding remarks. Finally, the WIP proposes to enhance the setting for the UC Davis Arboretum plant collections.

The proposed plan is a culmination of extensive research, interviews, meetings and a community workshop held over the past year. Numerous meetings with wetland ecologists, environmental engineers, civil engineers, landscape architects, and University staff, faculty and administrators provided the foundation for our recommendations. The recommended actions are aimed at establishing the Waterway as a healthy managed ecosystem that connects the campus and the community both metaphorically and physically. Secondly, the Committee has also provided recommendations meant to monitor and manage the system to measure its health and improve its connection with the community. Actions have been divided into a two-tiered approach. In the first

tier are those recommendations that should be implemented in the first 18-months of the program. In the second tier are actions that can be taken during the first year and a half, but full implementation may rest with the results of the initial actions. These two stages could be fully implemented within approximately three years if adequate funding and administrative support are provided.

ARBORETUM WATERWAY IMPROVEMENT PLAN CONCEPT



RECOMMENDED ACTIONS AND IMPLEMENTATION STRATEGIES

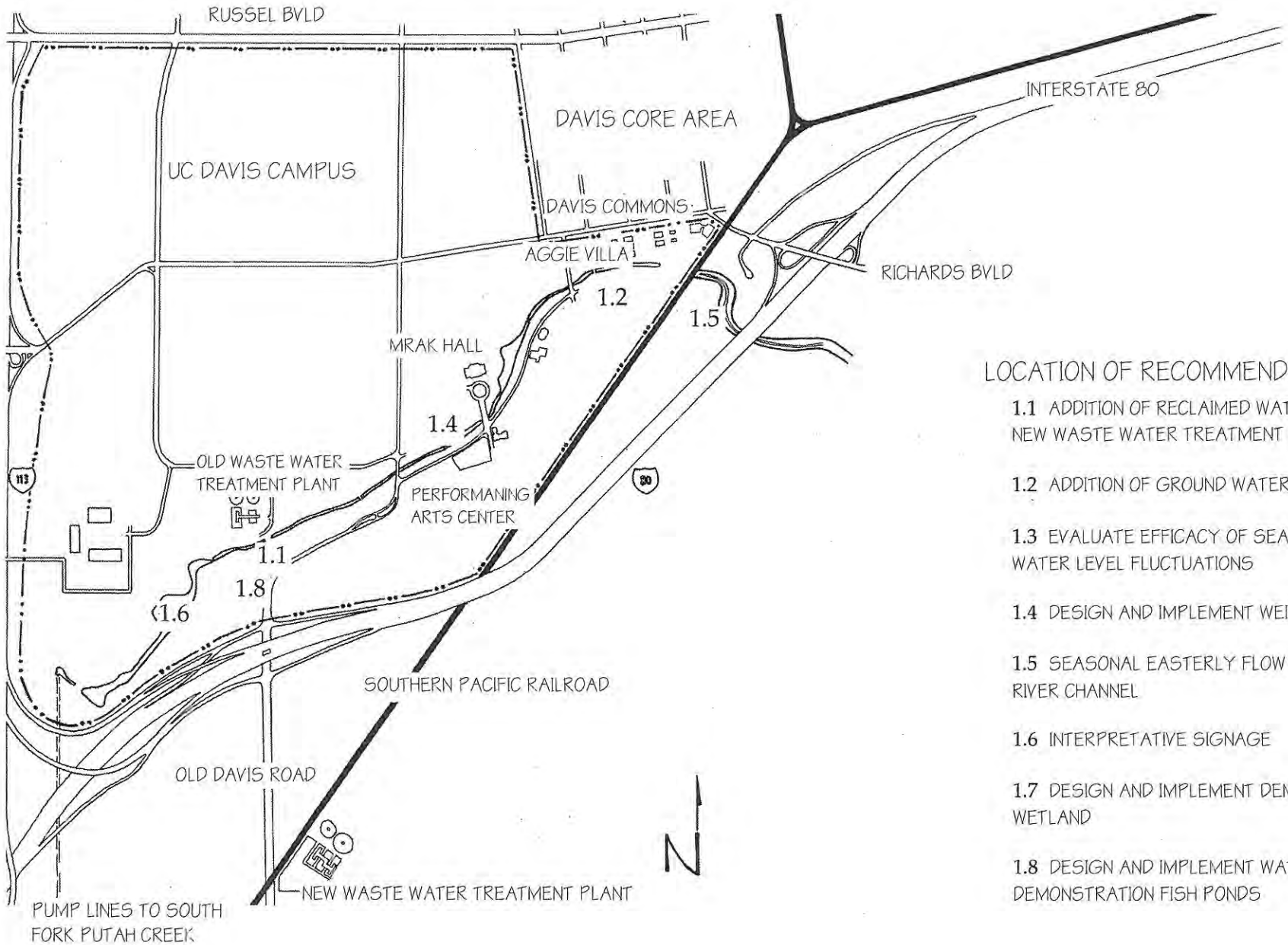
TIER 1: 18-Month Implementation beginning 4/1/2000

WATERWAY IMPROVEMENT RECOMMENDATIONS

1.1 Action: Redirect reclaimed water from the new waste water treatment plant through the Arboretum Waterway. Direct flow toward the west where it will eventually be returned to the South Fork of Putah Creek via the west pump station. The amount returned to the South Fork should reflect the recent flow rates that the campus has dedicated to maintaining flows to Putah Creek.

Rationale: Using reclaimed water will allow the West End of the Waterway to experience flow. An existing, unused pipeline can be put into service to return the water to the Waterway at a point near the old water treatment facility. Currently, the campus releases all reclaimed water into the South Fork to support the aquatic ecosystems especially during the critical dry summer months. The permit allows the campus to discharge the reclaimed water directly into Putah Creek. It is important to hold discussions with the local water board regarding the issue of using reclaimed water in the Waterway prior to discharge in Putah Creek. The University must also consider the loss of water due to evaporation and assure the same amount of water returns to Putah Creek after it has flowed through the Waterway.

The principal costs of this recommendation will be the purchase and installation of a pump and the increased operating costs. The Committee suggests that the Associate Vice Chancellor- Facilities develop a cost proposal for implementation and maintenance.



LOCATION OF RECOMMENDED ACTIONS

1.1 ADDITION OF RECLAIMED WATER FROM THE NEW WASTE WATER TREATMENT PLANT

1.2 ADDITION OF GROUND WATER

1.3 EVALUATE EFFICACY OF SEASONAL WATER LEVEL FLUCTUATIONS

1.4 DESIGN AND IMPLEMENT WEIRS

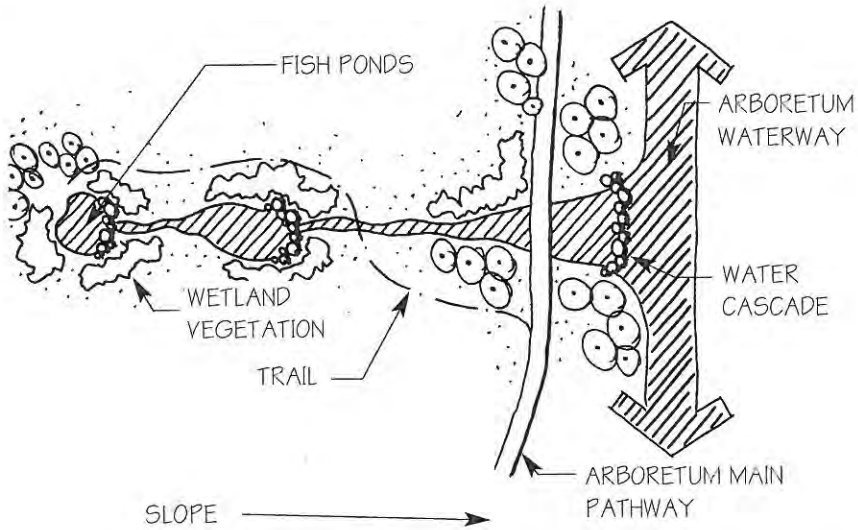
1.5 SEASONAL EASTERLY FLOW TO REMNANT RIVER CHANNEL

1.6 INTERPRETATIVE SIGNAGE

1.7 DESIGN AND IMPLEMENT DEMONSTRATION WETLAND

1.8 DESIGN AND IMPLEMENT WATER QUALITY DEMONSTRATION FISH PONDS

RECLAIMED WATER INFLOW AND DEMONSTRATION FISH PONDS



1.2 Action: Pump water from an irrigation well, located near the A Street bridge, into the Waterway and direct flow to the west. At a location near the west end of the Waterway, pump added ground water from the Waterway and use it for campus irrigation.

Rationale: This recommendation will provide for flow through the eastern portions of the Waterway. Since this water would be used for irrigation of Arboretum collections and general campus landscape it is imperative that it is monitored on a regular basis to assure appropriate water quality. The recycling of Arboretum water must be compatible with existing campus irrigation systems for it to be feasible and cost effective. Finally, there must be a thoughtful effort to make the public aware of this proposed multi-purpose irrigation system.

1.3 Action: Evaluate the efficacy of allowing seasonal water level variations as a means of improving water quality.

Rationale: By reducing the Waterway volume in the summer, the potential benefits of water flows would be increased. However, the potentially erodable area along the bank increases as water levels fluctuate up and down. In order to mitigate the possible increased erosion from varying water levels, the design and location of new bank plantings and stabilization techniques must be coordinated with the Arboretum. The increased exposure of degraded gabions and concrete edges must also be considered in addition to the possible negative effects on established specimen plantings. If fluctuating water levels prove to be a viable option for the long-term management of the Waterway, additional steps need to be taken. The management of water levels must comply with flood control policy, bank stabilization and vegetation programs, and water addition and withdrawal policies.

1.4 Action: Recommendations 1.1 and 1.3 may require the construction of two to three weirs at specific locations along the Waterway to ensure proper flow directions.

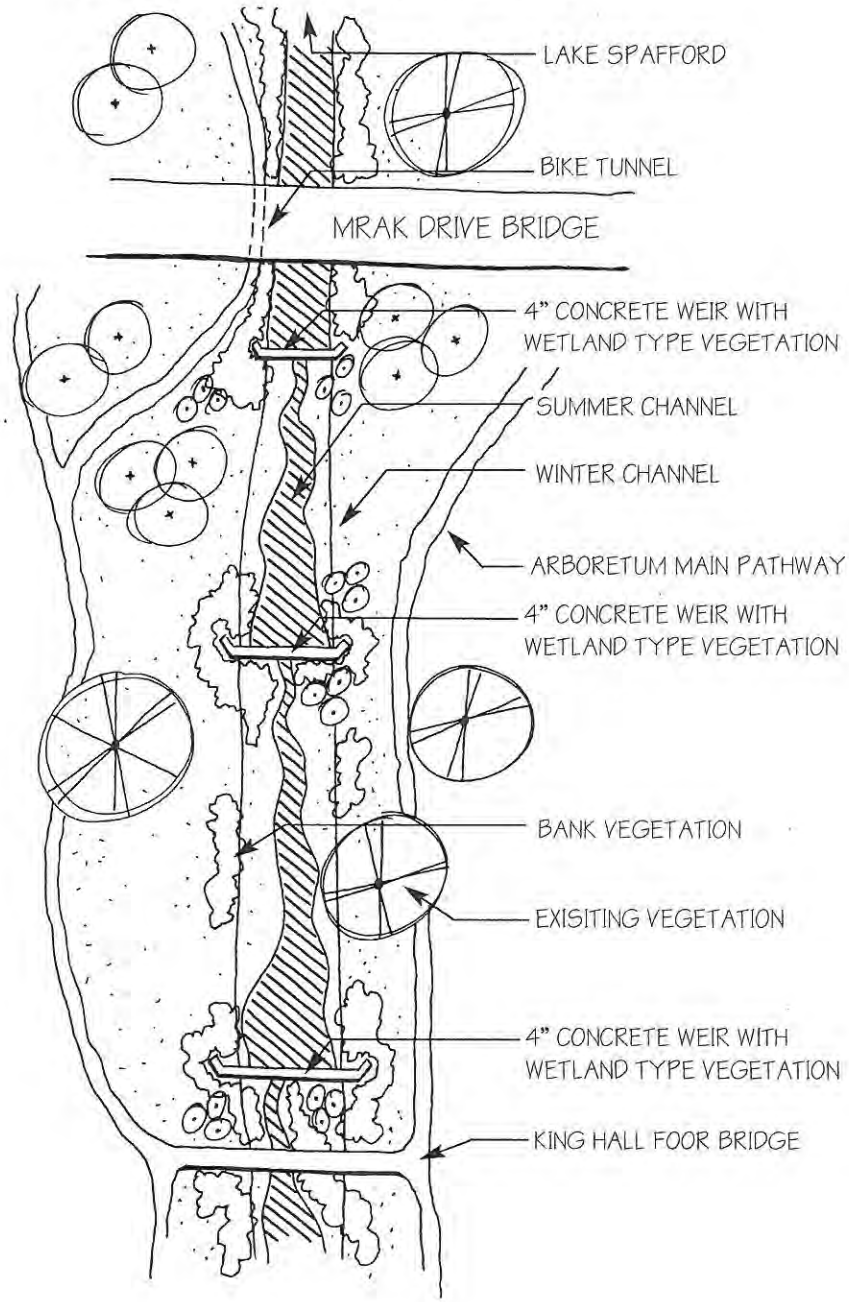
Examples of weirs used in other waterway projects in Florida and Connecticit. top phot by M. Francis. right photo by Lucy Chamberlain

Rationale: One of the core elements of recommendations 1.1 and 1.3 is to ensure a westerly flow of water. This will involve establishing high points in the Waterway from which water will flow from east to west, consistent with the existing direction of flow, but contrary to the historical direction. Weirs will allow greater control of seasonal water levels, thereby creating a more captivating and lively Waterway while maintaining deep water pools in high use areas during hot summer months. The effects of varying water levels and seasonal flow will be monitored. Conceptually, one weir could be placed to the west of the Mrak Drive bridge to maintain water levels in Lake Spafford, and a second weir placed near Putah Creek Lodge to direct the added reclaimed water to the west. However, it is vital that placement of weirs be carefully considered to avoid compromising the Waterway's flood control function and to coordinate fully with the Arboretum planning process.

1.5 Action: Pursue the idea of having seasonal flow eastward under the Southern Pacific railroad. This project could be done concurrently with the construction of a bike underpass. The central concept is to use the remnant creek channel at the east end of the campus and extend the Waterway south to Interstate 80 to convey overflow water in the winter during flooding conditions. This recommendation requires further discussions between the campus and the City although preliminary discussion has found considerable community and campus support for this concept. It will also require some thoughtful consideration of the east end of the campus property as the south Davis continues to grow and the bicycle traffic using the new underpass increases. Finally, it will require an evaluation of the frequency and volume of flow that might be diverted to the east.

Rationale: There is considerable enthusiasm within the Committee for the long-term strategy of seasonal variation of the water levels and water flows through the Waterway. The other scenarios we describe in these recommendations would create a westerly flow, and indeed, it is the view of the Committee that this

PROPOSED WEIRS FOR WATERWAY

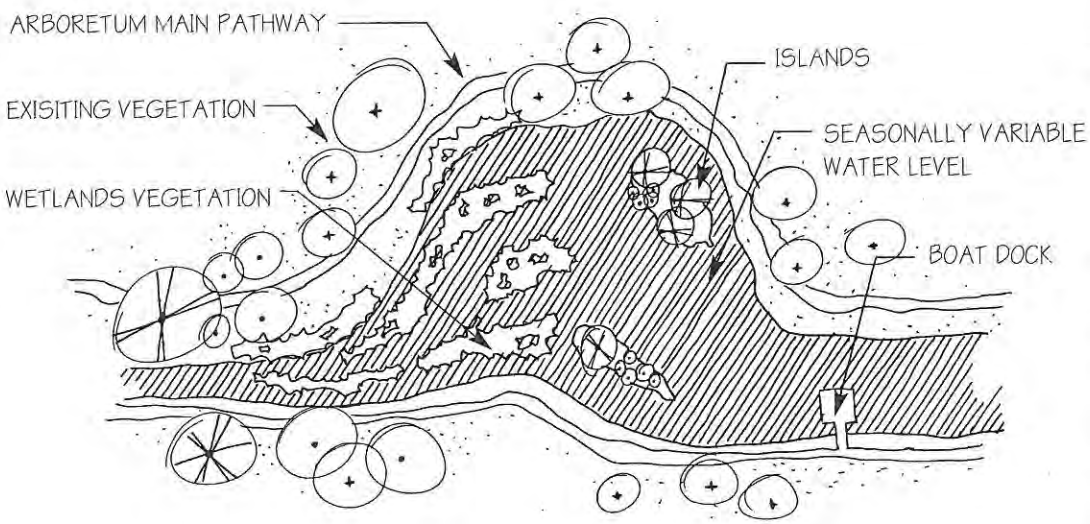


will predominate most of the year. However, there is the potential for the campus to make a dramatic change in the east end of the campus and the way that it connects with South Davis. Between the Southern Pacific railroad and Interstate 80 lies a remnant of the original Putah Creek. Currently, this is a largely inaccessible area, bordering on the light industrial area surrounding Olive Drive. The Committee believes that much of this is likely to change with the construction of the bicycle underpass. This area will become the main entrance to the downtown and the campus for hundreds of bicyclists daily. The creek bed, now a largely unmaintained landscape, will necessarily change to accommodate the safety and hazard concerns of the users. Opening a waterway under the railroad tracks will provide the opportunity for a dramatic positive change in this landscape. During flood years, water could run into this region, establishing an environment reminiscent of the original creek. It could also be the centerpiece for renewal along Olive Drive as this area acquires the vistas of a natural habitat minutes by foot from downtown. The concern that originally caused the east end to be closed, namely that allowing floodwaters to overflow to the east would cause property damage downstream, has been alleviated. At times of severe floods, when such threats are real, the existing flood control pumping station at the west end can be activated to eliminate the possibility of flooding to the east. An evaluation is needed to determine how much flow could be diverted to the east and the types of environmental and aesthetic benefits it would create.

1.6 Action: Establish interpretative signage consistent with the Arboretum's mission which reflects the dynamics of the Waterway and encourages continued community participation and stewardship.

Rationale: Any development of an interpretive scheme must be consistent with the long-term planning of the Arboretum. By providing better educational messages that relate the history and culture of the watershed, interpretative signage will enhance people's experience of and satisfaction with the Arboretum.

WETLANDS DEMONSTRATION



1.7 Action: Begin planning and implementation of a demonstration wetland that will biologically filter nutrients within the water and improve water quality for possible irrigation use.

Rationale: The Committee believes that wetlands could be an effective means of filtering water as well as a means of enhancing the beauty of the Waterway. Prior to irrigation use, the wetlands could clean Arboretum water near the large lakes to the west. We recommend that the Arboretum and Office of Administration - Facilities take the lead in developing a plan for one or two demonstration wetlands. It is important that any wetland development not be

allowed to significantly decrease the volume of the Waterway or hinder its flood control function. The plan must also recognize the invasive tendency of wetland species and provide contained planting areas to control spreading root systems. When selecting the desired plant species in consultation with the Arboretum and related experts, further consideration must also be given to wind dispersal of seeds and the potential spread of wetland species. Wetland ecologists currently teaching on the campus would be excellent resources for this planning.

1.8 Action: Plan a water quality demonstration fishpond at the point where reclaimed water is returned to the Waterway, assuming that the decision is made to use reclaimed water.

Rationale: Using reclaimed water, the pond will provide a healthy environment for fish and other aquatic creatures. The pond will serve as a water quality monitoring station while clearly demonstrating the life supporting quality of the reclaimed water. Although construction of the pond would not occur for at least 18 months, the Committee believes that the planning needs to be commenced during this first phase.

WATERWAY MANAGEMENT RECOMMENDATIONS

1.9 Action: Record waste water treatment plant outflow and pump station run times at west end of Waterway to quantify the amount of water flowing to the South Fork of Putah Creek.

Rationale: This will allow the University to identify projected increases in waste water treatment plant outflow (growth water) which could be put to alternative uses during periods in which there are non-dry conditions. As the campus continues to grow, it is anticipated that the total amount of reclaimed water will increase beyond the current average outflow estimated at 1.5 million gallons per day. With the return of salmon and the current restoration efforts along Putah Creek, it is essential that UC Davis maintain existing water releases to the South Fork.

1.10 Action: Using the Darby Report as a foundation, conduct an updated inventory of nutrient sources and develop a comprehensive resource management program that addresses water, land and wildlife issues in particular. Reinstate a year-round water and sediment sampling program.

Rationale: The Darby Report is a comprehensive assessment of water quality issues within the Arboretum Waterway. The Report and its findings should be used initially as a foundation for developing sampling techniques and programs to identify remaining nutrient sources. In the past, storm water runoff from the Cole Facility and water from animal cage wash-down areas have contributed organic materials to the Waterway. Another major source of biomass within the Waterway comes from the waterfowl, particularly mallard ducks. Campus irrigation runoff may also provide large amounts of aqueous chemicals that promote algae growth.

1.11 Action: Adopt a waterfowl management plan to reduce organic waste and bank erosion, as well as, the potential for waterfowl diseases to be transmitted from an over-populated resident community to migrating waterfowl.

Rationale: The Committee strongly urges that the campus work with appropriate state and federal agencies to develop and implement a waterfowl management program that will stabilize the duck population at an appropriate density and reduce the potential for disease. Both botulism and avian cholera have been found among the waterfowl during periods of overpopulation. The latter is considered by California State Fish and Game managers to be especially serious as a threat to wild, visiting populations which can become infected from the resident ducks and then spread the disease into the larger community. Additionally, it is believed that one of the reasons that the local rat population has reached dangerous levels in some parts of the Arboretum adjacent to the Waterway is largely due to the abundance of food left for the waterfowl but that is consumed, instead, by the rats. Finally, it

is estimated that mallards cost the Arboretum $8,000 annually in plant damage and disallow bank-stabilizing vegetation to take root. (Darby Report, p. 21)

1.12 Action: A program should be developed for skimming the Waterway on a regular basis, possibly in consultation with the Department of Mechanical and Aeronautical Engineering or researchers in other related fields.

Rationale: The Darby Report urged the campus to take a more active role in limiting the amount of biological materials that come into the Waterway. The Committee acknowledges that this action is complex and would require significant manpower. The Associate Vice Chancellor of Administraton -Facilities can assess the feasibility of options for such a program.

1.13 Action: Encourage public input and participation through an outreach program.

Rationale: The Committee strongly believes that an important feature of this process is the continued involvement of the public. There has been considerable community outreach through a workshop, personal interviews and the work of the Committee itself. In particular, the Committee recommends at least one additional workshop be held in Winter 2000 sponsored by the Arboretum and the Office of Administration - Facilities.

1.14 Action: We recommend that these first tier actions be overseen by a committee comprised of UC Davis faculty and staff. This committee and a project manager should be appointed by the Executive Vice Chancellor and should be comprised of:

Arboretum Director
Associate Vice Chancellor – Facilities
Planner from Planning and Budget Office
Up to six faculty members

Other members may be brought in at the discretion of the committee chair.

This Committee should be convened at the beginning of the Winter Quarter 2000. In its charge, the committee should be asked to:

a. Finalize the measures to be undertaken in Tier 1 during summer 2000 (due February 15, 2000).
b. Develop specific task list by June 15, 2000.
c. Evaluate and report to the campus by November 1, 2000 on the success of the short-term measures.
d. Encourage community awareness and participation through workshops and media coverage.
e. Develop a funding plan for Tiers 1 and 2.

The Committee believes that this proposed committee would be most appropriately positioned to provide the funding analysis and information to the Executive Vice Chancellor. Specifically, the cost for the following items from Tier 1 must be further analyzed:

1. The connection of Arboretum Waterway to new waste water treatment plant outflow.
2. The addition and withdrawal of ground water to and from the Arboretum Waterway.
3. Construction of underpass beneath Southern Pacific railway and east flow feasibility study.
4. Research and construction of two to three weirs in Arboretum Waterway.
5. Revegetation of banks near weirs.
6. Community outreach program, including interpretive signage.
7. Management plans for waterfowl, and other detrimental nutrient sources.
8. Construction of wetlands area and fish pond as demonstration models for improving water quality.

TIER 2 - Programs for 3-Year Implementation beginning 4/1/2000

2.1 Build one or more fishponds to demonstrate quality and clarity of reclaimed water.

2.2 Undertake an evaluation of all of the mitigation measures put into place during the initial 18 months of the project. For example, if the demonstration wetland is successful, a wetland development plan will be needed. This will be coupled with a seasonal water level management plan.

2.3 Encourage the Arboretum Director and the Associate Vice Chancellor – Facilities to seek a broad spectrum of sponsorships by UCD departments in order to realize full use of the Arboretum and Waterway as an educational and restorative medium. Likely departments would be those focused on hydrology, wildlife biology, ecology, environmental engineering, environmental studies, environmental design, landscape architecture, nature and culture, and art.

The garden pictured at right was planted by UC Davis Botany Cluband has been maintained by volunteers since January 1999. photo by L. Griffith

2.4 Ask the Arboretum to consider canopy development as a way of reducing ultraviolet availability and the heating of water. Although the leaves will increase organic debris in the water, a skimming program implemented within the next three years could fully mitigate this.

CONCLUSIONS

The Committee views these recommendations as the framework for developing and maintaining the Waterway as a healthy, managed ecosystem that is a centerpiece of the campus and the Arboretum. With its flowing water, system of weirs, wetlands and levees, the Waterway would symbolize the cycle of water use in California: captured as a resource, transported, reclaimed and ultimately returned to the environment. Full implementation of these recommendations does not in itself represent an endpoint. There are many opportunities that may occur in the near or long term to further accentuate this landscape feature as one that defines the campus. The Committee has pointed out such an opportunity at the east end of the Arboretum where the current construction of the bicycle path to South Davis offers the possibility of a new campus gateway. At some point, it seems likely that the at the west end, the Arboretum might expand and with it, the Waterway as well. The Committee also looks positively upon exploring opportunities to extend the Waterway out of its current banks, into the campus and new facilities such as the Center for the Performing Arts. One opportunity here is to create a water feature that ties the Performing Arts Center and the Alumni and Visitor Center to the Arboretum and the Waterway. The Committee would welcome the opportunity to discuss these ideas with the designers for this project, or, if the current design phase is too far along, to hold discussions about possible next phases that would include features associated with the Waterway.

REFERENCES

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Faber, Phyllis M., Common Wetland Plants of Coastal California: A Field Guide For The Layman, Pickleweed Press, 1996, 212 Del Casa. Mill Valley. CA. 94941

Faber, Phyllis M. / Holland, Robert F., Common Riparian Plants of California: A Field Guide For The Layman, Mill Valley: Pickleweed Press, 1996.

Francis, M., S. Jones and K. Dawson, The Davis Greenway Plan, Dept. of Environmental Design, Landscape Architecture Program, Center for Design Research, UC Davis, 1988.

Waste Water Treatment Plant Replacement Project - Environmental Impact Report, Environmental Consultants Jones and Stokes Associates, Inc., Office of Planning and Budget, UC Davis, 1997.

Appendix A

Arboretum Waterway Design Workshop Agenda

1:00 PM	Signin, Introductions, Overview of Workshop Agenda - Bon Powell
1:15 PM	Cleaning up the Waterway – Challenges and Opportunities - B. Powell
1:40 PM	Alternative Design Concepts Mark Francis and Luke Griffith
2:00 PM	Small Group Discussions Group A – Incremental Approach facilitated by David Phillips Group B – West Flow Alternative facilitated by L. Griffith Group C – Living Waterway/East Flow Alternative facilitated by M. Francis
3:30 PM	Small Group Reports
4:15 PM	Next Steps, Workshop wrap-up - B. Powell
4:30 PM	Refreshments
5:00 PM	Canoeing

Appendix B

Arboretum Waterway Design Workshop Participant List

Laura Bassein
Mary T. Burke
Don Crosby
Roger Edberg
Sid England
Richard Evans
Mark Francis
Paul Graham
Steve Greco
Luke Griffith
Emily Griswold
Kathleen Holder
Alan Jackman
Skip Mezger
Mary Patterson
David Phillips
Bob Powell
Jon Price
Mike Reid
Eliska Rejmankova
Sarah Richards
Warren G. Roberts
Jeannette Robertson
Mitch Sears
Barbara Shneeman
Bob Segar
Ed Schroeder
Rob Thayer
Mai Troung
Truman Young