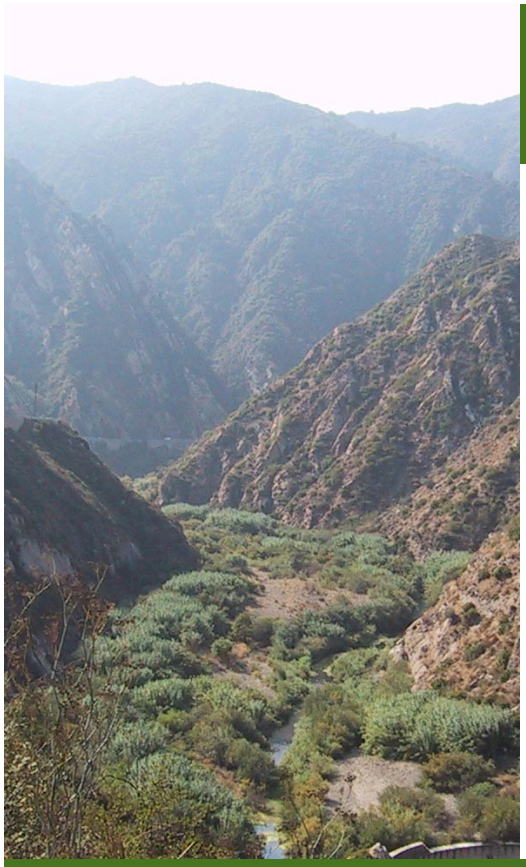

Watershed Management Area Plan for the Malibu Creek Watershed

Prepared for:

Las Virgenes Malibu Conejo Council of Governments

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January 2001

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I. EXECUTIVE SUMMARY

This report, the Malibu Creek Watershed Management Area Plan 2001 (WMAP), represents a significant commitment of vision and resources by the Malibu Council of Governments. Based on three meetings with the cities of the watershed, LA County Department of Public Works, Las Virgenes Municipal Water District and the project consultant team, a new philosophy has been articulated here. This new approach is based on the whole watershed, integrating its many uses and functions with natural resource assessment, land use planning and public or stakeholder involvement.

The approach to watershed management has five phases that are conducted to arrive at achievable watershed goals and actions. Phase 1 begins with the initial problem definition; phase 2 assesses the existing knowledge to clarify gaps in data and knowledge. In phase 3, the available data are analyzed to determine the extent of the problem identified in phase 1. Phase 4 reviews the initial problem, giving all stakeholders a chance to consider the issues in light of further data analysis. Only then, in Phase 5, are steps mapped out to take action to remedy the problem, based on best available knowledge and technology. This strategy is congruent with the watershed planning recommendations from the Regional and State Water Quality Control Boards, the agencies tasked with defining Total Daily Maximum Loads, which are the new water quality standards for the nation.

From the work undergone to develop this WMAP, four major areas have come to light that are in need of recognition. The first is the clarification that the Watershed-Wide Monitoring Program, already developed by the stakeholder in the watershed, is an excellent advance in water quality protection for the basin. In order to further water quality protection this program is in need of support and funding. The second, and the most important deliverable from this project, is the first Geographic Information System (GIS) based product developed for the Malibu Creek basin. Different layers from this product have been graphically represented in the WMAP report in Chapter 2. The GIS product is a planning tool that will have many applications beyond this project.

The third is recognition of the need for an organization to protect and manage the stream corridor system throughout the watershed, tentatively called the Malibu Watershed Conservancy, described in Section 5.2.1 of this report. The final is this WMAP report, which draws extensively from the excellent efforts already underway within the Malibu Creek Watershed, to point the way forward for protecting and enhancing not only the water resource but also the landscapes that make Malibu the unique place it is. This is a living, working document, which can be improved through the participation of the many stakeholders and their consistent efforts to integrate water resources with land use practices.

One primary function currently lacking from the broad scope of water protection efforts is a central data archive, where all relevant data can be stored and accessed by the public. Much data has been generated for the watershed features, but are currently housed in different organizations, including the LA County Public Works Department, Heal the Bay, Las Virgenes Municipal Water District, among others. This data can be difficult to locate and obtain when watershed-scale projects are undertaken. This archive should house and manage the GIS data product as well as all updates; all the water quality data; and natural resource information. Further studies are needed to inventory the wetlands, document stream geomorphology (to aid future stream restoration efforts) and to inventory the remaining riparian and floodplain habitats, as measures to protect and enhance water quality. Through the avenue of the proposed Malibu Watershed Conservancy this organization will be given the ability and direction to access, process and develop this information.

The report documents the existing programs being conducted by the Cities, and prepares the way for grant funding for the innovative programs described in the report. Taken together, the people of the Malibu watershed have already shown leadership in watershed management and protection of natural resources, in a region where much has already been lost.

1.0 FRAMEWORK AND GOALS OF THE PROJECT

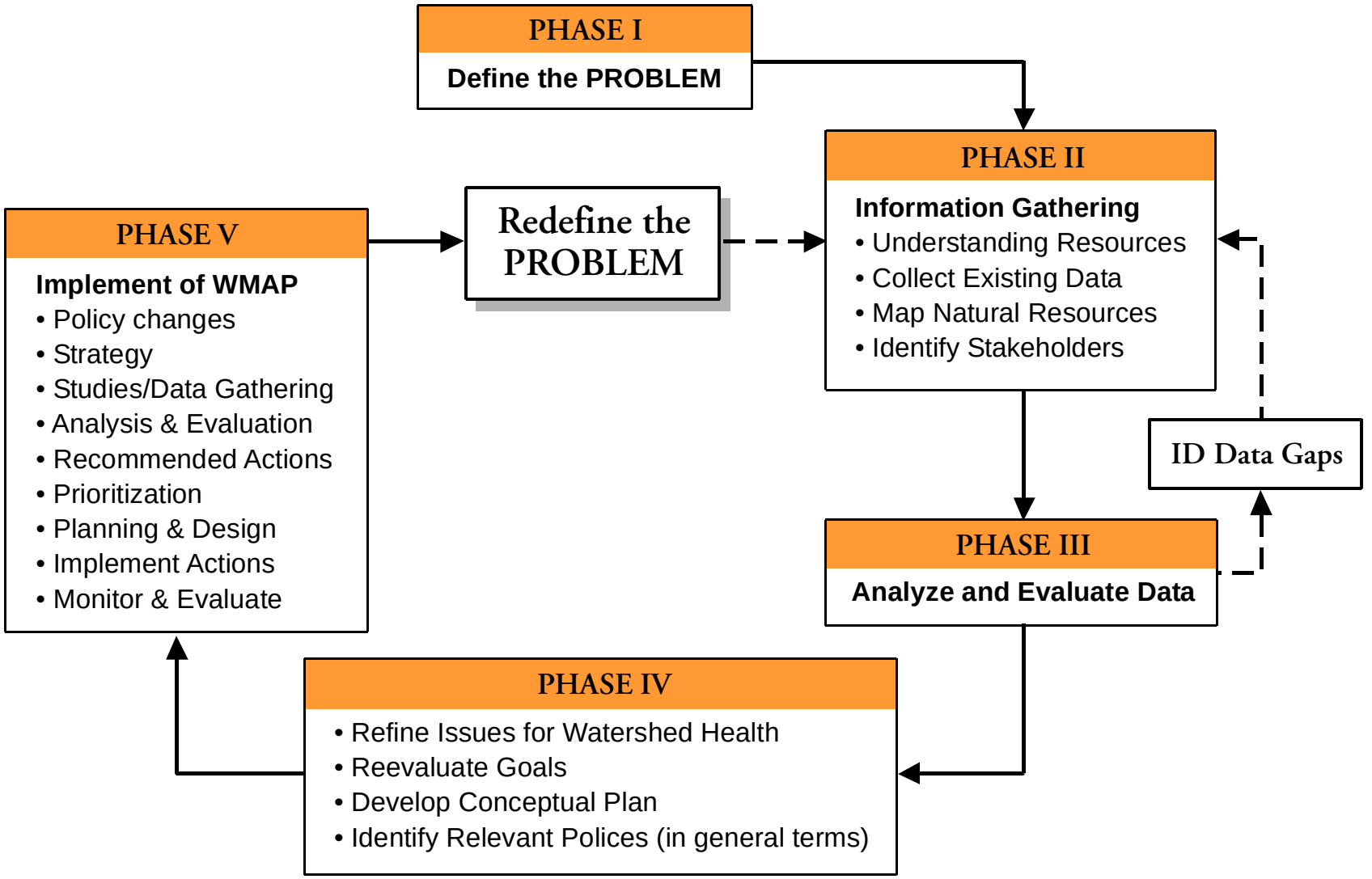
1.1 INTRODUCTION: PROBLEM DEFINITION - PHASE I

The intent of this document is to set up the framework for long-term watershed planning in the Malibu Creek Watershed (MCW). Until recently, efforts undertaken to clarify water quality and other problems have primarily been focused on the lower watershed – the lower Malibu Creek and the Malibu Lagoon. In order to ensure sustainable water quality and watershed health, a watershed-wide perspective has been adopted in this Watershed Management Area Plan (WMAP). The process of watershed management is dynamic, and this process must allow new information to be incorporated into decision-making and the prioritization of efforts. This document demonstrates a step-wise and dynamic process of watershed management as it applies to the entire MCW, enabling implementation measures that lead to the attainment of the watershed goals set forth in this process. Chapter 5 of this WMAP, and specifically Table 4, are the actions that the Malibu Council of Governments (COG) has agreed to implement, it reflects their level of commitment to the process.

1.1.1 Framework for Watershed Management

Long-term, sustainable watershed management can be conducted in phases designed to determine and clarify watershed issues, set goals and implement policies, strategies, and practices to achieve those goals. Each phase builds upon the information gathered and assessed in the previous phase, working toward the establishment of management measures to improve and preserve water quality, beneficial uses, and habitat areas within the watershed. The intent of this report is to establish the framework that will lead to improvements in long-term watershed management. The framework will include past achievements, data gaps, and implementation strategies. *Phase I*, problem identification, begins when a perceived problem surfaces in water quality or other resource within the watershed (see Figure 1, *Watershed Management Area Planning Framework*, on page 2). In this phase, a problem is identified which motivates the community to begin this process. The increase in illness to surfers and swimmers at the Malibu Surfrider beach and subsequent beach closures have been one of the primary driving factors, which has led to the identification of water quality as a problem. Further water quality issues in the upper watershed, such as the increase in perennial flows and the presence of algae in streams, have also provided challenges within the watershed.

In order to understand the problem(s), in *Phase II* (Chapter 2) an initial effort is made to identify the perceived/actual problem and collect appropriate baseline information. Stakeholder involvement is important in the earliest stage to increase awareness of potential problems and to create widespread ownership of solutions. Realizing that problems in the Lagoon may originate



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WaterCycle LLC

Source: PCR Services Corporation and WaterCycle LLC, 2001

Figure 1
Watershed Management Area Plan (WMAP) Framework

anywhere in the watershed, baseline data are collected to characterize existing watershed conditions. There are natural background levels of pollutants that are assumed to have been originally in balance with the carrying capacity of the ecosystem. In this case, carrying capacity is a measure of the ability, severely reduced by development, to absorb, render harmless and recycle pollutant constituents. These background levels (gauged from existing reference reaches) may or may not be harmless to humans, but are overlaid by anthropogenic inputs into the system that may both exceed human wellness thresholds and also affect natural processes. Studies to be completed in Phase II could include:

- Inventory and map existing wetland and riparian resources of the watershed;
- Study watershed hydrology, stream geomorphology and wetland functionality;
- Inventory and map human-made storm water conveyance and storage systems in the watershed, in order to understand where potential inputs to the system may occur. Potential non-point sources may include horse corrals, spray field irrigation near stormdrains, septic systems within 100 yards of riparian areas, sediment storage and sediment delivery to stream channels throughout the watershed;
- Multi-year study of water quality conducted simultaneously throughout the watershed using uniform sampling protocols, including reference reaches and impacted areas;
- Study of water use and water input affecting natural hydrological processes;
- Inventory and map existing and expected land uses, including preservation areas.

In *Phase III* (Chapter 3) the information gathered from *Phase II* is analyzed and evaluated to clarify the perceived/actual problem, to identify other potential problems, and to identify gaps in the data set that warrant further studies. This illustrates the iterative nature of the process. Identification of potential sources and distribution of pollution, significant biological and hydrological areas within the watershed can result from this assessment and evaluation. The use of Geographic Information Systems (GIS) technology can be a particularly powerful aid to deriving conclusions in this, as well as in other phases.

Based upon this evaluation and assessment, in *Phase IV* (Chapter 4) understanding of the problem(s) are reviewed. Collectively, the stakeholders establish resource management goals and objectives that address immediate and anticipated problems, to lead toward sustainable watershed health. Goals and objectives for the Malibu Creek watershed relate to:

- Water quality;
- Water quantity; and

- Natural resources.

In *Phase V,* (Chapter 5) management practices are instituted that lead to the achievement of the goals and objectives identified in *Phase IV*. Both immediate and long-term implementation strategies should be established that address immediate concerns, and set the framework for long-term solutions to more challenging problems. The strategies should support the principles of sustainable development. Priorities for implementation actions should be set in light of anticipated land use changes and natural resource conservation needs.

1.1.2 Goals of the Watershed Management Area Plan

Past efforts and actions already underway in the Malibu watershed have made significant progress in identifying problems, clarifying issues, setting goals, and presenting measures to prevent and remediate watershed issues. The goals of the WMAP report are to establish a framework for sustainable watershed management and to recommend further actions to be carried out, in order to:

- Identify and manage processes contributing to water quality degradation and water quantity problems;

- Identify protection, conservation, enhancement, restoration, and retrofit opportunities that support biodiversity and improve water quality;

- Develop long-term programs for evaluating natural resources, water quantity issues and water quality data collection and analysis; and

- Restore natural processes with respect to the hydrological cycle, which can result in better overall water quality.

1.2 CONTEXT: WATERSHED HEALTH

The watershed is a hydrologic, geomorphic and ecological cycle, maintaining a dynamic equilibrium between growth and decay, organic and inorganic matter, so that various ecosystems continue to support life, though their nature may change with time. River corridors reflect land use and overall ecosystem health of the watershed (Hynes, 1985). Species abundance and genetic diversity depend on conservation and management at the ecosystem level, so landscape-scale efforts must include habitat and ecosystem biodiversity for both conservation and rehabilitation.

The health of a pristine watershed will depend on the dynamic equilibrium of natural processes, including "background levels of pollutants" (such as nitrogen, selenium, etc.) that change as human influence is introduced. These also depend on air quality (that is itself a function of land use – sometimes many miles away). Land use otherwise determines the quality and quantity of the

aquatic environment, although river channelization exacerbates the situation by eliminating the in-channel and riparian processes, including water purification. Only through accurate assessment of the state of the environment in general, using indicators that complement water quality, can a provisional judgment be made of the balance required between developed and natural areas. Water quality occurs within a practical context of land use, leading to the question: "How well are we doing with husbandry of the land and its wildlife, with nature conservation as a whole?"

1.2.1 Development and Wildlife Loss

Globally, the fossil record suggests that 95% of all the species that ever lived are extinct, with the average life span of a mammal species being about one million years (Pettifer, 1997). By contrast, although there may be some 13 million species on earth, extinction rates in the past century show a species life span now averaging only 10,000 years. A reduction to between 100 to 1,000 years is currently threatened, so that extinction rates are 40 times greater than the past average 'natural' level for mammals and a staggering 1,000 times for birds; an estimated 40 to 100 species become extinct every day (Owen and Chiras, 1995). This global pattern is reflected in the changing biodiversity of the MCW. There remain a wide variety of riparian and upland habitats, with about 644 species of native plants and 236 species of introduced plants. In 1995, nine birds, one fish, and one plant species were federally listed as threatened or endangered (NRCS, 1995, pp.16-31). Since then, the southern steelhead has joined the tidewater goby on the list, although it is ironic that some of the anthropogenic changes (such as the quantity of imported water) which threaten the goby actually favor the steelhead.

The world's human population doubled to 2 billion between 1830 to 1930, doubled again to 4 billion by 1974 and reached 6 billion in 1998 (United States Census Bureau, 1997). Population pressures have led to global erosion of 24 billion tons of topsoil per year - a loss equal to half of America's cropland soils over a decade (Owen and Chiras, 1995). This has a devastating effect on water quality, the morphology of rivers, and their carrying capacity for wildlife. These changes are again reflected in the Malibu Creek watershed, which has seen considerable expansion in population since the 1990 census, recently averaging 2% per year.

Increasing population leads to an increasing 'human environmental footprint'. This influence ranges widely, from growth in the demand on water and power, through numbers of vehicle-miles traveled, to imported food and waste products. Exotic plants replace native species and plant communities in lawns and gardens that are watered and treated with fertilizer and pesticides. There is also pressure on wildlife and water quality from recreational uses. Culverted streams are part of the legacy of a focus on hygienic development, which sought to sanitize the urban environment, and in essence, control nature. Development continues to replace both farmed and more natural areas, increasing the impermeable area of the watershed, leading directly and indirectly to concentration of runoff and pollutants.

If rural nature is eroding, nature near cities is fast disappearing. In watersheds lacking a strong land use planning system, urban sprawl continues unabated, often replacing agricultural land

and other open space. This offers an illusion of economic growth without increasing either real human wealth or happiness (Kinsley and Lovins, 1995), but it does make further demands on our services, especially water and power. Further development in the Malibu watershed threatens to increase water imports, which will affect water quality in many different and complex ways. Although development plans recommend native plantings, there is yet little influence over homeowner preferences. However, modifications to existing street design can accommodate native plants while improving safety and retaining parking facilities. How can we protect the integrity of natural areas and their functions sufficiently to sustain watershed processes?

1.2.2 Implications for Environmental Legislation, Policy and Planning

Environmental legislation is relatively new and has largely taken the form of throwing protective boundaries around development and natural areas alike, attempting piecemeal protection for parts of natural, open systems. A successful example of environmental protection is the UK's National Trust landholdings. These lands are designated *in perpetuity* to remain in the ownership of the people, protected from *any* attempt at land use change, including attempts by the central government or military. Only while this trust is maintained will people donate their property, with sufficient maintenance funds, to the National Trust.

Few rivers or floodplains in California watersheds have attracted protection from development, and no significant effort has been mounted to protect the long profile of the river corridor for the multiple benefits of water quality improvement, wildlife habitat or flood damage reduction. There is as yet no broad or focused legislation that addresses the more subtle loss of riverine and floodplain habitat. Some buffer zones have been established along Malibu Creek in the State Park, as well as some upland areas that have been declared SEAs, have State or Federal protection. The formation of the Malibu Council of Governments has enabled the promotion of legislation to provide incentives for property owners to donate land for open space.

Increasing the resilience of the watershed to change in both land use and climate means moving from the traditional paradigm of surface water *disposal* to *management*, enabling conservation and restoration of the hydrological cycle. Measures generically known as 'source control' address the root causes of urban degradation of the water environment (Urbonas and Stahre, 1993), particularly when combined with environmentally sound planning of infrastructure and development layouts, and when using vegetative treatment of the runoff. Retrofitting of existing development is also practical; e.g., pipes leading to existing outfalls from stormdrains can be diverted into constructed wetlands, allowing both treatment and evaporation (in the case of Malibu Creek) to improve the eventual input to the river system. Effective source control, in both the rural and urban context, can be seen as a necessary precursor to water quality conservation, but needs economic justification as well as technical credibility.

1.2.3 Conservation and Biodiversity

In general, the legal protection of natural areas in the US (such as Yellowstone National Park established in 1872) does not guarantee protection of biodiversity, nor was it intended to do so (Noss and Cooperider, 1994). Malibu Creek State Park is given a substantial degree of protection by the Santa Monica Mountains National Recreation Area. Most protected natural areas suffer from incompatible uses, often being designated for recreational rather than habitat value, and are typically under threat from surrounding land uses, invasive plants, feral animals and other pollution.

Rivers in such stressed areas will reflect that stress; river conservation therefore must match the carrying capacities for wildlife and human activities well beyond the river corridor. The dangers of introducing exotic species have been demonstrated many times. Giant cane (*Arundo donax*) from the Iberian Peninsula has so choked rivers in California, including Malibu Creek above and below Rindge Dam, that eradication programs statewide have now begun to target thousands of acres for removal.

Early efforts in river restoration typically focused on a river site or reach without the more holistic consideration of the river as a hydrological, geomorphological and ecological continuum in the watershed context. Ensuring that meander migration will not out-flank bank protection works in a major flood event may be as important as keeping grazing animals from the young green shoots of bank revegetation projects. Typically such 'restoration' projects do not address biodiversity issues, and may risk becoming a monoculture when only one or a few species are used. Soil bioengineering and the new discipline of biogeomorphology have emerged to address the gap between hard river engineering and ecological approaches to river management. All too often, flood control and stream bank stability problems are "solved" by paving over the stream bed or armoring creek banks with riprap. The end result is the loss of riparian habitat, increased stream velocities, and increased rates of erosion and sedimentation.

The Malibu watershed has a particular need for the watershed scale approach. One primary issue is that a high volume of imported water has enabled development to exceed the natural (hydrologic) carrying capacity of the watershed. Limited value has been placed on safeguarding the water cycle, including protection of rivers and wetlands. A basic need in the strategy to manage for better water quality is therefore strategic land use planning, implying amongst other actions, a targeted land acquisition program that protects significant resources.

The challenge for landscape planners and designers is to understand watershed conservation and biodiversity, and to adopt approaches which integrate ecology, landscape heritage and local economics (Hesketh, 1997). Where mitigation has been prescribed to 'balance' environmental losses from development, there is often a predominance of small scale plantings over the more involved 'restoration' of habitats and landscapes. It is unrealistic to expect sustainable river conservation, enhancement, or restoration from such opportunistic arrangements.

1.2.4 Sustainability and Sustainable Development (SD)

To apply these concepts to Malibu, their origins need to be briefly outlined. The publication of the World Conservation Strategy (IUCN, UNEP & WWF, 1980) led the first change in global perceptions of the nature of development and the need for conservation of nature and natural resources. It originated the phrase 'sustainable development' (SD) and led to the establishment of the World Commission on Environment and Development (WCED) and the subsequent publication of '*Our Common Future*', commonly known as the Brundtland Report (WCED, 1987). This report called for the marriage of ecology and economy, together with institutional change to tackle the challenges of population, food security, species and ecosystems conservation, energy, industry, urbanization and managing the commons, all needed to support the inter-generational equity principle articulated in the report.

The definition of SD in 'Caring for the Earth' is that which "*improves the quality of human life while living within the carrying capacity of supporting ecosystems"* (IUCN, WWF, UNEP, 1991). This definition implies that SD is not a synonym for 'sustainable growth', an oxymoron even in economic terms (Daly and Townsend, 1993); growth is quantitative increase in physical dimensions, whereas development should be seen as qualitative improvement in non-physical characteristics (Daly, 1991). Development growth has put great pressure on the carrying capacity of the Malibu Creek watershed in terms of the ability of the natural system to absorb pollutants, partly because the natural system has not received sufficient value and protection for its function in this regard. The consequence of over-development in natural watersheds in increased impermeable areas, which when they exceed more than 10% of a subwatershed, leads to habitat degradation and changes in the system's ecological balance. At 30% impermeability levels watershed degradation has been found to be irreversible. Fortunately, much of the Malibu Creek watershed tributary drainages have impermeabilities of less than 10%, and so there is a tremendous opportunity for effective watershed management.

Development growth results in conversion of natural capital, including river corridors, into human capital such as structures and machinery. This is the ruling paradigm of *weak sustainability*, assuming that the mix of natural and human assets will somehow 'remain constant'. It is now evident that natural systems are being over-stressed locally and globally, and the surfers' complaints apparently testify to local symptoms of watershed issues. However, our knowledge of what we need to survive is adequate to embrace *strong sustainability*, keeping natural assets constant, so that loss of a natural asset would need to be offset by creation of a natural asset of *equal* value to the ecosystem. The effectiveness of mitigation, rather than conservation, has been so strongly challenged that development policy should dictate conservation of natural resources as the norm.

The generic issues faced by Malibu were addressed at the 1992 Earth Summit at Rio de Janeiro, particularly in terms of the biodiversity protocol and Agenda 21. Local government was given a special responsibility to promote the principles and implement the actions articulated in Agenda 21. One of the five products of the Summit, Agenda 21 is a blueprint on how to make

development socially, economically, and environmentally sustainable. Summarized, Agenda 21 explains that population, consumption, and technology are the primary driving forces of environmental change, and it offers policies and programs to achieve a sustainable balance between consumption, population, and the Earth's life-supporting capacity. It describes some of the technologies and techniques that need to be developed to provide for human needs while carefully managing natural resources (Keating, 1993). Keating's readable text is in many ways an overview of *Caring for the Earth*, in which holistic management of the hydrological cycle is clearly identified as the basis for SD. One of the powerful messages is that change should be incremental, small-scale and appropriate, facilitating adaptive management and avoiding irreversible damage such as extinction of species.

The difficulties of achieving *constant natural assets* in practice are exemplified by the 'no net loss' rule applied to wetlands of the United States. Wetland scientists found that the functional value of a replacement wetland could not be guaranteed as replacing the lost asset, when a change was made in its geographical position within the watershed. Likewise, river corridors have suffered so much degradation in most countries that there are now virtually limitless opportunities for conservation and enhancement, if not rehabilitation, to offset the unavoidable impacts of development.

The challenge for the Malibu Creek watershed is to satisfy Total Maximum Daily Loads (TMDL) requirements through watershed management. This implies a need to identify the threshold between constant and critical natural capital, and then to define what constitutes true substitution to achieve constant natural assets. The challenge comes at two stages: deciding what development should go where, and how it should be implemented. Decisions need to be based on decision-support processes that assess the carrying capacity and natural capital thresholds of the environment at strategic and project levels respectively, and involve stakeholder participation (Gardiner, 1991; 1996).

In the socio-economic arena, the hardest challenge is probably the application of the basic principles of sustainability. Complementing the System Conditions articulated by The Natural Step (see Appendix A), the following principles have been widely recognized:

- The Precautionary Principle – where there are threats of serious or irreversible damage to the environment, the lack of full scientific certainty should not be used as a reason to delay taking cost-effective action to prevent or minimize such damage;

- The Preventative Principle – it is better for society to avoid incurring the costs resulting from development activities, which seriously damage natural or physical capital, than to be required to pay for damages after they have occurred;

- The Polluter Pays Principle – the costs of preventing or cleaning-up pollution and waste should be borne by those responsible for causing the pollution and waste, and not by society at large (the taxpayers);

- The Participation Principle – an essential prerequisite for achieving sustainable development is to encourage widespread and informed public participation in decision-making;

- The Subsidiarity Principle – an issue should be managed as close as possible to its source, i.e., local control should always be applied before regional controls;

- The Integration Principle – environmental requirements must be taken into the definition and implementation of all areas of policy-making.

Building on the last principle, the most challenging institutional issue in relation to management of non-point pollution is well articulated in the Brundtland Report:

> "The integrated and inter-dependent nature of the new challenges and issues contrasts sharply with the nature of the institutions which exist today. These institutions tend to be independent, fragmented and working to relatively narrow mandates with closed decision processes… the real world of inter-locked economic and ecological systems will not change; the policies and institutions must."

1.2.5 Land Use Management and Sustainable Water Quality

Water quality within the streams and creeks is largely determined by the quality of watershed runoff from the zero, first and second order streams. River conservation in the Malibu watershed is therefore influenced by land use practices and policies including farming and animal husbandry. Despite the publication of Carson's 'Silent Spring' in 1962, the toxicity and diversity of agricultural chemicals has increased (Campbell and Cooke, 1997). Steep declines in all forms of wildlife have been documented as indirectly attributable to pesticide use, not only from farming activities, but also from other human-related activities such as landscape management. Until the subsidiarity principle is upheld as basic to all land management, improving water quality requires wide buffer zones along streams to protect riparian processes from intensive human and animal impact.

Soils with higher humus content hold water better, reducing plant water demand and also the rate of runoff, which determines soil erodibility, river baseflow, and the subsequent health of the river. A more natural hydrological cycle is therefore significantly supported by enhancing soil fertility and structure – increasing soil organic carbon or humus, protecting biological/microbial biomass (earthworms, bacteria, fungi, etc.), increasing predator/prey interactions and reducing chemical inputs. By reducing chemicals designed to poison pests, and planting biodiverse buffer zones between smaller fields, the net balance of predators and pests (prey) is encouraged. Other measures would include not building in the floodplain or establishing riparian buffer set back zones to protect the streams from input from the surrounding development. Integrated Pest Management

(IPM) requires help from entomologists to identify insect pest species and to target their control through the use of predators, either birds, other insects, or sometimes fungal pathogens specific to the pest insect, often controlling pest infestations by interrupting the breeding cycle through insightful management practices.

1.2.6 Linking Economics With Ecology

The links between equity, our ecological life-support systems, and watershed conservation are becoming clearer. In the coming decades, we will see more examples of communities who are investing in protecting their environment, and gaining economically by so doing. Examples can be found in the Australian Landcare initiative (which supports integrated watershed management), and the California Urban Streams Restoration Program. Good ecological thinking is good economics in the short-, medium- and long-term, when all the costs of doing business – including environmental clean-up and restoration – are included in the calculations. Altruistic behavior and building sustainable human community, in harmony with nature, is a matter of enlightened self-interest.

Accurate public perception of ecological functions is vital to sustainable watershed management. Children are learning the importance of the aquatic environment and clean healthy rivers in supportive watersheds, by participating in educational programs such as RiverWatch and Adopt-A-Watershed. The watershed restoration program should therefore include actions to provide guided access to 'natural' areas, such as elevated walkways (perhaps leading to bird blinds) into restored lake margins, near schools. These are significant factors for conservation in the Malibu watershed, as in the rest of the world.

2.0 INFORMATION GATHERING – PHASE II

2.1 WATERSHED FEATURES AND MAPS

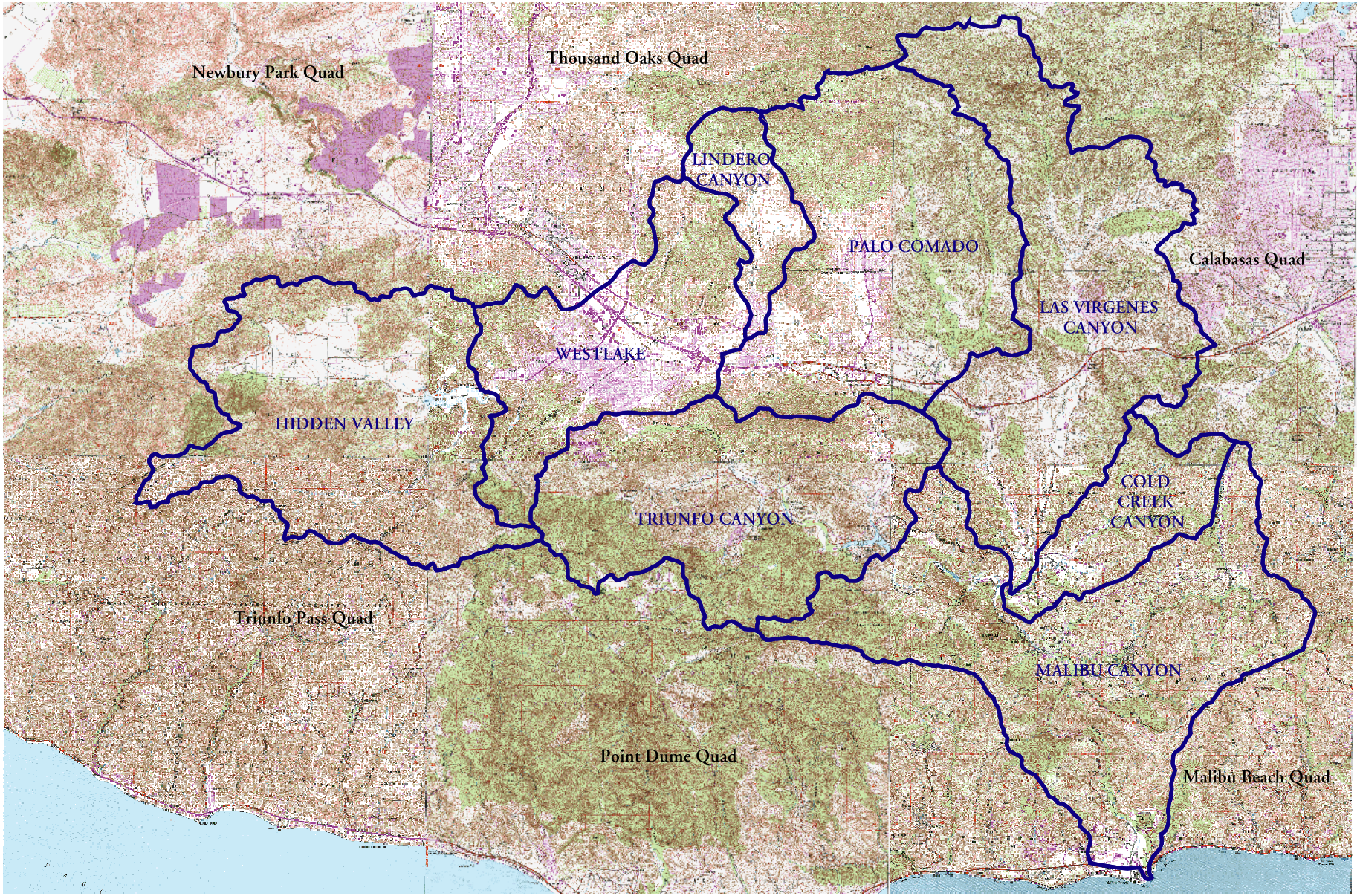
The Malibu Creek watershed encompasses approximately 109 square miles (28,230 hectares). The watershed is located in the northwestern end of Los Angeles County and the southeastern end of Ventura County. The region is located within the southern California coastal belt, a Mediterranean-type climate, and is subject to summer-dry and moist winter periods. Average summer temperate is 71°F (22°C), average winter temperature is 53°F (12°C), and average annual temperature is 61°F (16°C), with an average frost-free season of 275-325 days. Eight major subwatersheds were identified in the USDA-NRCS (1995) study: Hidden Valley; Westlake; Triunfo Canyon; Lindero Canyon; Palo Comado; Malibu Canyon; Las Virgenes Canyon; and Cold Creek Canyon (see Figure 2, *Topography and Sub-Watershed Boundaries*, on page 13).

2.1.1 Geology and Soils

The Santa Monica Mountains are part of the Transverse Ranges, underlain primarily by marine sandstones and shales laid down approximately 70 to 20 million years ago. These landforms range in elevation from sea level to 3,100-ft (1000m) at Sandstone Peak in Ventura County. At the western end of the watershed, Hidden Valley contains a wide valley floor consisting of Holocene alluvium up to 60 ft (20m) deep, surrounded by Miocene Conejo volcanic formations (see Figure 3, *Geology*, on page 14). The middle northern reaches are Cretaceous and Tertiary sediments, and Tertiary sediments are predominant toward the coast. The canyons draining the Santa Monica Mountains to the north are typically steep and hold shallow alluvial deposits less than 30 ft (10m) in the stream valleys and terraces. These alluvial fills grade to less than 5ft (1.3m) deep on the canyon slopes (data from USDA-NRCS, 1995).

In the eastern part of the watershed, tertiary basaltic and andesitic flows, pillow breccias, intrusive minerals and dikes can be found. Malibu Canyon cuts through Tertiary sandstones, siltstones and breccias interbedded with Tertiary volcanics. Quaternary landslides occur frequently throughout the watershed, and are especially noticeable near the coast and in the southwestern part of the Cold Creek subwatershed. Landslide rates may be significantly higher on steeply sloping hills managed for cattle grazing, where vegetation no longer protects soils from rainfall impacts and increased erodibility.

The Malibu Creek Watershed contains 38 soil mapping units in Ventura County, and 40 soil mapping units in Los Angeles County. Soils in the watershed are derived from weathered sandstones, shale, igneous rock, and from alluvial derived from mixed sources, including marine



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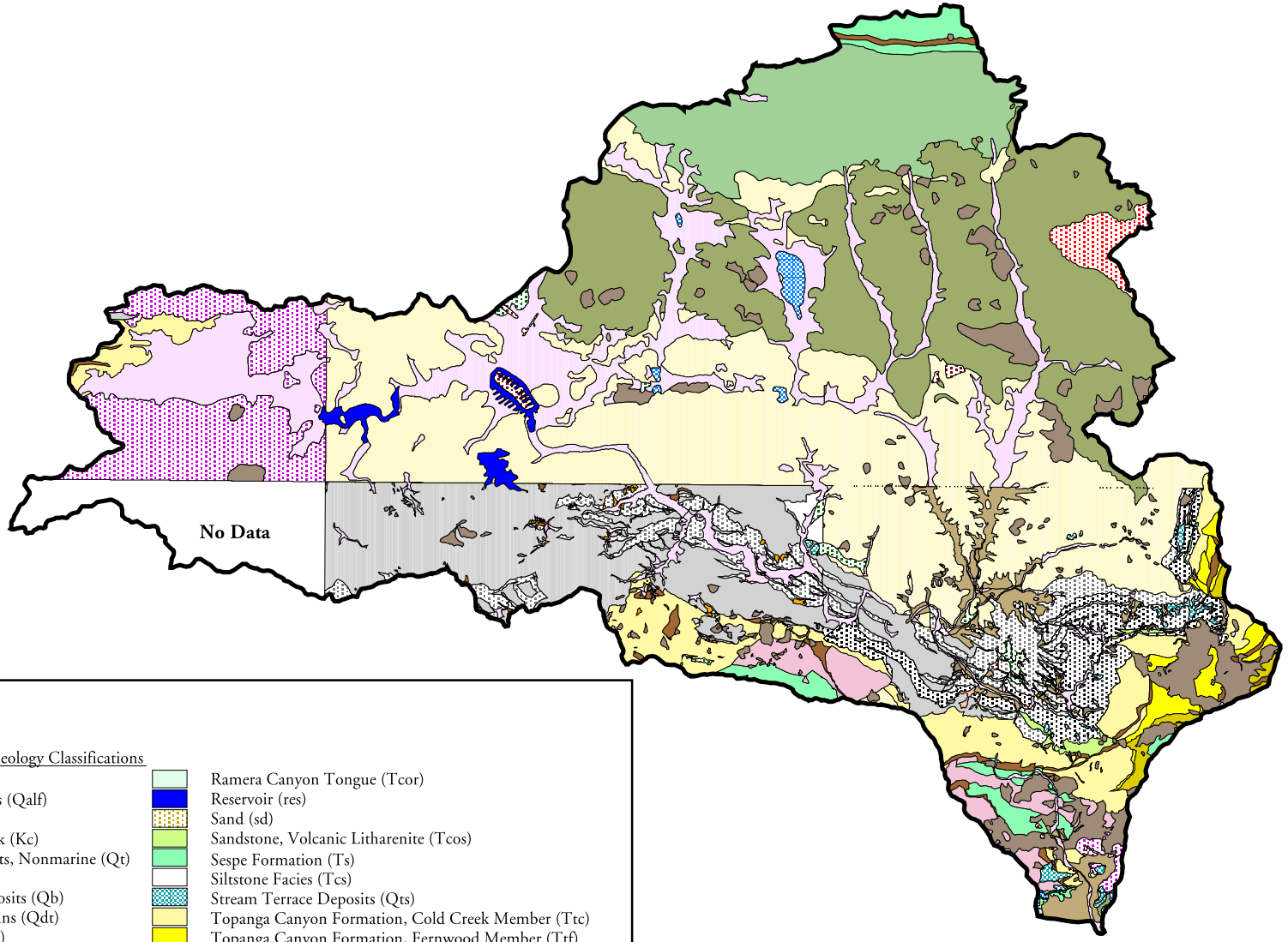
Source: USGS Topographical Quadrangle Maps and Los Angeles County Department of Public Works

Figure 2
Topography and Subwatershed Boundaries
Malibu Creek Watershed



Malibu Creek Watershed

Geology Classifications

- Alluvium (Qal)
- Alluvium, Fan Deposits (Qalf)
- Artificial Fill (af)
- Carbonate-Silicate Rock (Kc)
- Coastal Terrace Deposits, Nonmarine (Qt)
- Colluvium (Qc)
- Colluvium, Beach Deposits (Qb)
- Colluvium, Debris Trains (Qdt)
- Colluvium, Dunes (Qd)
- Conejo Volcanics (Tco)
- Conejo Volcanics, Flows (Tcof)
- Conejo Volcanics, Pillow Breccia (Tcop)
- Fan Deposits (Qf)
- Intrusive Rocks (Ti)
- Landslide deposits (Qls)
- Monterey Shale (Tm)
- Ramera Canyon Tongue (Tcor)
- Reservoir (res)
- Sand (sd)
- Sandstone, Volcanic Litharenite (Tcos)
- Sespe Formation (Ts)
- Siltstone Facies (Tcs)
- Stream Terrace Deposits (Qts)
- Topanga Canyon Formation, Cold Creek Member (Ttc)
- Topanga Canyon Formation, Fernwood Member (Ttf)
- Topanga Canyon Formation, Saddle Peak Member (Tts)
- Topanga Group, Calabasas Formation (Tc)
- Towley Formation, ss (Tw)
- Trancas Formation (Tr)
- Undifferentiated Surficial Deposits (Qu)
- Vaqueros Formation (Tv)
- Volcanic Breccia (Tcob)

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WaterCycle LLC

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4000 0 4000 8000 12000 Feet

Source: USGS, Digitial Map Files, 1998.

Figure 3
Geology within
the Malibu Creek Watershed

and non-marine deposits. The major upland landforms are marine sandstone, shale, igneous rock, and semi-consolidated regolith. Lowlands soils derived from shales are loamy, silty and clayey, including the Castaic, Nacimiento, and San Benito series. Sandy soils such as the Gaviota series are formed from material weathered from sandstone.

Floodplain Soils

Data on the characteristics and distribution of floodplain soils is available from the Ventura NRCS Soil Survey Report. The original survey (1968) is now being updated (2001) by NRCS, and is in need of funding support for completion of the update and for digitizing the results. These data will be useful in preparing maps of infiltration and exfiltration for groundwater recharge.

Stream Channel Network

The headwater streams of this watershed drain the steep sandstone outcrops of the Santa Monica Mountains to the south, and the sharp contours of the Simi Hills to the north. Typical of well-drained rock substrates and alluvial soils, the zero (0) and first (1st) order streams have few bifurcations, reflecting that surface water is easily infiltrated in these upper subwatersheds (see Figure 4, *Stream Network and Associated Floodplain*, on page 16). The long, narrow canyons such as Palo Commado and Las Virgenes Canyon draining to the south from the Simi Hills typically have few confluence points. Water and sediment delivery off the headwater swales is typically rapid and episodic, and can be exaggerated by the loss of the native chaparral, oak woodlands, and grass savannas that historically dominated these landforms prior to two centuries ago.

The Strahler stream order system is employed here, where 1st order streams begin at the upstream end of the watershed with the USGS blue lines, and only become 2nd order where two 1st order streams join, and so on. The Hidden Valley plain supports a small narrow second-order channel that remains connected with the surrounding floodplain. This floodplain developed from colluvium from the surrounding hills which, after fluvial transport became deposited as alluvium, to depths up to 60 ft. The 0 and 1st order streams flowing north through the Santa Monica Mountain range are typically steep, bedrock channels with numerous waterfalls and chutes. These streams typically support high sediment delivery to downstream channels. The vast majority of the Malibu stream network is made up of these smaller-order streams (not all shown in Fig. 4). The 0 and 1st order streams flowing south from the Simi Hills have lower gradients and narrow, longer drainages. Second (2nd) order streams tend to form in the higher valleys, support floodplains formed by flood events and historically supported important riparian and floodplain habitats. These 2nd order valley soils are typically natural groundwater recharge zones.

Riparian vegetation plays an important role in the morphology of ephemeral and intermittent channels in Mediterranean climates. The increased bank strength from roots and large wood jams is critical for the ability of the channel and banks to withstand the sudden increases in shear stress during flashy floods. The loss of streamside trees and shrubs has significant consequences for

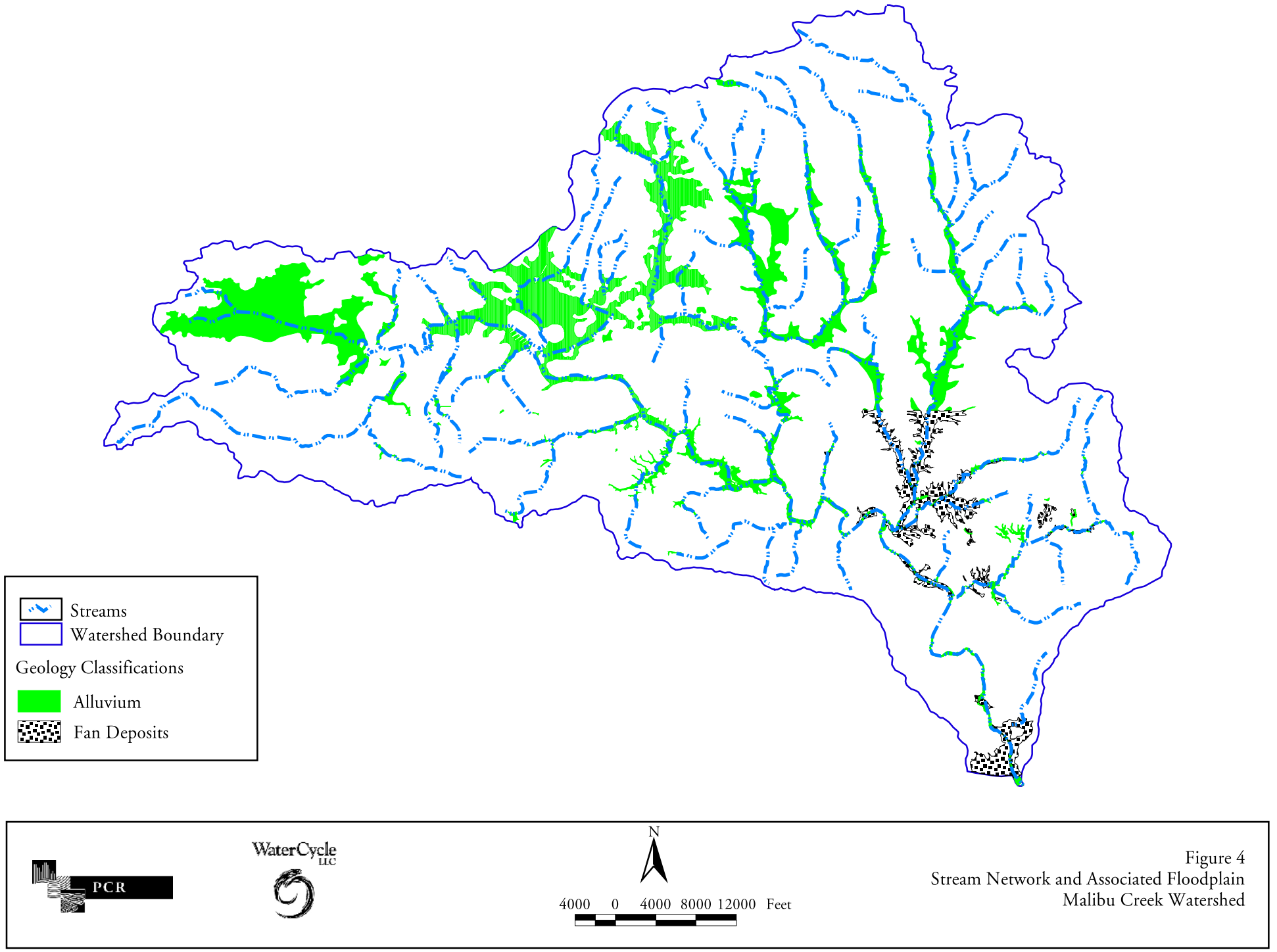


Figure 4
Stream Network and Associated Floodplain
Malibu Creek Watershed

channel morphological stability, and can result in over-widened channels and unstable banks. The natural roughness of unaltered floodplains provides for high rates of floodwater attenuation, which decreases flood flow velocity, increasing flow duration and the volume of floodwater infiltration across floodplain surfaces.

Almost all of the Malibu Creek 3rd order streams have been significantly altered, and the historic relationships of channel morphology with discharge will be difficult to characterize for these stream segments. The mainstem Malibu Creek is a 4th order stream as it flows into the Pacific Ocean. It becomes 4th order where Triunfo Creek joins Medea Creek, approximately 9 miles upstream of Malibu Lagoon. Through the main reach of Malibu Canyon below the confluence with Las Virgenes Canyon, this bedrock- dominated channel is primarily a gaining reach (groundwater dominated) with physical processes dominated by sediment transport. This reach supported historically perennial flow and significant volumes of sediment transport, especially during peak flows. These sediments become finer over distance, to nourish the beaches of Malibu and the Santa Monica Bay with sand and gravel.

2.1.2 Hydrology and Stream Network

Average annual rainfall is about 24 inches (61cm) in the southern half of the watershed, and 14 inches (35cm) in the northern half. Nearly all rainfall occurs between November and April. Annual precipitation is highly variable, ranging from near zero to 70 inches (178cm) over the period of record. One rainfall gauge exists in the area at Leo Carrillo Beach in Ventura County at elevation 50 feet (15m). Rainfall during storm events is not evenly distributed around the watershed, and is typically higher across the Santa Monica Mountains, diminishing northward toward the Simi Hills. Low fog is commonly produced by a marine inversion layer, which typically occurs in valleys on summer mornings, dissipating by afternoon. This fog may decrease local visibility, but it provides an important moisture source for native vegetation (data from USDA-NRCS 1995).

Runoff rates from the exposed rock formations of the mountain rim of the watershed may be high. Although infiltration into rock formations does occur, these rates have not been quantified. Historically, many streams of the upper watershed are intermittent to ephemeral USGS blue-line channels, drying up in the mid-summer until the onset of the rainy season. Given their position in the watershed, local residents' comments and substrate type, it is reasonable to assume that Las Virgenes Creek, lower Medea Creek and Cold Creek were historically perennial to intermittent. These streams are historically losing streams in summer, delivering most of their flow to groundwater, with exceptions of discontinuous stream segments on Malibu Creek below the confluence with Las Virgenes Creek. Except for springs emanating from the Lower Topanga Formation, groundwater fed by precipitation roughly parallels the topography, converging in the valleys. Groundwater continues on a downstream gradient toward the ocean, emerging as a gaining stream below the Las Virgenes confluence.

During the 1950s, there was a notably dry period which further reduced creek flows. Until the 1960s, stream flows had been progressively reduced by an order of magnitude by artificial diversions, on- and off-stream storage and groundwater pumping. Since the importation of water began in the 1960s, stream flows have increased by an order of magnitude, causing many streams to flow perennially. The effects of water importation were magnified by the abandonment of most pumping (R. Orton, pers. comm. 2000). The practice of lining stream channels with concrete box construction in urban areas has begun to decrease the rate of groundwater infiltration from the stream channel network in the urbanized upper watershed, such as at Medea Creek in Agoura Hills.

Springs originating from bedrock aquifers, and seeps emerging from alluvium, were observed by Flowers (1972). With few exceptions, most springs emanate from the Lower Topanga Formation, which is exposed along the crest of the Santa Monica Mountains, the southern boundaries of the basin, and along the lower reaches of Malibu Canyon. Surface water enters the steeply north-dipping strata and emerges as springs where the strata are cut by stream channels. The most important springs of this type are found in the upper reaches of Cold Creek, La Sierra Canyon and a small tributary south of Century Reservoir. Groundwater is impacted by infiltration of surface waters carrying contaminants from development. Septic systems can contribute to groundwater bacteria and nutrients, which can re-emerge as surface flows degrading surface water quality.

Dam construction is limited on Malibu Creek, the most important being Rindge Dam, three miles upstream from the ocean. This and other dams are constructed in bedrock, which intercept the down-valley movement of groundwater, increasing water storage within valley walls and sediments, and increasing streambank storage of water upstream. Dams prolong flows, halt (or reduce) sediment transport (once the dam reaches sediment storage capacity), altering the delivery of sediments to the lagoon and beach. Rindge Dam is a major obstruction to flows and fish passage, and is currently being considered for removal in a study by the Army Corps of Engineers Los Angeles District.

Lakes in the Malibu Creek watershed are mostly manmade for water supply and recreation. With the exception of Sherwood Lake, they are typically relatively small in area and depth, and provide some incidental groundwater recharge. Currently only the Las Virgenes Reservoir is used for water supply.

Malibu Creek flows to the Santa Monica Bay through Malibu Lagoon. The Lagoon is closed most of the year by a sand and gravel berm created by ocean currents transporting sediments littorally. The lagoon was historically breached by flood flows, and in recent decades by mechanical breaching to manage lagoon water levels below 4 ft. to protect local septic systems and 'restored' habitat areas. Currently breaching events occur during water levels between 6 and 7 feet, at or near the natural level of breaching aided by the "Shovel Brigade", who apparently are interested in protected the beach profile for surfing wave quality (R. Morgan, pers. comm., 2000). Increased flows owing to water importation may now cause the lagoon to breach at other times of year than the historic flow regime, causing water quality problems for recreation along the beaches, but this

has not been fully documented (R. Orton, pers. comm, 2000). Following breaching, the bar is typically replaced by littoral drift in a short time, sometimes after as little as two weeks.

2.1.3 Vegetation and Wildlife Ecology

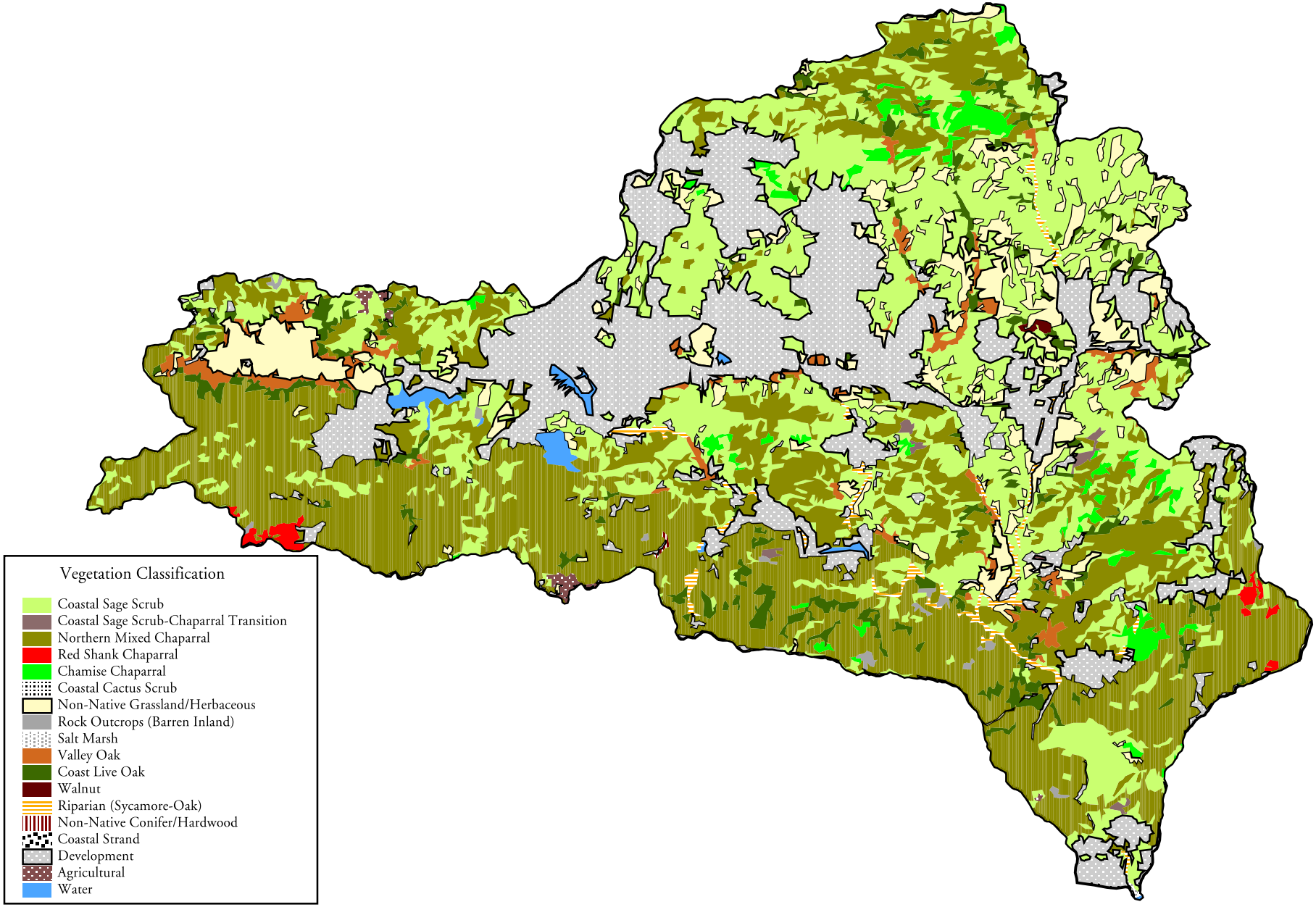
The vegetation and ecology of the Santa Monica Mountains (SMM), including the MCW, is consistent with that of a Mediterranean climate with mild winters, warm dry summers, and seasonal coastal fog. It is these unique conditions which have created the diverse assemblage of plant communities and habitat types within the MCW. This diversity is also reflective of the complex topography, underlying geology, and soils of the watershed. The southern slopes of the SMM are strongly affected by the marine weather conditions while the northern slopes are influenced by drier inland weather conditions.

Most of the MCW is heavily vegetated with native plant communities. Vegetation in general plays an important role in stabilizing soils and preventing erosion. Within the MCW this role is crucial in many areas where chaparral covers steep slopes with sandy soils. This role functions to protect not only freshwater stream habitat but coastal marsh habitat at the mouth of Malibu Creek as well. Watershed plant communities are diverse, and include oak woodland, walnut woodland, riparian woodland, valley oak savannah, grassland, coastal sage scrub, chaparral, wetland, coastal marsh, ornamental landscapes, and disturbed lands including agricultural lands (Figure 5, *Vegetation Map*, on page 20).

The diversity of vegetation types and the large acreage of natural open space within the MCW provides habitat for an abundant and diverse wildlife community. Only a few wildlife species are entirely dependent on a single vegetative community. For most species, the entire mosaic of vegetation types within the watershed and adjoining areas constitutes a functional ecosystem, both within the watershed and as part of the regional Santa Monica Mountains ecosystem.

Amphibian populations are plentiful due to the high moisture content provided by coastal conditions, as well as the large number of drainages and year-round surface water sources. Amphibians are likely to be in highest numbers within the moister woodland areas and canyon bottoms. Many reptilian habitat characteristics can also be found scattered throughout the watershed such as rock outcrops that allow for high visibility, and small mammal burrows which allow for cover and escape from predators and extreme weather. Over 35 species of reptiles and amphibians have been recorded within the watershed. Several invertebrate studies have been performed in the watershed, including two under the auspices of UCLA – funded through the Coastal Conservancy (Ambrose, 2000) and the SMMRCD (1994). These studies concluded that there is some invertebrate diversity problems within the watershed. Further work in this area is needed.

Bird diversity is high in the MCW. The scrubland, woodland, riparian, and grassland habitats within the watershed provide foraging and cover habitat for year round residents, seasonal residents, and migrating song birds. There are many year-round water sources located throughout



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3000 0 3000 6000 9000 Feet

Source: NPS 1997

Figure 5
Vegetation
Malibu Creek Watershed

the watershed as well as abundant foraging, perching, and nesting habitat along the northern slopes of the MCW. The southern edge of the watershed, along the coast rim, is also part of the Pacific Flyway migration route. The combination of these resources as well as the confluence of many community types supports an unusually high diversity of bird species. Records from within the watershed indicate that nearly 400 species of birds utilize the habitat within the watershed at some point in their life cycle.

Mammal diversity, not surprisingly, is also high within the watershed. Fifty species of mammals have been observed in the watershed including mountains lions, mule deer, bobcat, badgers, and many others. While most of these species can be found in other areas within the region, the MCW and the Santa Monica Mountains are unique in the number of coexisting populations of so many species.

While all of the habitat types within the watershed ecosystem play important roles, riparian habitats and salt marsh are integral to the maintenance of the high species diversity. Riparian communities, including southern willow scrub, sycamore-alder woodland, southern cottonwood-willow riparian forest, oak riparian forest, freshwater marsh, salt marsh, and mulefat scrub can be found along all the major drainages and many of their tributaries throughout the watershed. Although the acreage of these communities is much smaller than the adjacent upland communities, they concentrate many essential resources which are generally scarcer in upland communities, including food, water, and shelter in a variety of forms. Shelter may be simply tree shade that can substantially decrease air and water temperatures. Furthermore, it is estimated that at least 85% of all wildlife utilize riparian areas at some point in their life cycle (Washington State Department of Biology). Clearly these communities are important to upland species and are essential in maintaining wildlife diversity and abundance in the watershed.

The salt marsh habitat of Malibu Lagoon, at the mouth of Malibu Creek, is an uncommon wetland resource in the region. This community provides habitat to a multitude of bird species for both foraging and breeding. Records indicate more than 260 bird species have been identified in the lagoon and adjacent upstream riparian habitat. In addition, this marsh represents one of the few remaining salt marsh communities in the region. The brackish conditions of this community create habitat for a variety of species not found in any other community. Although the lagoon is relatively small, its existence substantially increases the diversity of species within the watershed. The Malibu Lagoon is Santa Monica Bay's only remaining brackish water lagoon.

2.1.4 Sensitive Plant Communities and Species

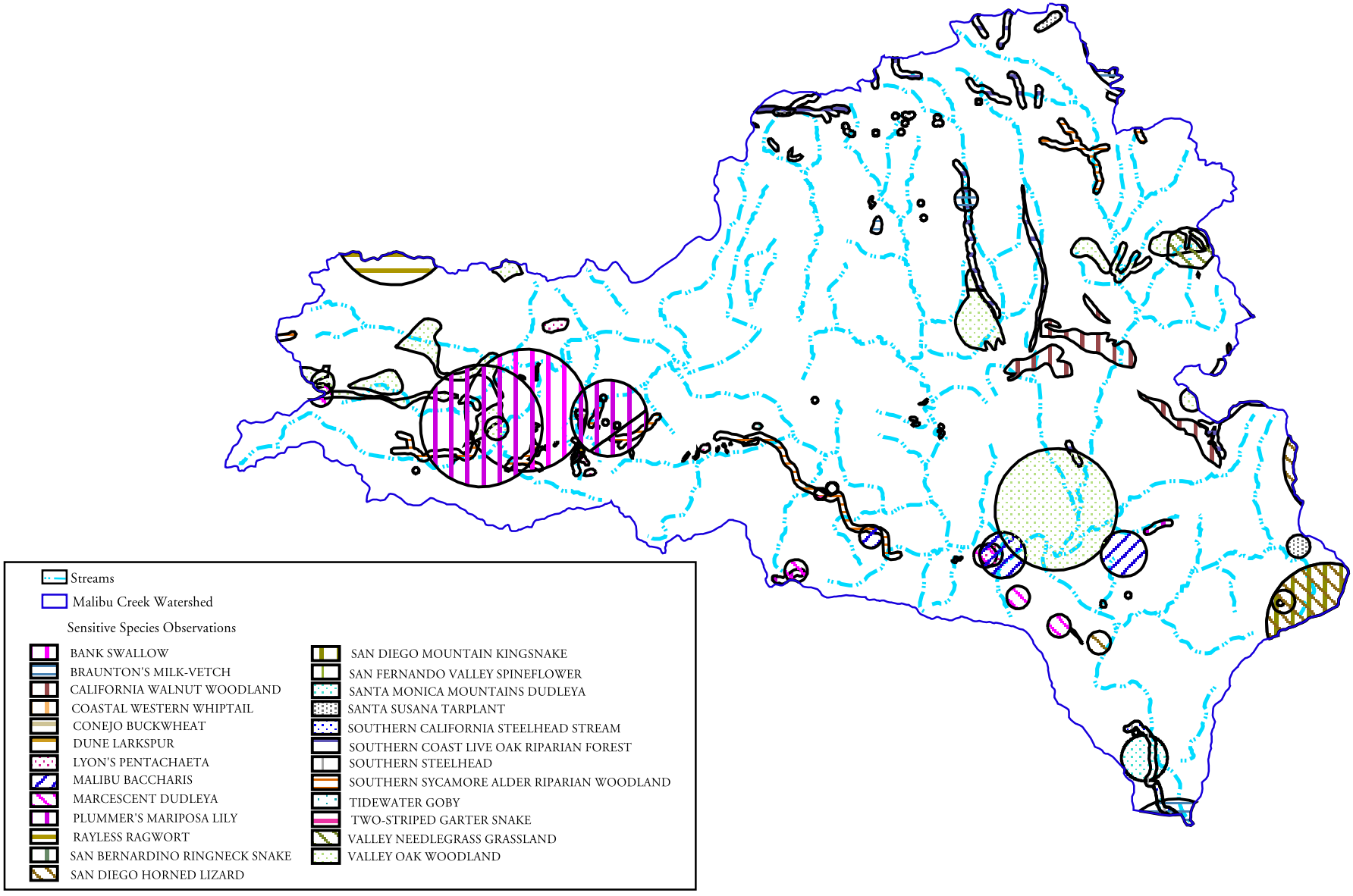
The vegetative communities and wildlife species of the MCW are part of a diverse and increasingly rare complex of natural ecosystems adapted to the Southern California Mediterranean climate. Natural habitat areas within the MCW have declined and become more fragmented and isolated due to encroaching human occupation. As a result, many plant communities and species within the watershed are rare.

The watershed supports several habitat types considered sensitive by resource agencies, namely the California Department of Fish and Game (CDFG) [California Natural Diversity Database (CNDDB), 2000], because of their scarcity. These habitat types support a number of state and federally listed endangered, threatened, and rare vascular plants, as well as several sensitive bird and reptile species. These communities include perennial bunchgrass, coastal sage scrub, valley oak woodland, walnut woodland, southern willow scrub, southern cottonwood-willow riparian forest, sycamore-alder woodland, oak riparian forest, salt marsh, and freshwater marsh. These communities are considered highest-inventory priority communities by the CDFG, indicating that they are experiencing a decline throughout their range.

Many sensitive plant species occur or potentially occur within the MCW. Several of these are federally or state listed threatened or endangered species including Braunton's milkvetch, marescent dudleya, Santa Monica Mountain's dudleya, and Lyon's pentachaeta. Recently the San Fernando Valley spineflower, formerly thought to be extinct, was re-discovered on the Ahmanson Ranch property on the East Fork of Las Virgenes Creek. Many other sensitive plants that occur within the watershed are either state or federal species of concern or included in the California Native Plant Society watch list. This high concentration of sensitive plant species renders the watershed regionally and globally unique.

A number of sensitive animal species also occur within the MCW. Federally or state listed species previously recorded include the red-legged frog, tidewater goby, southern steelhead, southwestern willow flycatcher, and least Bell's vireo. In addition to listed species, there are many unlisted sensitive species such as the southwestern pond turtle and the San Diego coast horned lizard which occur in suitable habitat areas throughout the watershed. The approximate location of many known populations of sensitive species are on record with the CNNDB and are illustrated in Figure 6, *Sensitive Species Range Map*, on page 23. Although this figure does not represent the locations of all sensitive species populations, it clearly indicates that the watershed has a high concentration of sensitive biological resources.

Although many of these species are protected to some degree, the fragmentation and isolation of habitat units within the watershed continues to threaten their existence. As discussed above, riparian habitat represents a highly concentrated resource area for many species. However, without a link to upland habitats, these areas become islands of habitat and the rich diversity within them declines. Therefore, it is crucial that linkages between key resource areas and adjacent upland habitats are maintained in order to stem the loss of biodiversity within the MCW and to protect the long-term health and viability of watershed ecosystems.



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4000 0 4000 8000 12000 Feet

Source: CNDDB 1999

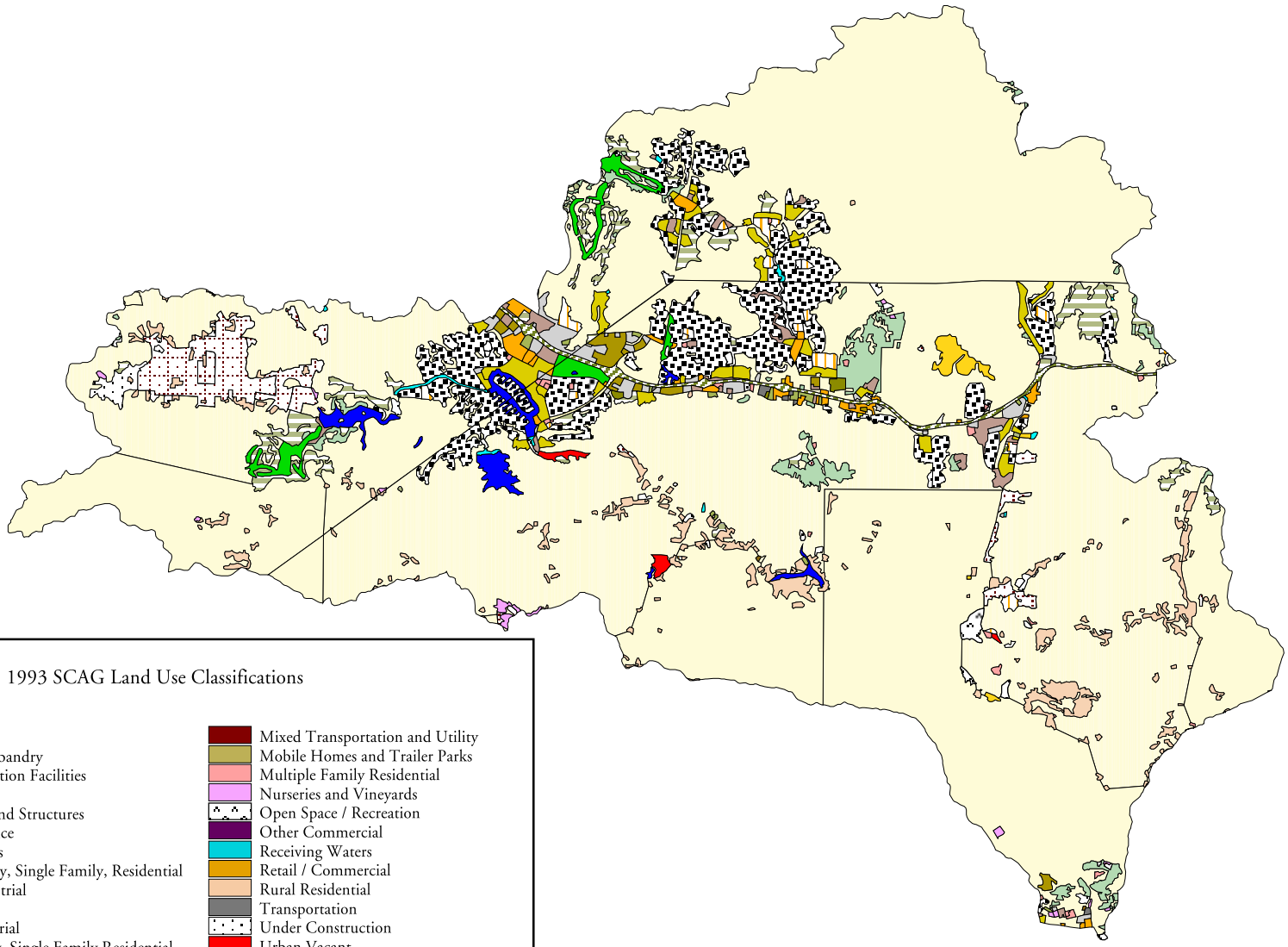
Figure 6
Selected Sensitive Species Observations
Malibu Creek Watershed

2.1.5 Land Uses

Much of the MCW remains in a relatively undeveloped condition. This unique circumstance, with a population of approximately 13 million people in the Los Angeles basin within an hour drive, offers residents of the watershed a rare opportunity to experience the natural beauty of the California landscape while enjoying the benefits of a large city nearby. According to 1993 data from the Southern California Association of Governments (SCAG) land use classification for the Malibu Watershed, roughly 80 percent of the watershed is undeveloped (see Figure 7, *Land Use Within the Malibu Creek Watershed*, on page 25 and Table 1, *1993 SCAG Land Use Classification for the Malibu Watershed*, on page 26). This number may have decreased somewhat since 1993 due to recent residential and commercial development. There is no guarantee, however, that this relatively pristine landscape will always remain as it is, due primarily to development pressures from the nearby population center. Several large-scale development projects are currently in the planning phase, including the Ahmanson Ranch project that proposes to create an entirely new city directly north of the city of Calabasas (see Figure 8, *Projected Potential Land Use Within Malibu Creek Watershed*, on page 27). Unless long-term land use planning is designed to preserve these unique features, Malibu Creek Watershed may lose the natural characteristics that draw people to live there.

The dominant human-altered land uses within the watershed include residential use (including *under construction* areas), agriculture, and commercial/industrial use; all have profound effects on the native landscape. Residential development, commercial, and industrial land conversion promote further change including river channelization for flood control, road construction, and landscape alteration for recreational purposes such as golf courses and 'aesthetics'. This leads to the loss of wildlife habitat, and an increase in stress on the surrounding natural systems that can and does lead to degradation in the water quality. Development has been concentrated within the watershed, primarily centered in and around the cities of Agoura Hills, Westlake, Malibu, and Calabasas. Primary pollution sources detrimental to the environment and to humans originate from these urban centers (see Figure 9, *Urban Runoff Pollution Sources*, on page 28). Mass grading operations associated with new development, if not properly managed, can increase sediment loads to steams, while post-development conditions retard sediment delivery to these same streams, impacting the stream geomorphic equilibrium.

Golf courses occupy more than 450 acres of the watershed. Water recycling has become institutionalized in these areas; Las Virgenes Municipal Water District (LVMWD) encourages land managers to utilize recycled waters in an effort to distribute treated effluent. Golf courses maintain a higher permeability than urban areas, however, environmental impacts can and still do occur. In an attempt to maximize land use, remove obstacles from fairways, and maintain the monoculture of weed-free lawn, buffer areas protecting stream are often sacrificed and streamside shade is lost. Without riparian buffers, the stream has no natural filter system to process impacts from the herbicides, pesticides, and other input generated by these land management practices. Golf courses are prime candidates for habitat enhancements.



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WaterCycle LLC

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5000 0 5000 10000 15000 Feet

Source: SCAG 1993

Figure 7
Land Use
Malibu Creek Watershed

Table 1

1993 SCAG LAND USE CLASSIFICATION FOR THE MALIBU WATERSHED

Land Use Class	Acres	Percentage
Vacant	56132.4	80.05
High Density, Single Family Residential	3917.9	5.59
Agriculture	1410.6	2.01
Rural Residential	1378.6	1.97
Under Construction	1275.9	1.82
Low Density, Single Family Residential	943.2	1.35
Multiple Family Residential	862.1	1.23
Receiving Waters	470.1	0.67
Golf Courses	458.9	0.65
General Office	435.7	0.62
Urban Vacant	391.3	0.56
Transportation	366.1	0.52
Retail/Commercial	320.6	0.46
Educational	300.1	0.43
Open Space/Recreation	284.4	0.41
Animal Husbandry	266.2	0.38
Light Industrial	235.3	0.34
Utility Facilities	177.9	0.25
Institutional	98.1	0.14
Nurseries and Vineyards	82.1	0.12
Mobile Homes and Trailer Parks	79.7	0.11

Note: Information missing for parts of watershed boundary

Source: 1993 SCAG Land Use Classification

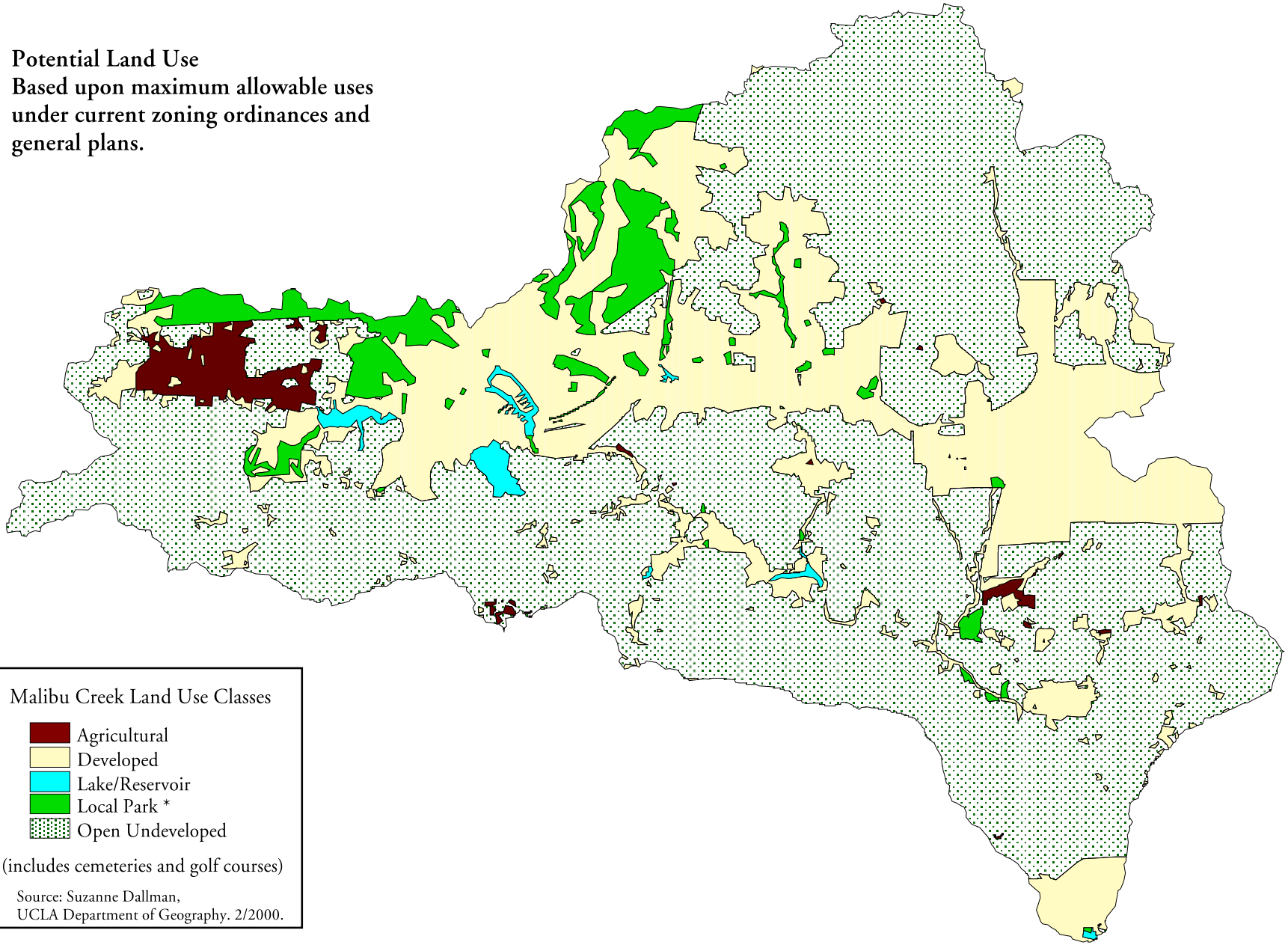
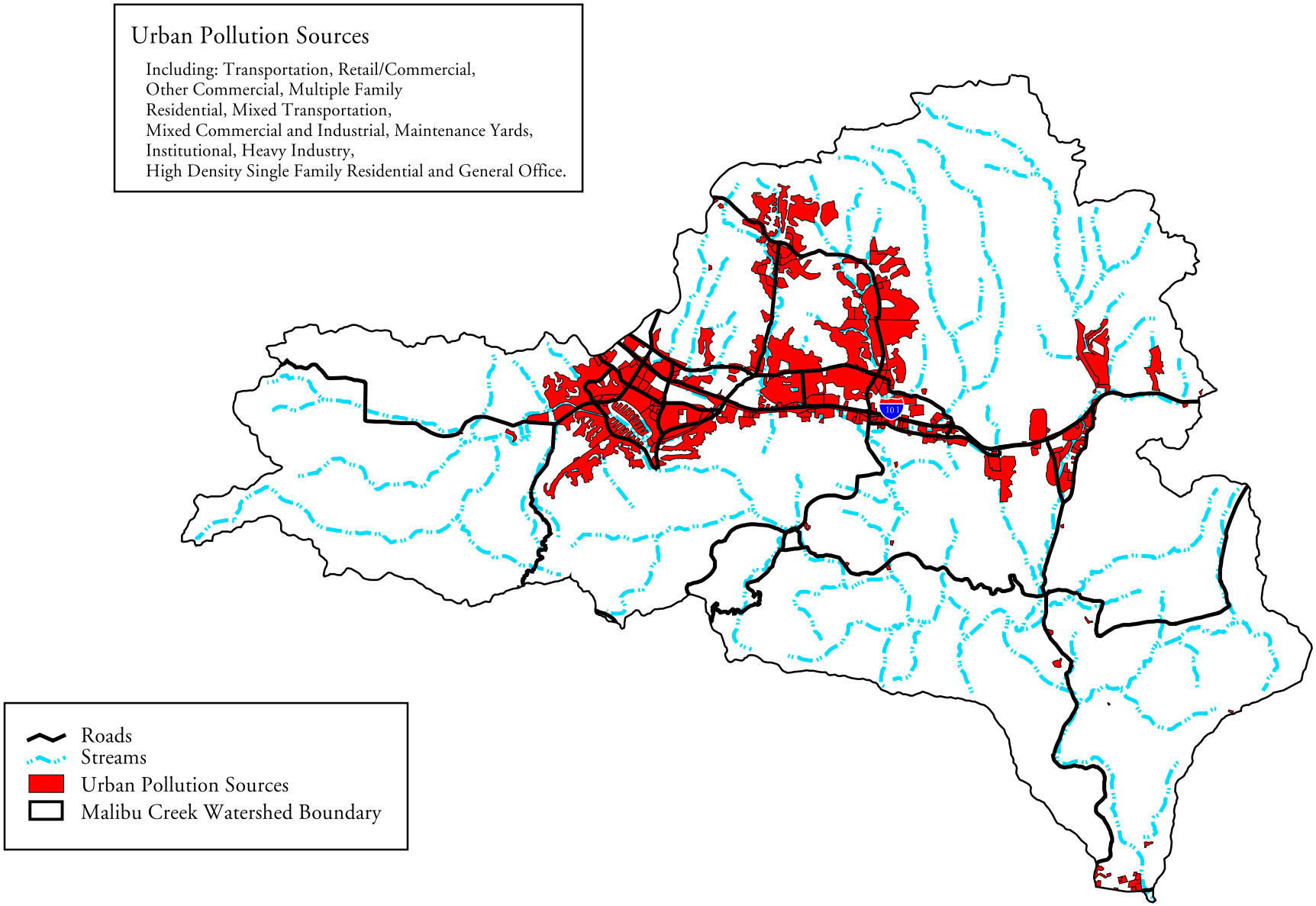


Figure 8
Projected Potential Land Use Within
Malibu Creek Watershed



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WaterCycle LLC

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4000 0 4000 8000 12000 Feet

Source: SCAG Land Use 1993 and Heal the Bay.

Figure 9
Urban Runoff Pollution Sources
Malibu Creek Watershed

Agriculture and animal husbandry primarily occur in the western end of the watershed, including along Potrero Creek and in Hidden Valley, although horse stables are frequently also found in the upper watershed within the canyon valleys. Riparian areas in the western end of the watershed are either absent or degraded due to inappropriate farming and animal husbandry, including over-grazing up to the channel margin and removal of the native riparian cover.

2.2 EXISTING MONITORING EFFORTS

Monitoring for water quality within the Malibu watershed focused in the early 1980s solely on the Malibu Lagoon and near-shore, according to available data archives. It is possible that monitoring occurred prior to 1979, but these records were not accessed during the course of the WMAP project. Early work focused on the need to detect pollutants affecting beach recreation at Malibu, particularly bacteria and other human pathogens. Only in the late 1990s did the perception arise that upper watershed conditions could play a role in the condition of lagoon and near-shore receiving waters. Recently emphasis has shifted to detecting pollutants of concern in the source tributaries and upper watershed areas, as protracted efforts to improve lagoon water quality by the City of Malibu have yielded minimal results.

The RWQCB Los Angeles Basin Plan (1994) is the first report to compile strategic water quality programs and the authorization to conduct them, designate beneficial uses for regional water bodies and set WQ objectives, report sampling parameters and locations, and to identify practices likely to impair water quality. Basin Plan Table 6.3 lists nine stations in the Malibu watershed to be sampled for trace elements and organic chemicals. Only one station (Malibu Creek) was sampled prior to 1985, and in no sampling year have all stations been sampled for the defined parameters. Staff at RWQCB may have conducted an analysis of existing water quality data for the MCW (R. Collins RWQCB, pers. comm, 2000).

Heal the Bay (1998) produced the first watershed-based framework for monitoring the MCW, in cooperation with California State Polytechnic University, Pomona Landscape Architecture Department, and the Coastal Conservancy. This report provides a vision statement for water quality based on the entire watershed, and describes many watershed resources in the context of water issues. A dry weather monitoring program is established to assess the overall ecological health of the watershed, to be conducted primarily by volunteers, in seven subwatersheds with two fixed sampling locations each. A companion volume was published, the Malibu Creek Watershed Stream Team Field Guide, which specifies protocols for the sampling methodology for physical parameters, chemical parameters and benthic macroinvertebrate assessment. These sites have been monitored monthly since 1998, and the data are reported in Appendix B.

The Malibu Creek Watershed Advisory Committee Monitoring and Modeling Subcommittee produced a Malibu Creek Watershed Monitoring Program report (1999). The primary goal of this proposed program is to develop a data collection monitoring program to address

pollutants that impair the formally-designated beneficial uses of Malibu Creek and its tributary streams (see also Section 2.2.1). A monitoring network is proposed which utilizes existing stations where possible, based on a tiered approach of sampling intensity. This proposed framework is discussed in greater detail in Section 5.1.

2.2.1 Defined Beneficial Uses for Malibu Streams and Lakes

Beneficial uses for Malibu water bodies are reported in the Basin Plan (1994) in two general categories; human uses and aquatic life. These beneficial uses are summarized in Table 2, *Designated Beneficial Uses for Malibu Creek Watershed*, on page 31. Note that, although all water bodies except Malibu Lagoon are potential sources of Municipal Water, current and projected water importation levels indicate that implementation of these uses is not anticipated in the foreseeable future. The other significant uses for Malibu water bodies include contact recreation, non-contact recreation and four categories of wetland and wildlife habitat.

2.2.2 Summary of Known Water Quality Impairments

The formal list of impairments from the Basin Plan (1994) is given in Table 3, *Water Quality Impairments In the Malibu Watershed*, on page 32, including the number of impairments per site. The list of streams, lakes and estuaries incurring the 303(d) listing with SWQCB is given in Appendix C, Malibu Creek Watershed 303(d) list of Pollutants of Concern, and are illustrated in the GIS layer (SWQCB, 2000) in Figure 10, *303(d) Listed Estuaries, Streams, and Lakes of the Malibu Watershed*, on page 33.

2.2.3 Summary of Known WQ Data Sources, Parameters and Locations

Water quality data, sampling methods and proposed sampling programs were obtained from several sources. The most complete data set for the upper watershed comes from LVMWD, with nine stations above Tapia dating as far back as 1979. Currently, there are several agents conducting monitoring efforts, including:

- Los Angeles County Department of Public Works (LACDPW);
- Los Angeles Regional Water Quality Control Board (RWQCB);
- Las Virgenes Municipal Water District (LVMWD);
- Heal the Bay (HTB);
- City of Calabasas; and
- Ventura County.

Table 2

BENEFICIAL USE DESIGNATIONS FOR MALIBU WATERSHED

E = Existing beneficial use I = Intermittent beneficial use k = public access denied

P = Potential beneficial use *MUN designations may be considered for exemptions at later date

Water Body	MUN	IND	PROC	AGR	GWR	NAV	REC1	REC2	WARM	COLD	EST	MAR	WILD	RARE	MIGR	SPWN	WET
Malibu Lagoon						E	E	E			E	E	E	E	E	E	E
Malibu Creek	P*						E	E	E	E			E	E	E	E	E
Cold Cr	P*						E	E		P			E	E			E
Las Virgenes Ck	P*						E	E	E	P			E	E	P	P	E
Century Resrv	P*						E	E	E				E				E
Malibou Lk	P*					E	E	E	E				E	E			E
Medea Cr	P*				I		I	I	I	P			E	E			E
Medea Cr	I*				I		E	E	E				E				E
Lindero Cr	P*						I	I	I				E				
Potrero Ck	P*				I		I	I	P				E				
Lk Eleanor Ck	P*				I		I	I	I				E				
Lk Eleanor	P*				E		E	E	E				E	E			E
Triunfo Ck	P*						I	I	I				E	E			
Triunfo Ck	P*				I		I	I	I				E	E			
Westlake Lake	P*					E	E	E	E				E				
Las Virgenes Resrv	E	E	E	E			Pk	E	P				E				
Hidden Valley Ck	I*						I	I	I				E				
Lk Sherwood	P*				E		E	E	E				E				E

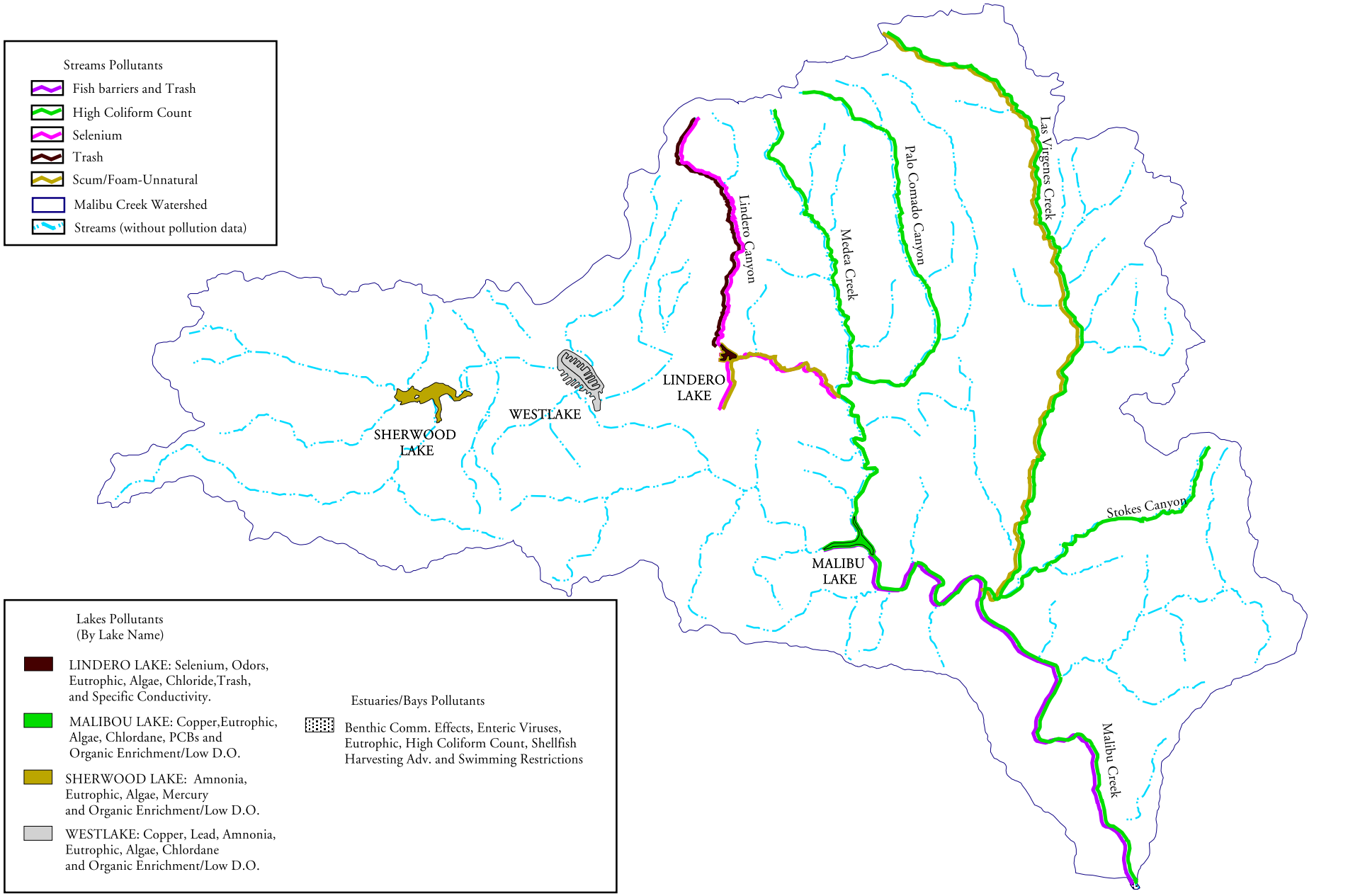
MUN Municipal & Domestic
IND Industrial Service Supply
PROC Industrial Processing
AGR Agriculture
GWR Groundwater Recharge
NAV Navigation
REC1 Contact Recreation
REC2 Noncontact Recreation
WARM Warm Freshwater Habitat
COLD Cold Freshwater Habitat
EST Estuarine Habitat
MAR Marine Habitat
WILD Wildlife Habitat
RARE Rare, Threatened or Endangered Spp.
MIGR Migration of Aquatic Organisms
SPWN Spawning, Reproduction or Rearing Habitat
WET Wetland Habitat

Source: Water Quality Control Plan Los Angeles Region (Basin Plan) 1994, RWQCB

Table 3
WATER QUALITY IMPAIRMENTS IN THE MALIBU WATERSHED

Water bodies listed below are ordered from upstream to downstream direction ↓	Algea	Ammonia	Beach Closures	Benthic Effects	Chloradane	Chloride	Copper	DDT	Enteric Viruses	Eutrophic	Fish Barriers	High Coliform Counts	Lead	Mercury	Nutrients (Algea)	Odors	Org. Enrichment/LowD.O.	PCBs	Scum/Foam - unnatural	Selenium	Shelfish Harvesting Adv.	Special Conditions	Trash
Westlake	x	x			x		x			x			x				x						
Medea Creek to Lindero confluence	x											x								x			x
Lake Sherwood	x	x								x				x			x						
Lindero Creek												x								x			x
Triunfo Creek - Reaches 1&2													x	x									
Medea Creek - Reach 2	x											x			x	x			x				x
Malibou Lake	x				x		x			x							x	x					
Lake Lindero	x					X				x						x				x		x	x
Liberty Canyon Creek																							
Las Virgenes Creek												x			x		x		x	x			x
Stokes Creek												x											
Cold Creek																							
Malibu Creek												x			x				x				x
Malibu Lagoon				x					x	x		x						x			x		
Malibu Lagoon Beach (Surfrider)			x					x				x						x					
Malibu Beach			x					x															

Source: Water Quality Control Plan LA Region (Basin Plan), 1994. RWQCB



Source: SWRCB 2000.

Figure 10
303 (d) Listed Estuaries, Streams and Lakes of the Malibu Creek Watershed

There may be other intermittent cooperators such California State Parks, National Parks, etc. No well-organized water quality sampling program has yet been implemented to address watershed-wide contributions to the Malibu Lagoon, which would enable detection of the pollutant and pathogen sources.

Existing sampling locations are shown in Figure 11, *Water Quality Monitoring Stations*, on page 35. The proposed locations are part of the recommended watershed-wide monitoring program discussed in Chapter Five. When a comprehensive sampling program is developed, the collection of all existing data into one data archive may be able to locate all data sources.

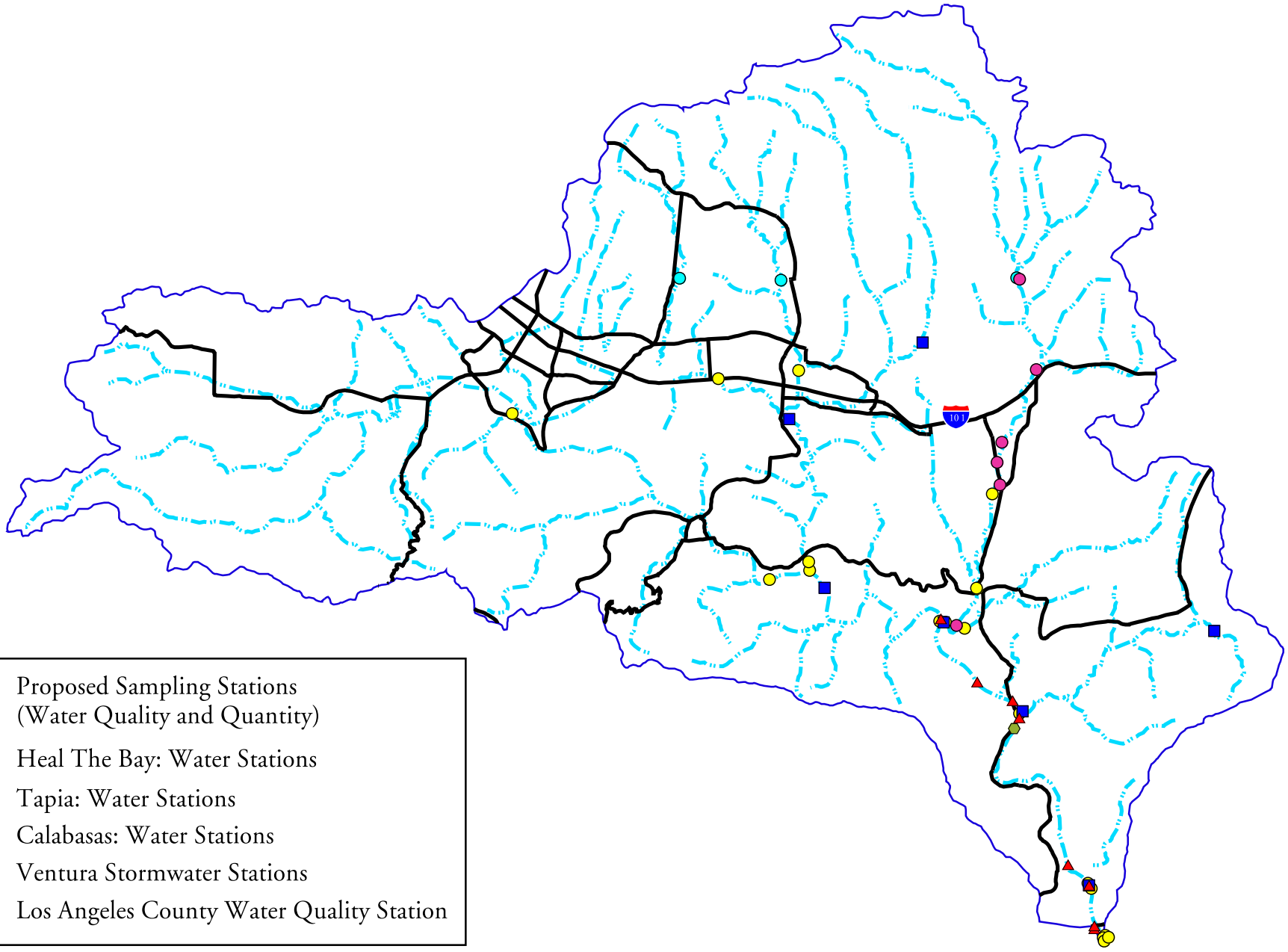
The 303(d) data from RWQCB suggest that impairments have occurred in five lakes, five streams, the lagoon, and beach for 26 parameters. These parameters are:

Algae	DDT	Nutrients (Algae)	Shellfish Harvest Advisory
Ammonia	Enteric Viruses	Odors	Specific conductivity
Beach Closures	Eutrophic conditions	Org. /Low D.O.	Swimming Restrictions
Benthic Comm. Effects	Fish barriers	PCBs	Trash
Chloride	High Coliform	PH	Zinc
Chlordane	Lead	Scum/Foam-unnatural	
Copper	Mercury	Selenium	

The data supporting these 303(d) listings were not available for review by this project, and the data available do not always correspond with the 303(d) list. For example, RWQCB data for 1997 showed 11 sites exceeding the Maximum Contaminant Threshold for Barium, but Barium exceedance is not shown on the 303(d) list.

Similarly, the threshold exceedance for nutrients has not yet been determined, but Malibu and Las Virgenes Creeks are listed for nutrients, largely because of the algal bloom in the Lagoon. The LA Regional WQ Board is currently working on nutrient effluent limits for the Tapia facility (the Board has proposed levels of 3.5 mg/L for nitrate, and 0.4 mg/L for phosphate). The TMDL standard for nitrate is due in 2002. Nutrient data from LVMWD indicate that nitrogen levels have declined over the period 1979-1999 for sites upstream of the Tapia STP (see Figure 10, *Listed Estuaries, Streams and Lakes of the Malibu Watershed*, on page 33).

Available coliform data from RWQCB appear to have records only for two grab sample periods, one in June 1996 and one in June 1997. None of these samples include data from lake water; all twelve sites are on lower Las Virgenes and Malibu Creeks. None of the sites were sampled more than once, and many data points do not exceed state standards. Lake data were not made available to the consultant team on this project, and did not appear in either the RWQCB or LA County data sets. Tapia has been monitoring coliform levels for approximately 10 years. LVMWD data indicate that coliform levels are elevated in some streams for some periods of the year.



PCR

WaterCycle LLC

Source: Heal the Bay and LA County Department of Public Works.

Figure 11
Water Quality Monitoring Stations
(Existing and Proposed)

Ventura County data sets include grab samples from 2 storm event dates, November 1997, January 1998, and 2 dry weather dates May 1998 and August 1998 for Lindero Canyon, Las Virgenes Canyon and Medea Canyon. All samples tested above the coliform limit of 2000 MPN/100mL. AB411 standards for ocean bathing are 400 MPN/100 mL for fecal coliform, 100,000 MPN for total coliform, and 104 MPN for enterrococcus. Variation across the data set is high. This data set appears to be detailed and well documented in terms of assumptions and methodology. It is not clear whether this data set was utilized in the 303(d) analysis. Some of the available data sets are compiled in Appendix B for the reader to see what has been reported, and how these parameters compare with the 303(d) list.

2.3 EXISTING PROGRAMS

This section discusses the existing programs that cities in the Malibu Creek Watershed currently implement for improving water quality, and the body of knowledge related to uncovering the sources of pollution entering the storm drain system. Agoura Hills, Calabasas, Malibu and Los Angeles County, and Westlake Village are included in the MCW. While all cities and the County dutifully implement the NPDES Permit requirements, due to the needs of individual cities and County there are additional programs completed on a voluntary basis. These programs support the individual General Plan mission, the economic base, or the desires of their citizens. It should not be interpreted as a blanket requirement that all communities would benefit from or could support, fund or implement all these programs.

The NPDES Permit requirements include the Model Programs for Development Planning, Development Construction, Public Agency Activities, Illicit Connections and Discharges, and Public Education, both Site Visit and Five Year Plan.

2.3.1 Development Planning

Model Program Requirements

The Development Planning Model Program deals with post construction structural best management practices (BMPs) on the following types of development of projects:

- 100+ home subdivision;
- 10 – 99 home subdivision;
- 100,000+ square foot commercial development;
- automotive repair shop;
- restaurant;

- retail gasoline outlet; and
- hillside located single-family home.

If the project is not one of the types of development listed above, but has the following characteristics, the project must include post-construction best management practices.

Vehicle or equipment fueling areas	Vehicle or equipment maintenance areas including washing
Commercial/industrial waste handling or storage excluding typical office or household waste	Outdoor handling or storage of hazardous materials or waste
Hillside locations	Outdoor working areas for activities such as but not limited to welding, cutting, metal fabrication, assembly, application of paints, coatings or finishing, pre-cast concrete fabrication
100,000+ square foot industrial development	Parking lots with greater than 200 parking spaces
Outdoor animal confinement	Location adjoining to bisected by or directly discharging to a designated environmentally sensitive area, riparian corridor or wetland

The projects listed above are considered priority projects, and as such must implement post construction best management practices consistent with the Standard Urban Storm Water Mitigation Plan (SUSMP). As of the writing of this section, the SUSMP had not been updated to reflect the State Water Resources Control Board (SWRCB) changes. Some cities in Los Angeles County petitioned the SWRCB to eliminate sections of the SUSMP. Prior to January 15, 2001, each City under the Los Angeles County NPDES Permit must obtain legal authority to implement the SUSMP. The cities must enforce the SUSMPs no later than February 15, 2001.

City Discussions

Each city has discussed their experiences with implementing the Development Planning Model Program.

Agoura Hills

Public Works takes the lead in implementing the Model Development Planning Program. However, these duties overlap as members of all departments have received training and dialogue continues as questions arise. The Planning and Building & Safety Departments take secondary roles. These duties require staff time to implement, but has not resulted in any new positions, as the staff size is relatively small. Our Permit or Plan Check fees have not increased as a result of NPDES requirements. Developers respond best to clearly defined requirements with specific measures of fulfillment of those requirements. Some of the more qualitative planning tools, such as a site location, may be more difficult to achieve. Even specific requirements for BMPs are difficult because there are no ways to quantitatively compare them. Catch basin inserts are wildly popular because they are inexpensive, but how much mitigation do these achieve, and which other BMPs are complimentary to them? A clear methodology needs to be developed for our watershed.

Calabasas

The City of Calabasas has implemented the spirit of the Standard Urban Storm Water Mitigation Plan (SUSMP) and Model Program for Development Planning since early to mid 1990s via the Urban Runoff Mitigation Plan section of the City's development code. While the City amended the development code in 1998, the City General Plan and landscaping requirements included pervious surfaces and water quality abatement prior to the development code amendment. The requirements include a percentage of property to be pervious depending on the zoning. 30% pervious is required for all parking lots with runoff being directed to those pervious surfaces; media filtration or like method to remove oil and grease from storm water flowing over parking lots; and proof of ongoing maintenance of the media filtration or like device. This requirement is implemented during Development Review Committee (DRC) for projects requiring public hearings. The Storm Water Program Manager in the Public Works Department has the primary responsibility for ensuring the requirements are implemented. The Storm Water Program Manager works closely with Planning and Building and Safety, as well as developers, to ensure installation of the requirements. The Storm Water Program Manager is one signature required for Certificate of Occupancy on DRC reviewed projects.

Malibu

The City of Malibu has been imposing controls on storm water pollution on a number of proposed commercial developments in the Civic Center area. Storm water detention and an integrated construction wetland have been proposed to deal with these proposed developments. Two major detention facilities have been installed during the last year and are operational with others still in the planning process. The City is very restrictive on allowable percent impervious surfaces and open space requirements, i.e.:

- Max. impermeable surface = 30% for ½ acre or larger lot up to 25,000 sq.ft. maximum;

- Grading limitation = 1000 cu. yds. (cut + fill total).

The planning department checks for compliance with CEQA on all project submittals and holds regular staff meetings to discuss new project submittals. NPDES issues are a significant part of these discussions and include construction inspectors, the NPDES coordinator, and the City Biologist. These meetings facilitate early detection of priority projects and allow compliance conditions to be incorporated into project approvals. Planning staff has been trained in the new Model Program.

Westlake Village

Several informational documents and hand-outs were prepared and utilized to educate City staff and construction applicants about storm water quality management requirements. All projects

submitted to the City for review and approval are required to comply with the City's storm water quality management program. Planning and Construction Priority Projects are identified immediately and the designers and developers are required to incorporate best management practices into the project designs from the planning stages and throughout the design and construction phases with requirements for transfer of lifetime maintenance responsibilities for permanent BMP installations.

2.3.2 Development Construction

Model Program Requirements

The Development Construction Model Program requires that all construction projects be reviewed for their potential impact to water quality and that inspectors on construction sites review and enforce, if necessary, the best management practices required for the site. Categories of best management practices required include sediment control, erosion control, site management, and materials/waste management. There are four categories of construction sites for the purposes of this program: Exempt, General Permit, Priority Project, and Minimum Project.

Exempt Projects

There are certain types of projects that will most likely pose a minimum risk of storm water pollution. As a result, these types and project characteristics can be exempted from the Model Program requirements. Specific types of projects exempted from the program include:

- Routine maintenance to maintain original line and grade, hydraulic capacity, or original purpose of facility;
- Emergency construction activities requirements to immediately protect public health and safety;
- Interior remodeling with no outside exposure of construction materials or construction waste to storm water;
- Mechanical permit work;
- Electrical permit work;
- Sign permit work.

Other projects may be exempted if they meet ALL THREE of the following criteria:

- There will be no significant soil disturbing activity;

- There will not be any outdoor storage or exposure to storm water of construction materials or construction wastes unless adequate control are provided; AND

- The activity poses a minimal risk of storm water pollution.

General Permit (NPDES Permit) from the State Water Resources Control Board (SWRCB)

Any project that is greater than five acres, or part of a larger project that is greater than five acres, is required to obtain a General Construction Permit and Notice of Intent (NOI) from the SWRCB. Part of the requirement of the General Construction Permit is to develop, implement, and maintain a Storm Water Pollution Prevention Plan (SWPPP) and to have a copy of the SWPPP on the construction site at all times.

Priority Projects

Priority projects are construction sites that have the potential to significantly affect water quality during construction. These projects are determined by the following:

- The project is not in the Exempt category or General Construction Permit category listed above; AND

- The project will result in soils disturbance of more than 2 acres of land (pursuant to the Clean Water Act – Phase II future standards will be 1 acres of land); OR

- The project is in or adjacent to an environmentally sensitive area; OR

- The project is located in a designated hillside area and soil disturbance will occur on site during the rainy season (November to April).

These projects must implement local Storm Water Pollution Prevention Plan (local SWPPP) and Wet Weather Erosion Control Plan (WWECP).

Minimum Water Quality Protection Projects

Projects not covered under the three projects listed above (Exempt, General Construction Permit, or Priority Project) are required to implement best management practices on a minimal level. Minimum best management practices include erosion and sediment control and construction materials management, such as spill prevention/clean up or litter removal.

Inspections

Cities must train inspectors to have a clear understanding of the potential for construction activities to pollute storm water and the identification of violations of the minimum water quality protection requirement for developer construction and implementation or corrective best management practices. Inspections for compliance must occur at least annually.

City Discussions

Each city has discussed their experiences with implementing the Development Construction Model Program.

Agoura Hills

The City of Agoura Hills was able to effectively encourage developers to properly implement local SWPPP/WWECP without a lot of discussion or resistance. Some details in the application needed correction, but the effort was mostly satisfactory. The City plans to improve record-keeping through digital technology. The City is investing in advanced Permit-tracking software that we hope will streamline the process of NPDES enforcement in the Permit process.

Calabasas

The City of Calabasas has fully implemented the Model Program, although some inter-departmental and intra-departmental communication problems have caused some difficulties in achieving this goal. The biggest success (and change from previous years) has been having all construction site superintendents with their water quality plans on site and taking erosion control seriously. Also, increased field support from building and grading inspectors has been imperative to the success of the program. Better coordination between departments will be the key goal for next year's programs.

Malibu

All building plans submitted to Building and Safety require an Erosion Control Plan, which must be available at the building site. The provisions include clear and direct guidance for BMP's that reduce pollutants in runoff. Also provided are standard details of temporary erosion control devices. These devices are standard on all plans for two reasons: one, projects sometimes get protracted into the rainy season; two, the mere presence of erosion control plans has educational value. Before the rainy season begins, contractors are given ample warning by Building and Safety to initiate the complete Erosion Control Plan. New pools require an agreement by owner to not discharge pool water without treatment. The City of Malibu has not approved any large grading projects (priority projects) which are subject to preparation of a SWPPP. Two projects were completed during the last year that included large storm drain detention facilities that have been

performing well in controlling rate of runoff. In the year 2001, more of these facilities will be installed as well as treatment systems per the SUSMP.

Westlake Village

One key element to the success of this program is continuous reminders of job site BMP requirements. Several informational documents and handouts were prepared and utilized to educate City staff and construction applicants about stormwater quality management requirements. All projects submitted to the City for review and approval are required to comply with the City's storm water quality management program. Planning and Construction Priority Projects are identified immediately. The designers and developers are required to incorporate best management practices into the project designs from the planning stages and throughout the design and construction phases, with requirements for transfer of lifetime maintenance responsibilities for permanent BMP installations.

2.3.3 Public Agency Activities

The Public Agencies Activities Model Program deals with the following city activities.

Sewage system operations	Public construction activities management
Vehicle maintenance material storage facilities management	Landscape and recreational facilities management
Storm drain operation and management	Street and roads maintenance
Parking facilities management	Public industrial activities
Emergency procedures	Dry weather flow diversion

Sewage Systems Operations

Sanitary sewer pipes and pump stations owned and operated by a city must implement spill/leak/overflow response and containment procedures to prevent the overflow from entering the storm drain system. In addition, the agencies are required to implement preventive and corrective maintenance and investigate suspected cross connections. When sewage has entered the storm drain system, public health agencies must be notified.

Public Construction Activities Management

The cities are subject to the same requirements as the Development Construction Model Program. Please see that section for information.

Vehicle Maintenance/Material Storage Facilities Management

Cities must evaluate public facilities for use. Upon that evaluation, some public facilities must develop pollution prevention plans that include best management practices for site specific control.

Landscape and Recreational Facilities Management

There are significant requirements for this section. The main objectives are 1) minimize the discharge of pesticides, herbicides and fertilizers to the storm drain system and receiving waters; 2) prevent the disposal of landscape waste into the storm drain systems; 3) minimize trash, debris and their pollutants from entering recreational water bodies; and 4) discharge municipal swimming pool water in a manner that will not contribute pollutants to receiving waters. Facilities required to implement the requirements are parks, golf courses, swimming pools, riding trails, recreational water bodies, picnic areas, sports field, and landscaped areas in parking lots.

Storm Drain Operation and Management

Essentially, the requirements of this section are to meet four objectives. Firstly, to inspect and clean catch basins annually and keep appropriate maintenance records. Secondly, the agencies must remove trash and debris annually from open channels and properly dispose of these materials to prevent discharge to receiving waters. Thirdly, public employees need to report prohibited non-stormwater discharges observed during the course of normal daily activities so they can be investigated, contained and cleaned up or eliminated. Lastly, the cities have to review maintenance activities to verify that they minimize the amount of pollutant discharge to receiving waters.

Streets and Roads Maintenance

This section seeks to reduce the discharge of pollutants associated with activities occurring in street and road rights of way through street sweeping of curbed streets. It also requires actions to minimize the discharge of pollutants associated with the maintenance of streets and roads. This includes saw cut, paving, concrete, good housekeeping and employee training.

Parking Facilities Management

Publicly owned parking lots with more than 25 spaces must have a parking facilities management plan to remove debris. How often, when and by whom debris removal is conducted is not specified here.

Public Industrial Activities

Agencies that operate Phase I industrial facilities may seek coverage under the storm water NPDES Permit as an option.

Emergency Procedures

The objectives of this section include protecting surface water quality through appropriate best management practices and emergency response activities that do not conflict with public health and safety during an emergency.

Dry Weather Flow Diversions

This section of the Model Program only required the County to list existing programs and feasibility studies for dry weather flow diversions.

City Discussions

Each city has discussed their experiences with implementing the Public Agency Activities Model Program.

Agoura Hills

The City hires a contractor to handle and apply pesticides and keep records on their use, in compliance with state regulations on Pesticide and Pest Control Operations. All pesticides are applied in accordance with the label directions. The City does not store any pesticides or fertilizers. Uses of pesticides are minimal during the rainy season. All landscaping wastes including tree trimming and lawn mowing are taken to the landfill or used as mulch. The County of Los Angeles performs all storm drain cleaning and management on a contractual basis with the City. BMP's are required for all City Projects, including the use of sandbags, street sweeping, and other appropriate practices. Contractors are advised of our requirements and contract inspectors are also required to be knowledgeable about stormwater pollution prevention practices. Although we contract with the LA County, it is apparent their crews are being properly trained regarding NPDES BMP's. The City has only very limited parking at 3 small parks. These lots are swept on a monthly basis or as needed.

Calabasas

The City of Calabasas had four major construction contracts during this reporting period: Agoura/Calabasas Community Center, "round-about" speed reduction structures on two roads, an addition to the Tennis and Swim Center, and a major slope repair along Mullholland Highway. The Agoura/Calabasas Community Center installed Fossil Filters in every drain in their parking lot to reduce the amount of oil and grease delivered to the storm drain facility. The City has also installed a CDS Unit and Abtech Filters to prevent some trash from entering the creeks from Calabasas Road. This area is considered a priority area due to heavy traffic.

Malibu

The most significant action taken by the City of Malibu to improve stormwater pollution was the installation of a Stormceptor with a Purizer Disinfection Facility on the major storm drain which outlets directly into Malibu Lagoon. This facility will not only remove grease, oil, trash and debris from the storm drain discharges but also will disinfect up to 200 gallons per minute to meet EPA standards for Rec-1 contact use. A complete report of results will be released by the end of the calendar year. The City hopes to install two more systems on the other major drains from the Civic

Center Area which impact water quality in the Lagoon and Malibu Surfrider Beach. The total project cost is estimated at $1.5 million with Purizer donating the disinfection facility. The City expended $151,000 that includes $59,000 reimbursable from the Prop A Grant. A full report of water quality monitoring of this facility will be available in December 2000. The City is seeking grant funding to install two more similar facilities on the other two major storm drains from the Civic Center area.

The other significant action was the completion of a thorough investigation of septic systems in the vicinity of Malibu Lagoon and surfzone. URS-Greiner Woodward Clyde completed this study in November 1999. The study confirmed that the septic systems of beachfront homes in the Malibu Colony are not a source of contamination to the surfzone, however they are a potential source to the Lagoon. The primary source of contaminants is the three storm drains discussed above.

Westlake Village

The City contracts for most public agency services. LA County performs Road and Storm Drain maintenance. Maintenance of the sewer collection system is conducted by the LA County Sanitation District, whereas the trunk mains are maintained by Las Virgenes Municipal Water District (LVMWD). LA County agencies comply with the model program. The practices of LVMWD, under a State Industrial (POTW) permit, are deemed to match and in some cases exceed the model program standards. The sewer spill response process (refer to the ICID Model Program annual reporting form) has been improved. Development of a schedule for collection-system maintenance has been initiated to ensure all sewers are properly maintained, tentatively on a three-year cycle (more frequently for problematic or "trouble" reaches).

2.3.4 Public Education

There are two different public education requirements. The first is the public education site visit program for commercial and industrial sites. The second is the Five Year Plan for Public Education. Los Angeles County Department of Public Works implements the majority of the efforts in this program. The cities do implement many programs.

The site visit program requires that cities send a representative to each required business and notify them of their responsibilities and the requirements of the NPDES Permit. Facilities covered under the NPDES Permit for this site visit program include Phase I Industrial Facilities, vehicle service related businesses, gasoline stations, and restaurants. There are hundreds of other types of businesses identified by Standard Industrial Code (SIC) that are regulated by this program. There is a specific time cycle requirement for these visits and specific public education pieces used for this requirement.

The Five-Year Public Education Plan includes hundreds of specific actions under four basic categories: general public/residents, businesses, school education and public agency employees.

The cities contribute to an annual public education campaign administered by Los Angeles County for the general public and residents. The business education primarily falls under the site visit program. Los Angeles County also administers school education. Training for public agency employees falls primarily to the cities. However, training materials have been made available to the cities from Los Angeles County.

City Discussions

Each city has discussed their experiences with implementing the Public Education program.

Agoura Hills

The City of Agoura Hills participates in the countywide program, as well as specific involvement for the watershed. We participate in the Household Hazardous Waste Round-up by promoting the events and advertising in local papers, the cable station and City website. We also offer disposal for used oil, batteries and paint on the first Saturday of each month, along with oil recycling containers and other promotional items. The City's annual Spring Fest Celebration coincides with Earth Day and features recycling and stormwater information booths. The City also distributes flyers at the public counter. The County performs educational site visits for industrial and commercial uses for the City under contract, and staff reviews and reports from these visits to determine if follow-ups are necessary.

Calabasas

Using a 319(h) Grant, the City of Calabasas was able to extend public education greatly during the past fiscal year. Specifically, an environmental resource center was created in the library including two computers that default to the City's environmental web page when a user goes on line. The resource center was decorated with a variety of environmental information, including posters, flyers, brochures and other items for HHW, Used Oil, Grasscycling, storm water quality and other information. Also, the City purchased a environmental education kiosk. While the content is not great yet, the kiosk itself is a useful tool for distributing information. It is anticipated that the kiosk will be circulated to a variety of locations throughout the City once the content is improved. Also, the City hosted its annual pollution prevention event, which included a HHW recycling event, filming of an environmentally themed production, a creek clean up, and a wheel of fortune game. Several newspapers covered the event. Both Heal the Bay and Los Angeles County, as well as the Malibu Creek Watershed group, provided education booths. The City of Calabasas also sent staff and distribution materials to the Los Angeles County Fair booth.

Malibu

The Malibu Lagoon Stormceptor and Purizer received a lot of media attention, which has helped keep the water quality problems at the forefront of the community awareness. The City has new capability to produce programming for its own radio station. Production of the first NPDES

public service announcements will be completed soon. The City sent press releases to the local papers preceding Earth Day. These were modified versions of the ones provided by County and included information about Malibu's programs. There was an enthusiastic response to the provision of used oil recycling containers to Malibu Auto Parts. These are offered free to the public, along with an oil recycling flyer that definitively describes the local programs and County roundups. Malibu Auto Parts advertises these containers in the local papers. County Water Works has reported that use of their used oil collection facility has substantially increased due to increased awareness. Pooper Scooper dispensers are located at City-operated Bluff Park in heavily trafficked areas. They encourage pet owners to dispose of animal wastes properly.

Westlake Village

The City of Westlake Village has provided supplemental giveaways to the Los Angeles County Public Education Booth at the Los Angeles County Fair. This year, staff was also sent to help promote and distribute that information to the public at the Fair. The City has also promoted local clean up events and participated in pollution prevention fairs.

2.3.5 Illicit Connections/Discharges

This program has been a cornerstone of NPDES Permits since 1990. The model program requirements themselves include describing what is illegal to discharge into the storm drain and what is exempted and conditionally exempted. There are specific requirements for illicit discharges to the storm drain system, including spill prevention, investigation, containment, and clean up. There must be procedures to identify illicit connections to the storm drain system and consistent enforcement procedures to eliminating those connections. In addition, cities must follow standard enforcement, training, record-keeping, and public reporting procedures. Los Angeles County Department of Public Works performs most of the Illicit Connection portion of the implementation, as they are the primary contractors for maintenance and/or owner of the storm drain system. Illicit discharges are primarily code enforcement activities and are related to the public education component of the program.

City Discussions

Each city has discussed their experiences with implementing the Illicit Connection/ Discharges Model Program.

Agoura Hills

The City of Agoura Hills has trained inspectors to identify illicit connections and discharges and to promptly report them to the NPDES coordinator. An attempt is made to contact the responsible party immediately, and a letter is sent to them as well. If no response is observed within a reasonable period of time, the matter is turned over to Code Enforcement. Spills or other incidents

that are perceived to be an immediate threat will receive immediate attention from a city-contracted cleanup agency. Events are reported to the RWQCB.

Calabasas

The City seems to have an increase in reports of illicit discharges to the storm drain system. A goal for the next year is to incorporate a training program with the Los Angeles County Sheriff's Department, our contract police services, for illicit discharges that we estimate occur primarily during the weekends. The City Adopt a Creek program attempt to take grab samples for evidence of illicit discharges or accidental spills to the storm drain system.

Malibu

City inspectors have been trained to identify illicit connections and discharges. Illicit connections are immediately brought to the attention of the NPDES coordinator who attempts to contact the property owner in person. If that attempt fails, a letter is written to the property owner discussing the problem and what needs to be corrected. The property owner is given 7 days to respond before the matter is turned over to Code Enforcement and ultimately the City Attorney's office. The County Health Department supports our Code Enforcement action as well and issues notices. Illicit discharges require immediate action with the intent of stopping the source of pollution. The County Fire Department has met with the City regarding the use of absorbent materials and other methods to contain septic discharges, and has received from the City spill response kits to use on a trial basis. City staff has acquired sampling equipment for submitting samples to labs for testing.

Westlake Village

The model program procedure for illicit discharge investigation and follow-up is flawed. We have learned to contact various agencies in Ventura County (since our lake adjoins Thousand Oaks in Ventura County), plus our watershed Cities have had inconsistent response from LA County sanitation. We have implemented a more effective contact process, including our local lake management association, Ventura County Health, the State Office of Emergency Services, and local law enforcement and fire departments, depending upon the nature and severity of the spill. The Regional Board receives a report within seven days of all sewer spills. Ensure LA County health has a clear understanding of the intent and procedures integral to the model program. For sewer spills, our experience has found it is necessary to obtain an "Incident Control Number" from the State OES as a reference in all correspondence relating to the incident.

2.3.6 Storm Water Quality Improvement Efforts Implemented by Los Angeles County

Los Angeles County Department of Public Works has provided this discussion on present and future efforts in implementing stormwater pollution practices.

Present efforts:

- The County has adopted a storm water ordinance

- The County requires mitigation of runoff generated by the first 0.75-inches of rainfall for each storm event for discretionary development or redevelopment projects under the Standard Urban Storm Water Mitigation Plan (SUSMP).

- The County requires construction projects that will disturb more than two acres of land, are located in a hillside area, and are in or adjacent to an environmentally sensitive area to prepare a local storm water pollution prevention plan (Local SWPPP) before the issuance of a building or grading permit, and certify that the developer/contractor will implement it all year-round. The County also requires these projects to prepare and implement a Wet Weather Erosion Control Plan (WWECP) if the projects will leave soil disturbed during the rainy season, defined as November 1 through April 15.

- The County has been conducting the regular educational industrial and commercial site visits for the sties indicated in the 1996 NPDES permit.

- The County Department of Health Services has been conducting regular site visits of all horse stables, in which the storm water component is included, for the purpose of monitoring general health conditions.

- The County has fully implemented the BMPs in all the Department's operation and maintenance, construction, land development, and other activities and maintenance facilities.

- The County provides regular ongoing maintenance services that prevent degrading of the water quality, such as street sweeping, catch basin cleaning, tree trimming, yard sweeping, bike path maintenance, etc.

- The County paves roadway shoulders which are subject to erosion.

- The County places sandbags or K-rail wrapped with filter fabric around temporary and long term dirt stock piles.

- The County has advertised a contract to line approximately 8 roadway culverts in the Santa Monica Mountains, which have rusted out or have other structural problems, instead of replacing the culverts. As no digging is involved, the process is much more environmentally protective than the standard process of replacing culverts. If everything is successful with this contract, the County will proceed with the lining of other culverts which we have deemed suitable for this process.

Immediate Outreach Program

All aspects of the immediate outreach program were completed during the 1996/1997 program year. The Immediate Outreach Program requirements were:

- make written materials available within their municipalities;
- list pertinent city phone numbers in local phone directories, or submit the numbers for listing in the next published phone directories;
- implement a catch basin labeling program;
- provide employee training; and
- have materials available at planning/permitting counters for construction contractors and/or developers.

Five-Year Storm water Public Education Program

The Five-Year Storm Water Public Education Strategy was approved by the Regional Board in December 1997. During the 1997-1998 year the Principal Permittee created a media campaign "Now You Know" and provided all Permittees with various media that could be used by the Permittees to begin implementation of the Five-Year Storm Water Public Education Program within their community. An interim segmentation study was conducted in July 1998 and a new media campaign was created for the 1998-1999 year, "Warning Labels". The Principal Permittee also made available both the print and radio advertisements for this campaign. During the 1999-2000 year, an expanded "Warning Labels" media campaign ran from April 2000 into July 2000. The campaign included over 2,600 60-second radio spots, 1,100 traffic report sponsorships, and 87 newspaper ads. Public outreach occurred at many major events, including Earth Fair, the County Fair, Los Angeles Ford Street Race and of many other locations. School education programs, Environmental Defenders, K-6, and Generation Earth, 7-12, continue to reach students countywide.

Future efforts which are proposed or under consideration

- The County is planning on installing catch basin inserts in all maintenance yards' catch basins, Catch Basin Debris Excluders in selected catch basins, and in-line storm water clean-up devices in selected storm drains.

- The County is investigating the construction of permanent roof cover for existing and new material storage areas and fuel dispensing islands in some of their field facilities.

3.0 ANALYZE AND EVALUATE DATA – PHASE III

3.1 PROBLEM DEFINITION AND REVIEW/ANALYSIS OF EXISTING WQ DATA

The initial problem definition was given to the consultant team as a brief summary; the problem is nutrients, bacteria, and trash. These parameters were presented as the criteria against which water quality improvements should be made.

Trash

The most consistent trash data set comes from Heal the Bay, who have monitored seven sites since November 1998. Of these, only one site, Cheseboro #7, reported trash observed more than 15% of the time. Trash is listed on the 303(d) list for Lake Lindero (low), Las Virgenes Creek (low), Lindero Creek reach 1 (low), Lindero Creek reach 2 (low), Malibu Creek (low), Medea Creek reach 1 (low) and Medea Creek reach 2 (low). No other data sets were obtained which measured trash as a parameter.

Trash was observed during field reconnaissance of this project, with the most pronounced occurrence at Malibu Creek State Park, near picnic areas along the stream. If trash is perceived as a problem, then more documentation of the nature and extent of trash occurrence and composition may be needed.

Bacteria

Bacteria data involve some greater effort to collect. On the 303(d) list, eight water bodies are listed as high for coliform counts; Medea Creek (reaches 1 and 2), Lindero Creek (reaches 1 and 2), Las Virgenes Creek, Malibu Creek, Malibu Lagoon and Surfrider Beach.

The State acceptable coliform threshold for recreational contact water is a log mean of 200/ 100mL, and for non-contact recreation a log mean of 2000/100mL. Data on coliform (fecal and total) counts are available from the RWQCB for 15 sites (one sample each, 1996 and 1997). In this data set, fecal coliform counts range from 40 – 270, MPN/100mL well below maximum thresholds. Total coliform counts range from 200 to 7000. MPN/100mL Coliform bacteria other than fecal can be found in nearly all soils worldwide, and fecal counts include not only all domestic mammals, such as horses, cattle, cats and dogs, but all birds and ducks as well. A comprehensive water-sampling program is needed to document the extent of a bacterial problem.

The most comprehensive coliform data set comes from Ventura County, who sampled three sites over four dates (1997-1998). Ventura found coliform MPN counts ranging from 3000 (upper

Medea Canyon) to 160,000 total coliform at Lindero Canyon. Fecal streptococcus was measured at Lindero Canyon in May 1998 (dry weather) at >160,000. This data point merits further investigation of replicated sampling on Lindero Creek. As the WMAP report focused on the upper watershed, we did not review the extensive data sets on coliform amassed for Malibu Lagoon, as the bacteria problem there is well documented.

Nutrients

Nitrogen and phosphate data were obtained from RWQCB, LVMWD, HTB and Ventura County. The most comprehensive data set was developed by LVMWD, MWD, which sampled 9 sites above the Tapia plant over a 20 year period, 1979-1999. LVMWD sampled for nitrogen and phosphate above Tapia, at the effluent outfall and in the lagoon.

Initial analysis of these data indicate that nitrate concentration above Tapia has declined over the period of record (see Figure 12, *Trends in Nitrogen concentration 1979-99*, on page 53). No factor(s) responsible for driving this decline are indicated from the data at this time; however, more detailed analysis could improve understanding of this phenomenon. No trend was detected among the LVMWD phosphate data set.

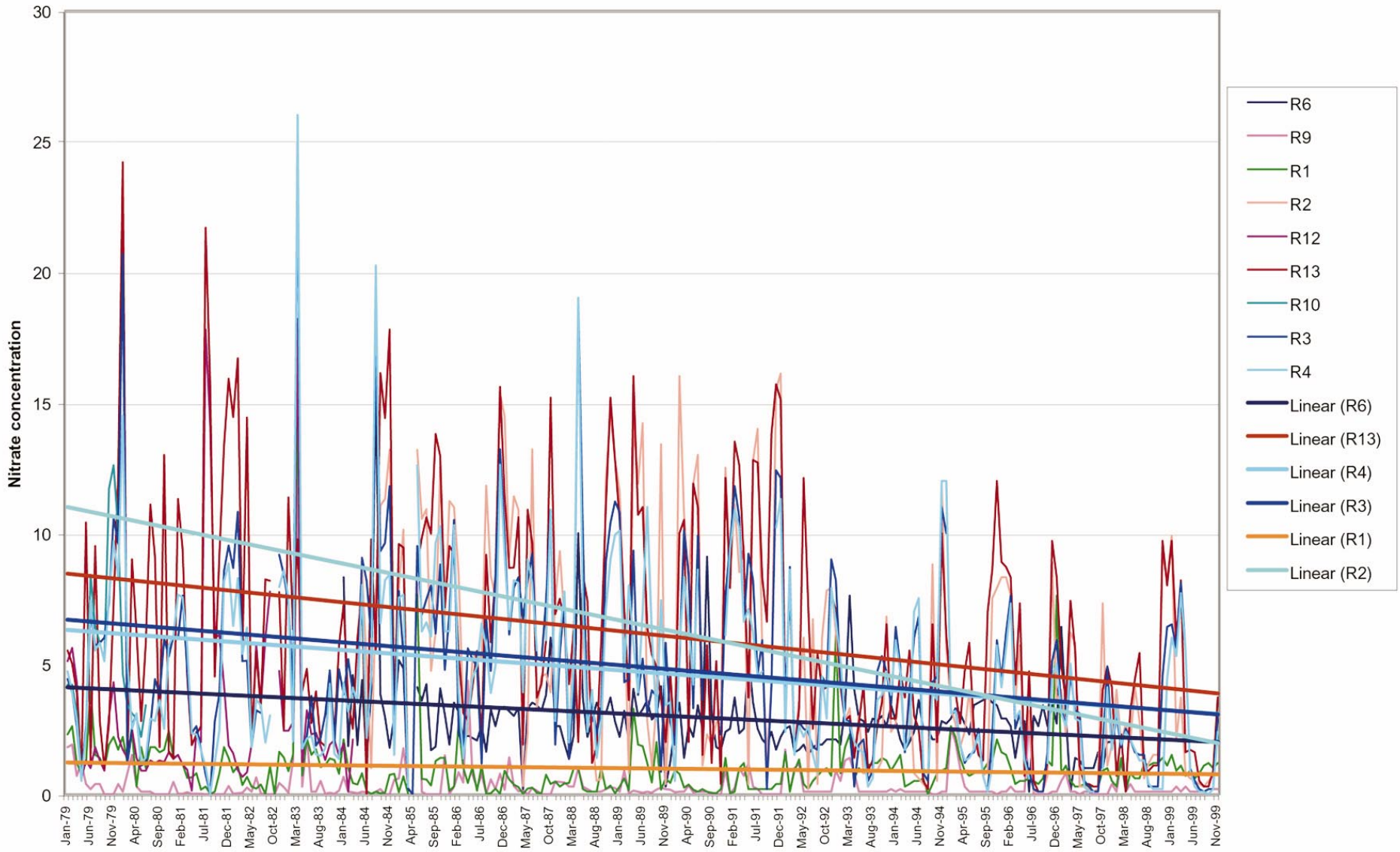
Heal the Bay provided nutrient data for nitrate, nitrite and phosphate, but time in this project did not allow for analysis of the HTB data set. A 17-month period of record may not be adequate to make statistically accurate predictions of trends in nutrient concentration, but could be helpful when combined with other data sets.

Nutrient data from LARWQCB were made available for the period 1993-95 for 16 water bodies and 35 sites. Parameters reported include NO_3, PO_3, DO_X, pH, and temperature, but sampling was inconsistent for these parameters across sampling locations and dates. In this data set, the period of record for Malibu Creek at Cross Creek Rd extends back to 1988-93, then continues for six sites from 1994-95. Data from 1996-97 were reported for 17 sites on 2 sampling days, in June of 1996 and 1997. These samples reported values for five species of nitrogen, 2 species of phosphate, MBAS (detergents), and algal cover and type. Again, sampling was inconsistent across sampling locations and dates. The primary difficulty in the determination that water quality is or is not impaired by nutrient concentration stems from the inconsistencies in sampling locations, dates, and parameters within the watershed.

3.1.1 Identification of Data Gaps

Framework Needed

A coherent framework is needed to inform the location of sampling sites and the protocols for parameters monitored. It should be made clear that a long-term commitment to funding and implementation of water quality and quantity monitoring is the only rational basis for water quality



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Source: LVMWD

Figure 12
Trends in Nitrate Concentration for 9 Stations above Tapia 1979-1999

sampling. To carry out sporadic sampling lacking such a framework is to make weak use of the scarce public funds available to detect water quality values.

Chemicals to be Monitored

Stakeholders in the watershed need to find agreement on the sampling protocols and parameters to be used in a watershed-wide sampling program, so that samples can be compared in the analysis phase. Such protocols can make the WQ sampling efforts cost-effective and the data meaningful. The data sets available (and others may be found) may provide enough information to make some initial decisions about the parameters already sampled which are to be monitored in future. However, the Basin Plan 1994 identifies other classes of pollutants that may be relevant for the Malibu Creek watershed, including metals, (dissolved and absorbed to sediment particles), bacteria, and other pathogens such as Enterococcus. For example, there are few data on synthetic chemicals such as Volatile Organic Chemicals (VOCs), nonvolatile Synthetic Organic Chemicals (SOCs), and detergents (MBAS). Few data exist on compounds such as Diazanon, Glyphosate, Chlordane, Lindane, and other pesticide chemicals used in urban landscapes, and the kinds of agricultural practices found in the watershed. Chemicals used in auto industries, computer and other local industries that may be subject to spills may also be of interest in a sampling framework, and these industries may be potential sources of funding to carry out these relatively more expensive tests.

The analysis of these pollutant parameters should include a spatial analysis of water quality impairment with respect to land use, to determine the potential sources of the detected pollutants.

TMDLs and Flow Data

If the parameters such as nutrients, synthetic chemicals, bacteria and metals are to be sampled to obtain TMDL thresholds at some point in the future, these data must be related to the range of flows for the tributaries and main stem of Malibu Creek. The current status of knowledge with regard to flows is currently based on a single flow gauge for the entire watershed of 109 square miles. Therefore, the lack of hydrology data is a critical limiting factor in monitoring water within Malibu watershed, especially for tributary streams. The work of determining additional rain and flow gauge locations should be conducted by a team of scientists focused on the watershed scale. The additional flow data should be used to inform a watershed hydrology model that uses a continuous simulation to characterize the low flows occurring most of the time, rather than an event-based model for extreme events (such as a 100-year flood).

Geomorphic Studies

Data on the features of the many natural and semi-disturbed channels of the Malibu watershed do not appear to exist. Geomorphic studies are needed to characterize hillslope sediment delivery zones, channel and floodplain geometry by reach for each subwatershed, bank and substrate sediments, local slopes, channel- floodplain ratios and floodplain characteristics such as topography.

This study should include an analysis of the channel network drainage density, related to vegetation cover, substrate, and slope. Sediment sources and rates of sediment transport are critical data in the analysis of pollutants which adsorb to sediment particles, such as heavy metal ions. With these basic data, the watershed manager can begin to identify zones of excess sediment delivery to stream channels. These data will also inform future riparian, floodplain and wetland restoration efforts.

3.2 INSTITUTIONAL ISSUES IN MALIBU CREEK WATERSHED

Review of existing policy and institutional framework and issues is key to recommending appropriate change to accommodate the WMAP process, but was omitted from the scope of this initial effort. This work should be carried out in future efforts. Nevertheless, recommendations have been made concerning the proposed Malibu Watershed Conservancy. Achieving the water quality goals to be set by the TMDLs needs the cooperation of all stakeholders and an organization dedicated to the task. The task includes technical coordination (among the many agency, jurisdiction, and pressure group stakeholders); analysis and recommendation of actions; and support of the COG as its political master. It may well evolve to have a more holistic watershed management function, within the same institutional structure. It is not realistic to expect an existing organization to accept this onerous responsibility to fulfill the federal mandate.

The other major institutional issue concerns the many stakeholders. The search for data sources to contribute to this WMAP illustrates the difficulty of operating without the network of stakeholders in place. It is very doubtful if any one person has a complete overview of what is available, who has it and where and how it can be publicly accessed. This network of stakeholders needs to be established as a matter of urgency before further steps are taken. All need to be given the opportunity of involvement in the process for them to share ownership of the problem and its solutions. As stated in EPA Watershed Management Guidelines, without that ownership, the process will be flawed. That is not to say that TMDLs cannot be set, nor that they cannot then ever be met, but that the process will be more slow and painful than otherwise.

3.2.1 Excess flows alter the historic hydrologic cycle

Owing to the coastal Mediterranean climate and historically more permeable soils in the watershed, the historic Malibu Creek system apparently was ephemeral in the upper reaches, intermittent to perennial in the middle reaches and perennial in the lower reach. The potential decrease in river baseflows caused by impermeable surfaces has probably been overwhelmed by the importation of large quantities of water to the watershed and creation of artificial lakes. Baseflows increased tenfold (from 205 to 2,050 acre-ft) in the sixty years from 1934 to 1994, however, no data exist to characterize flows prior to 1931, when significant abstractions were removed from surface and subsurface waters. Available data indicate that many middle and lower reaches now have perennial flows (NRCS, 1995, p.13). However, summer flows have many undesirable impacts in today's watershed. For example, higher summer flows concentrate and transport pollutants and

promote algal growth during warmer months. In an effort to decrease their impact, the Tapia Sewage Treatment Plant now distributes its treated effluent to land from April 15 to November 15 instead of discharging directly to the river. This partially addresses the symptoms of the problem, but not its causes, since Tapia receives only about 25% of the total volume of imported water.

Stream flows during storm events have also increased since urban development in the watershed, from an annual average of 11,895 acre-ft in 1934 to over 21,000 acre-ft in 1994. Total annual flows have increased from a 1931-1965 average of 12,000 acre-ft to an average of about 27,000 acre-ft from 1966 to 1994, comprising:

Tapia STP discharge	4,000 acre-ft
Home use & irrigation runoff	2,500 – 3,500 acre-ft
Septic tank seepage	500 acre-ft
Storm runoff	19,000 – 20,000 acre-ft

(USDA NRCS MCWNRP 1995, p.36)

Thus two major changes have affected the watershed. Storm runoff has nearly doubled (an increase of about 9,000 acre-ft per year), apparently as a result of increases in impermeable area and drainage infrastructure. Among other effects, this runoff will have greatly increased the stream's carrying power for sediment and its pollution load. There has also been a tenfold increase in the river baseflows, as a result of the importation of some 20,000 acre-ft of water, of which about 15,000 acre-ft is recorded as river flow, implying that some 5,000 acre-ft are lost to evaporation and groundwater. This tenfold increase will most noticeably affect the growth of algae, particularly since low flows in the summer coincide with the optimal temperature range for algal growth, generally around 60-80ºF (15-27ºC) (R. Orton, pers.comm. 2000). Research on the West Coast of the United States has shown that a mere 5% increase in impermeability can change the riverine environment so significantly as to threaten the survival of some salmonid fish species.

The volume of imported water into the Malibu watershed exacerbates the water quality problems that are normally experienced with land use change in general and development in particular. Although the conclusion is counter-intuitive, imported water appears to be the largest cause of poor water quality in the Malibu watershed. This is because the majority of imported water (after losses from domestic use and evapo-transpiration) joins Malibu groundwater flows, increasing the seepage into the river system, which extends perennial flows upstream to reaches that were historically intermittent or seasonal.

In the period 1997-1999, effluent discharge from Tapia has been diverted from Malibu Creek during April 15 through November 15. The Tapia discharge represents about 25% of the water volume imported into the MCW. No detectable change in lagoon breaching was observed

during this 3-year period, although the sampling period is brief for detecting significant hydrological change from this one action. Further data collection and analysis are needed better to characterize these hydrological relationships. Increase in streamflows resulting from the increased total imported water volume may affect the timing of breaching in Malibu lagoon. LVMWD has detected a trend in reduction of nutrient levels in recent years in Malibu Creek, which is likely to have been assisted by Tapia's efforts to distribute and monitor irrigation using effluent. It is probable that non-LVMWD spray irrigation, particularly in areas where fertilizer and pesticide is applied, will result in an increase of pollutants in the river system. For example, the uptake of fertilizer by the target crop is generally limited to about 35%, the remainder being removed from the soil by surface runoff or leaching to groundwater.

Without vastly (impracticably) increasing evaporative losses from new lake areas, exporting more of the effluent out of the watershed or decreasing the volume of imported water, the watershed's hydrologic cycle will remain heavily modified, presenting challenges to sustainable restoration of the affected parts of the system. The actions taken at Tapia STP have increased water loss, for example to evapo-transpiration, and creek flows have decreased as a result. There are several ways to return to a more natural hydrological cycle.

3.2.2 Development, impervious surfaces and channelization

As shown in Figure 8, *Projected Potential Land Use Within Malibu Creek Watershed,* on page 27, development results in a substantial increase in impervious surfaces that artificially concentrates rainfall, causing problems in both water quantity and quality. The road system is the most obvious element of development infrastructure that both concentrates and pollutes rainwater, however underground pipelines that have been constructed in a trench with permeable backfill can also absorb, intercept and channel surface and groundwater, often with significantly adverse environmental effects.

The adverse impacts from development begin in the construction phase, during which substantial soil disturbance and inadequate erosion control can result in the release of a high volume of sediment and general site detritus. The immediate physical impacts are the most obvious; new development typically replaces rural habitat with a densely built environment. Conventional construction practices clear the site of vegetation. Streams and ditches are channelized, or piped and back-filled. Humps and hollows will be eliminated through grading. Topsoil will be scraped off and moved, sometimes off-site if there is a local demand. Pavement materials and soil from elsewhere, containing unknown plant and other live material, are often brought in as fill.

Impervious surfaces cover the land, roof water is piped to a surface water sewer and the built environment is landscaped with non-native grass and other plants needing irrigation. Residual loads of nutrients and pesticides brought in to sustain exotic landscapes are concentrated with other pollutants associated with urban runoff in the pipes and ponds, and can cause eutrophic conditions, algal blooms and subsequent oxygen deficits, as well as deformities and tumors in wildlife, especially fish and amphibians.

Prior to development, rainfall is intercepted on a natural landscape by plant foliage and stems. High surface roughness with irregular topography and mature soils are features which enable rainwater infiltration. Where there is tree, shrub, forb, and/or grass cover, foliar interception can account for evaporation of a high percentage of rain showers. The duff layer or soil organic fraction absorbs a substantial amount of rain before it reaches the mineral soil, where plant roots will use a further fraction. Unless these natural conditions have been disturbed, for example by fire, there may be no visible surface water runoff in all but the heaviest rain events. Even on sites impacted by recent fire (unless the fire was very hot), soil erosion is typically low until soils become saturated. In Malibu on 1st and 2nd order streams, slower percolation into low-order streams may result in broad channels with shallow flows.

Evidence for this set of relationships can be seen in the upper reach of Las Virgenes Creek below the Ahmanson property, where the stream corridor is wide, forested and shows no single well-defined channel. Rain percolating slowly through the ground is cooled and biologically cleaned. Rainfall is distributed over a wide area, and a natural landscape maintains this dispersion, allowing groundwater to percolate relatively slowly to the river and groundwater systems throughout its length. The channels may be formed largely by seeps and springs in areas of permeable soils.

By contrast, roofs and roads intercept and absorb little, and concentrate rainwater into a pipe system designed to send it (and whatever pollutants it may now be carrying) under gravity to a downstream outfall on the river system as soon as possible, although it may be delayed in a detention pond en route. The local groundwater is not replenished, and in turn can no longer feed the river system with cool, clean water to maintain the baseflows on which river biota depend. The upper reaches of a river system impacted in this way are likely to be dewatered except during storms.

Downstream of these urban outfalls, however, the river system suffers a great increase in both volume and rate of inflow from these new 'tributaries'. The carrying capacity of the natural channel is exceeded, resulting in increased risks of both flooding and erosion of riverbanks and bed. The conventional response, exemplified in the Los Angeles region, has been to widen and armor the channel to increase its capacity, or conveyance, by encasing it in concrete. Compared with a natural channel, concrete provides a relatively smooth surface. Since discharge is proportional to smoothness (or inversely proportional to the roughness coefficient called Manning's 'n' by engineers), increasing the smoothness of the channel banks and bed by a factor of two will allow the capacity to double. The indirect consequence of such 'channelization' is that the built environment will be encouraged to extend to the edge of the new channel. Poor channel maintenance or elevated sediment inputs to the artificial system has often resulted in reducing the smoothness, the carrying capacity, and thus the level of protection actually provided by the flood. Tragic results have occurred when a flood exceeds the new carrying capacity (designed typically for a flood with an annual expected frequency of occurrence of 1 in 100)."

In summary, development of the Malibu watershed would be severely limited without the importation of water. The cycle of land use change (for example, land conversion from native vegetation cover to large animal husbandry to development) encouraged by the provision of water eats steadily away at the ecological foundation of the watershed, simplifying the landscape and reducing the essential connectivity between areas retaining ecological integrity. Lower water and air quality results from degrading ecosystem functions such as nutrient cycling and replacing such diverse functions with a relatively sterile and pollution-generating urban landscape.

3.2.3 Roads and Motor Vehicles

Settlements were often founded beside rivers, and were linked eventually with roads, which often followed the course of the river. Even where sited away from the riparian corridor and floodplain, the construction and operation of roads often has highly damaging consequences for the environment. The building of a road involves permanent ecological disruption, which is accompanied by an annual toll on wildlife extending beyond road kills. Roads (as traditionally built) concentrate rainwater and pollutants, including airborne pollutants washed onto the road surface during rainfall, often discharging directly into watercourses with none of the remediation associated with soil and vegetation. The wider the road, the more rainwater is concentrated and the more adverse is the impact on the river system.

Trucks and cars are leading contributors to air pollution and non-point source pollution of surface- and groundwater. As well as emitting noxious gases from inefficient combustion engines, vehicles typically drip oil and leave residues from auto body work, tires, brake-linings, etc. Future use of advanced polymer composites, better aerodynamic design, and fuel cells will improve on today's electric, gas and hybrid vehicles to reduce fuel consumption by 80% and noxious gas emissions. But oil leaks and other residues are likely to continue.

3.2.4 Loss of Habitat Degrades Ecological Processes

Wildlife, or even human, habitats are dependent on structure. The structure or architecture of plant communities and geomorphic features such as floodplains, hillslopes and river channels change over time, depending on the dynamic processes of fires, floods, landslides, and earthquakes. The native plant communities that have evolved in place over geologic time, such as floodplain oak woodlands, and riparian sycamore woodland, are well adapted to these dynamic changes and can recover from catastrophic events. These plant communities and the animals they support, have evolved features which enable plants and animals to deal with variations in climate (wet and dry periods) and geology. Background rates of exposure to chemicals, such as naturally occurring sulfur and selenium, vary over time. Sediment delivery in a tectonic landscape like Malibu, prone to landslides and rockfalls, is episodic, and native plants and animals are better adapted to such catastrophic changes than exotic species.

This range of natural or historic process remains in the background of urbanizing landscapes today. Such complex ecological processes continue to occur, supporting such interactions as the

web of insects that pollinate the native herbs, shrubs and trees that provide the architecture of the wildlife habitat. When the structure of the plant community is degraded by conversion to land uses, ecological processes are interrupted. This is to say, when a house lacks an integral part of its structure, such as a roof, wall or foundation, it ceases to function as a house.

Native soils are integral to the functions of ecosystems. Intact native soils with an organic soil horizon (or litter layer) host billions of fungi and bacteria per cubic centimeter. These micro-organisms efficiently cycle nutrients in soils, break down complex molecules into simpler forms and provide many ecosystem functions. Soils are typically the oldest features of any ecosystem, and provide the greatest complexity in terms of structure and function. When the plant community is degraded or lost, soils functions are diminished, which has direct impact on the quality of water infiltrated, cycled through and delivered from a site.

3.2.5 Public Health and Safety Risks

Public health in the MCW is associated with surfers and others participating in sports and recreation involving direct water-skin contact. The changes in surface water quantity in and downstream from developed areas will attract wildlife. In addition, these changes will also help sustain growth in the population of feral animals. Taken together, the implication is an increase in disease vectors and pathogens such as fecal coliforms in the urban environment from feral and domestic animals. Elevated bacterial levels can affect not only the health of wildlife and pets, but also their owners and the community in general.

3.3 MAP NATURAL RESOURCES – POTENTIAL FOR USING GIS AS A MANAGEMENT TOOL

The use of Geographic Information Systems (GIS) is a powerful tool in watershed-scale resource management. This WMAP effort has compiled existing information on topography, geology, streams, land use, water quality sampling locations, storm drain locations, threatened and endangered species habitat, and vegetation in digital format, as illustrated in Section 2 of this report. This information, in addition to the soils data that has not been prepared digitally, can be used for a variety of planning purposes including:

- Identification of reference reaches and water quality monitoring locations, to gauge parameters for measuring the success of various implementation efforts;
- Identification of potential water quantity monitoring locations;
- Identification of priority areas for downspout connection programs;
- Anticipate growth areas and how these areas may impact natural resource processes;

- Identification of regionally important areas for conservation;
- Setting priorities for conservation efforts;
- Determination of appropriate stream buffer widths.

As an example of how this information can be used, a preliminary assessment of potential high priority areas for buffer establishment or conservation along stream corridors was conducted using the GIS information available. Alluvial soil type inferred from the geology layer was overlaid with the stream network, potential and potentially developable land (based on current zoning). This assessment identifies reaches of stream that potentially may be affected by future land use changes, ultimately leading to further degradation in water quality or negative effects on the flora and fauna (see Figure 13, *GIS Assessment of Riparian Areas*, on page 62). These threatened areas should be "ground-truthed" to determine current conditions prior to setting priorities for preservation. Land use data used in the analysis was compiled from 1993 information and does not include recent development changes within the watershed.

Periodic updates of the GIS layers are needed as information is collected or revised. The GIS produced for the WMAP report represents the first attempt to develop a comprehensive GIS for the Malibu watershed.

The Malibu Creek Watershed needs a central data archive where all relevant natural resource data can be stored and retrieved. The GIS data and updates should be deposited in a permanent central archive and managed so that current information is available to the public and the data are easily obtainable.

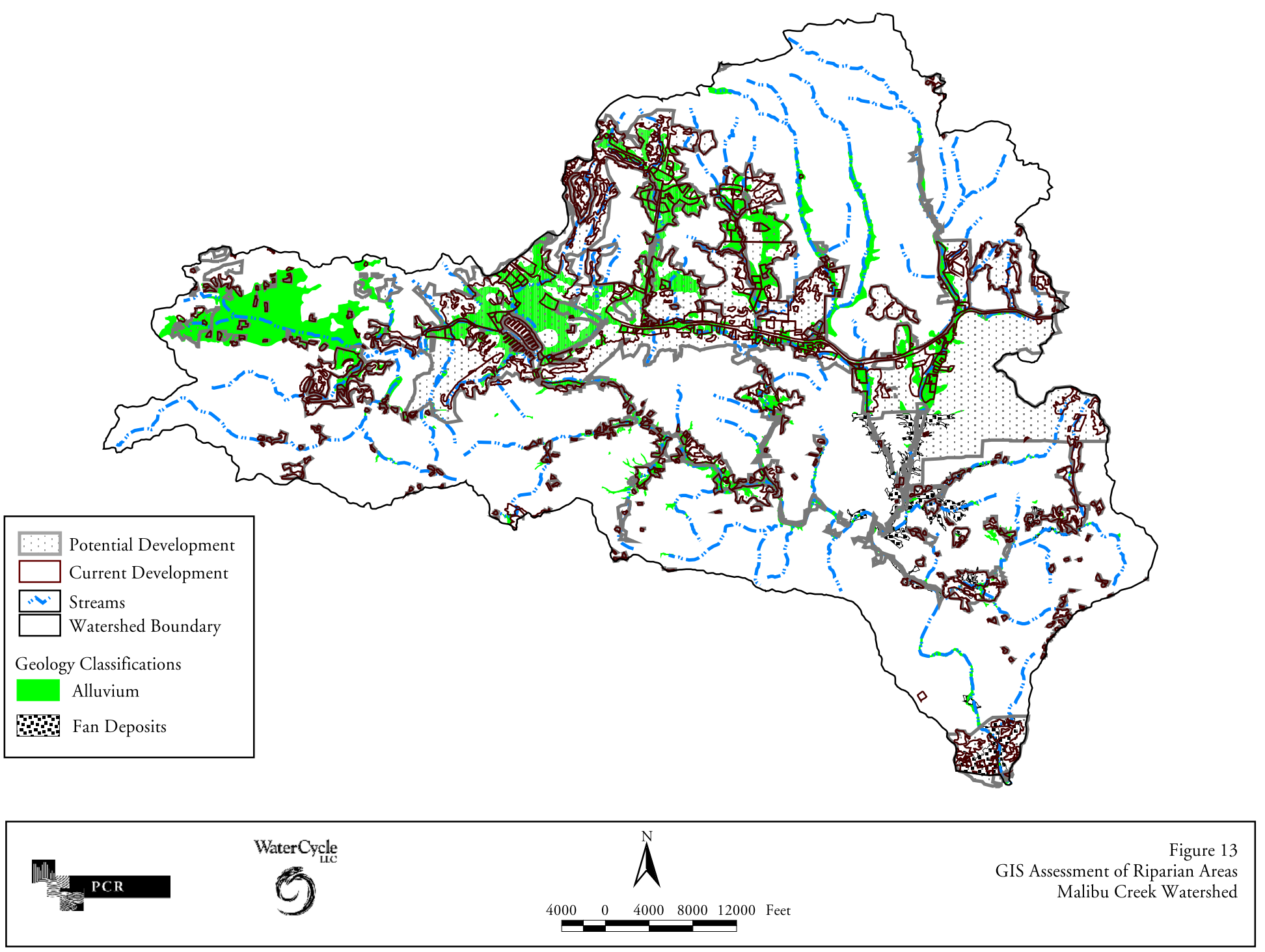


Figure 13
GIS Assessment of Riparian Areas
Malibu Creek Watershed

4.0 REFINE THE ISSUES FOR WATERSHED HEALTH – PHASE IV

Goals for Watershed Health

The task of watershed management is both iterative and interactive, and requires a long-term commitment to the task of understanding the complexities of a place and its people. Usually, watershed organizations are formed out of the perception that there are problems with the health of the land and water. The exact nature of the problems is typically not well defined in the popular understanding. Perceived problems may not be well documented in terms of data measurements confirming that the problems are real. Thus, setting goals to define an action program for watershed management to improve 'ecological health' is more difficult than it first appears. The more attention that is given to stakeholder participation, spreading awareness, understanding and ownership of the problems and the process leading to solutions, the more successful and cost-effective the implementation is likely to be.

Following the phases outlined in Chapter One provides one kind of 'roadmap' for gaining an understanding of watershed resources, functions, impairments and strategies for recovery. Phase I sets out an initial problem definition. Collection and review of the information gathered occurs in Phase II. Phase III involves analysis of the data available to the extent possible, with the inevitable discovery that data sets are incomplete to answer the questions posed in Phase I. However, going through these three phases permit those interested in watershed health to gain sufficient knowledge to set some initial goals for watershed health.

4.1 PRESERVE AND ENHANCE BENEFICIAL USES

Early efforts to define water quality needs focused on the beneficial uses of water bodies. The LARWQCB Basin Plan (1994) defined beneficial uses for the streams, lakes and lagoon of the Malibu Watershed (see Table 2, *Beneficial Use Designations for Malibu Watershed*, on page 31). According the Basin Plan (1994) table of impairments (Table 3 in Basin Plan), the major challenges to water quality are algae, coliform (both fecal and total) counts, and trash.

Major goals from these early watershed planning efforts include the ability to swim, have non-contact recreation, to fish in streams and lakes in the upper watershed, and to surf at the beach, without risk to health. Most streams and lakes are designated as potential sources for municipal and domestic water supply, but long-term infrastructure has been developed to provide domestic water for Malibu watershed residents from outside the region.

4.2 RESTORE NATURAL PROCESSES WITHIN WATERSHED

The measures identified, agreed, and implemented to manage point source pollution are often related to chemical processes and effluent standards (often related to the carrying capacity of the 'receiving watercourse') set out in legislation. The approach to minimize diffuse or (non-point-source) pollution is quite different, although legislation has been successfully invoked, for example to limit the rate of fertilizer application to Dutch pastures. Instead, Figure 14, *Possible Impact of Urbanization on the Hydrologic Cycle*, on page 65, shows the impact of land use change and management on the riverine environment, illustrating that diffuse pollution can be reduced through changes in land use management.

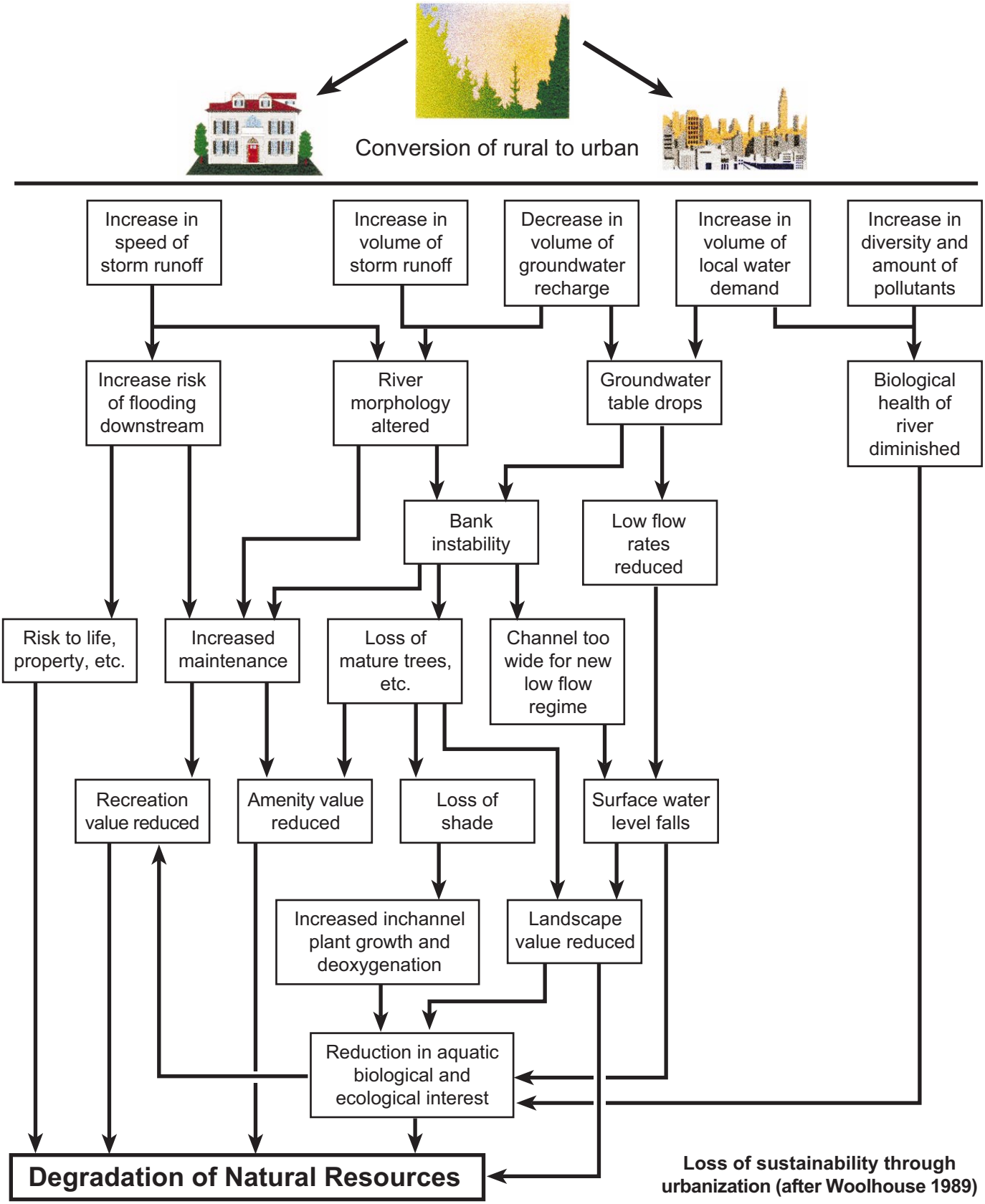
Influence on land use with private owners can be based on legislation (mostly vested in environmental protection agencies), land use policy (based on legislation vested in local jurisdictions with land use powers), and economic incentives (offered through taxation by jurisdictions and programs such as Conservation Reserve Enhancement Program by federal agencies). Alternatively, some jurisdictions increasingly favor land acquisition, particularly of floodplain lands, such as parts of the Mississippi after the flood of 1993.

The other obvious difference between the two types of pollution is that diffuse pollution generation is distributed throughout the watershed. Natural background rates of pollution are overlaid with anthropogenic sources that include aerial deposition as well as land uses. An intact ecosystem is capable of absorbing and recycling a pollutant load that is composed of naturally occurring substances. This environmental "carrying capacity" has thresholds that depend on factors such as characteristics of the soil and flora, and the variation of rainfall and stream discharge.

In order to optimize this carrying capacity, ecosystem functions need to be protected and enhanced. This implies protection of natural resources, especially the hydrologic cycle and bio-geomorphic equilibrium of the watershed, i.e., the set of relationships among watershed geology, soils, topography and native vegetation. However, rare events can and do cause dramatic changes when thresholds are exceeded. The resilience of the watershed to such change depends on the degree to which the functional complexity of the natural system has been simplified by anthropogenic disturbance. Similarly, anthropogenic sources of pollution can stress the environment well beyond the threshold or limit of its carrying capacity.

Protecting and restoring the natural functions of the watershed is therefore vital to maintaining its capacity to deal with the background rate of pollution. There are many examples of how natural functions can be restored, including:

- reconnection of the stream with its floodplain;
- reconnection of natural tributaries;



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WaterCycle LLC

Figure 14
Possible Impacts of Urbanization on the Hydrologic Cycle

Source: UK National Rivers Authority

- re-naturalizing channels constrained by concrete channelization;
- reducing areas of impermeability, particularly in the upper watershed;
- putting back large wood in-stream while rehabilitating riparian areas;
- managing grazing to appropriate levels with respect to timing and duration;
- keeping livestock away from riverbanks with off-channel watering practices.

Remembering that water flows downhill, moving water picks up and carries sediments as it travels. A natural watershed 'in dynamic equilibrium' has adjusted the exposure of its rocks, soils and slopes to the rainfall regime over time. In many regions, rivers are 'cut off' from their sediment supply by dams, bank armoring, and weirs. Acquisition of land near the headwaters to regain an appropriate sediment load by allowing needed bank erosion has been successfully tried in the region of Bavaria, Germany, where river banks had been armored to prevent erosion, causing channel incision and bank collapse in downstream reaches.

Dealing with added pollutant loading requires both policy and the practice of containment at source. Source control is the approach with greatest sustainability, capable of addressing multiple purposes, but will have design limits like any other facility. Vulnerable local systems will need additional protection against containment failure. Thus containment of concentrated pollutants – for example, in confined animal units – needs a back-up system that might include a lined reservoir close by and wide buffer zones protecting local watercourses. Another example of additional protection in source control is the education of the gardening public on the appropriate limits to the use of fertilizers and pesticides, as well as for farmers concerning the timing and rate of chemical applications to their fields, together with options to further reduce chemical use. Implementation of these options can bring awareness and change of behavior which saves money for both the individual and society. In horticulture and agriculture, principles of soil husbandry and integrated pest management have been shown to improve crop production and landscape health with dramatic results while eliminating hazardous wastes.

4.3 A CONCEPTUAL PLAN FOR WATERSHED MANAGEMENT

Sustainable development becomes a possibility when policies, plans, and programs for individual functions (for example; roads, power, water supply, sewerage, flood defense) are no longer considered in isolation from each other. When all policies, plans, and programs are brought into concert with each other (including conservation), sustainable development becomes possible. Even though the WMAP assesses how activities in the watershed influence water quality, it does not consider how progress towards other goals such as roads, water resources or flood risk reduction are to be made. These other goals will be considered by other departments and other agencies. In the

past, what seemed good for flood risk reduction often harmed water quality interests; for example, straightening stream channels and lining them with concrete. The decision to destroy a watercourse as a natural resource in this way was taken without reference to many other issues, such as needs for source control of urban stormwater runoff, or stream ecological values. The reason is usually institutional; responsibilities for runoff and flood risk reduction are conventionally split between different departments, if not different agencies. Source control techniques are only now (Year 2001) becoming known in California.

When all aspects of the water environment are considered together, there is often synergy between them that can minimize or eliminate the need for environmental destruction to meet the perceived need of one function such as flood defense. But it is acknowledged that further synergy is needed – between management of land use and the water environment. Currently, New Zealand is the only country of any significant size that has aligned its jurisdictional boundaries with watersheds, in order to link the management of land and water. Some countries, like the UK and Germany, have a 'one-stop shop' for the water environment to coordinate with local authorities responsible for, among other things, land use, and urban runoff. Agencies such as the UK Environment Agency emphasize 'customer service' as an advantage to this integrated system. Other countries, including the US, struggle to coordinate numerous agencies and jurisdictions to gain the synergy needed to allow sustainable development within a watershed framework.

It can be instructive to look at examples from countries like New Zealand and the UK simply in terms of the conclusions being reached as a result of this recommended synergy. For example, UK sociology research has documented that the public responds well to the idea that they are involved with one holistic process and document. The 'watershed management plan' combines all aspects of the water environment, in addition to the statutory land use development plans, rather than a whole suite of poorly-coordinated documents attempting to press the case for particular functions. Once a watershed management plan has been published, a number of issues can be reflected in the land use development plans. In 1994, the UK National Rivers Authority produced a set of 'guidance notes' (unofficially known as 'model policies') to provide local authorities with text for policies that were lacking in their development plans. These guidance notes (Appendix D, *National Rivers Authority Guidance Notes*) are being updated currently. They could provide a stimulus to produce something similar to promote policies for protecting and enhancing the water environment, including river corridors.

Available data concerning the water quality of the Malibu Creek watershed have been assembled in several existing reports, and is referenced rather than repeated in the WMAP except where needed. It will thus be an easier task to create a full Watershed Management Plan in due course. In the meantime, the Malibu Council of Governments will need to ensure that the policies, plans and programs of all other functions are considered in the interests of water quality protection and enhancement.

5.0 IMPLEMENTATION STRATEGIES, PRACTICES AND POLICIES TO ACHIEVE GOALS – PHASE V

5.1 INTRODUCTION

Fresh water is renewed within the carrying capacity of the regional hydrological cycle, that is to say that water resources are finite. Relying on extra resources from elsewhere is not sustainable in economic, social or environmental terms. A goal or principle of self-sufficiency brings ingenuity to the fore to solve big problems, even if they are only reduced as a result. This seems to be an approach being adopted by the LVMWD in attempting to reduce the volume of imported water, but partners in the community are needed to achieve more than limited success. It may be that these institutional partners will be found through meeting the TMDL requirements, since one significant way to improve water quality is to reduce water imports. Achieving good water quality is one way in which society can move toward more sustainable development and to a more sustainable lifestyle that regards water as a valued life resource.

As Germany has shown, imposing higher water protection standards encourages techniques and technology to achieve them that can bring substantial returns when sold on the open market. People respond positively to 'cleaning-up the environment', associating it with improved health and other benefits. And in improving water quality through enhancing the physical environment, there is high potential for substantial improvements to wildlife habitat in both quality and extent. Realizing this potential allows both biodiversity and biomass to recover – and provides high amenity and recreational benefits to the community, as well as higher adjacent property values. Clear benefits can be realized economically, socially and environmentally, many of which can be (and have been) quantified.

However, the delivery of these benefits is a new challenge to institutions whose structures and policies have been set up and evolved to deliver the alternative paradigm of treating water as a commodity, rather than a resource. Here is an opportunity for the Malibu COG to lead California out of this traditional way of thinking. If there is agreement that this should happen, the question is: "how can institutional structures be changed to make it happen?" It has been shown countless times that successful implementation of an initiative needs a champion. Such a person must be given the resources to progress the cause. These resources will soon need enhancing; complexity and resource demands will increase as the initiative takes root in the existing institutional structure. This important, federally-mandated initiative to define and meet TMDLs has so many potential pathways that it will rapidly consume any spare attention it has benefited from to date.

5.2 PRIMARY PROGRAMS

5.2.1 Malibu Watershed Conservancy

Water quality is a function of land use, and the impairment of water quality by the process of urbanization is well documented. Landscape processes such as wetland water retention, nutrient cycling, sediment delivery, and storage all contribute to downstream water quality (as well as many other valued features, such as landscape viewsheds and other amenities).

Management of the stream corridor network can address many of the most profound factors that degrade urban water quality. To enable the Malibu watershed to regain water quality in support of beneficial uses, the WMAP consultant team proposes the formation of a Malibu Watershed Conservancy (MWC), as an extension of an existing Land Conservancy. The mission of the MWC is threefold:

1. To coordinate the acquisition of the riparian corridor into public lands to ensure that these critical lands do not become degraded from unwise development, in order to protect water quality beneficial uses;

2. To direct the management of the stream corridor connected along the length of the stream network for integrated multiple functions, including water quality protection and enhancement, stormwater management, flood defense, wildlife habitat and recreation access, and enforcement of legislation relating to these functions;

3. To provide a single entity responsible for archiving the data needed to manage the watershed for multiple functions over the long term, including framing research questions, data collection and analysis including the GIS database, monitoring and archiving, to make these data available to the public.

The formation of a quasi- governmental or public authority would catalyze the ability of the stakeholders in this watershed to obtain funding from agencies, foundations, and private donors. This entity would be able to manage across jurisdictional boundaries, municipal and county lines, as the area delimited for management is that within the watershed boundary.

A MWC is the only entity that could cross subject disciplines to integrate water quality goals with land and water management practices. These practices include programs for stormwater management, flood risk reduction, open space and recreation, land use planning, as well as wildlife habitat needs within and near the urban and urbanizing areas. Protection of the Malibu riparian corridor network will require authority to acquire land and easements and enforce laws concerning water pollution across all subject areas, including illicit discharge and illegal land development practices. The MWC can act as the central coordinator for water quality research and monitoring programs, and can serve a role in public education.

It is clear that, at some point, the responsibility for progressing the many watershed-wide activities will need to be vested in an organization whose resources are not distracted by other pressing demands. It will need its own champion, familiar with Malibu issues, the Costa-Machado Water Act, and grant writing. The program will continue to need the support of all those currently pushing the initiative forward. Indeed more of them will be needed, in every organization in the watershed, and in corridors of power outside it. The conservancy will need to be watershed-wide, and it should be closely enmeshed with the COG, as illustrated in Figure 15, *Framework Institutional Responsibility of COG and Malibu Watershed Conservan*cy, on page 71. It appears that funding under the Costa-Machado Act – Prop 13, may be available to provide initial funding for the Conservancy. (See Appendix E, Proposition 13, Executive Summary.)

The Conservancy should provide a central forum for stakeholder involvement and participation. This Non-governmental Organization (NGO) agency should be in a position to promote the transition from the WMAP to a full watershed management plan in due course.

5.2.2 Watershed-wide Water Quality Monitoring Program

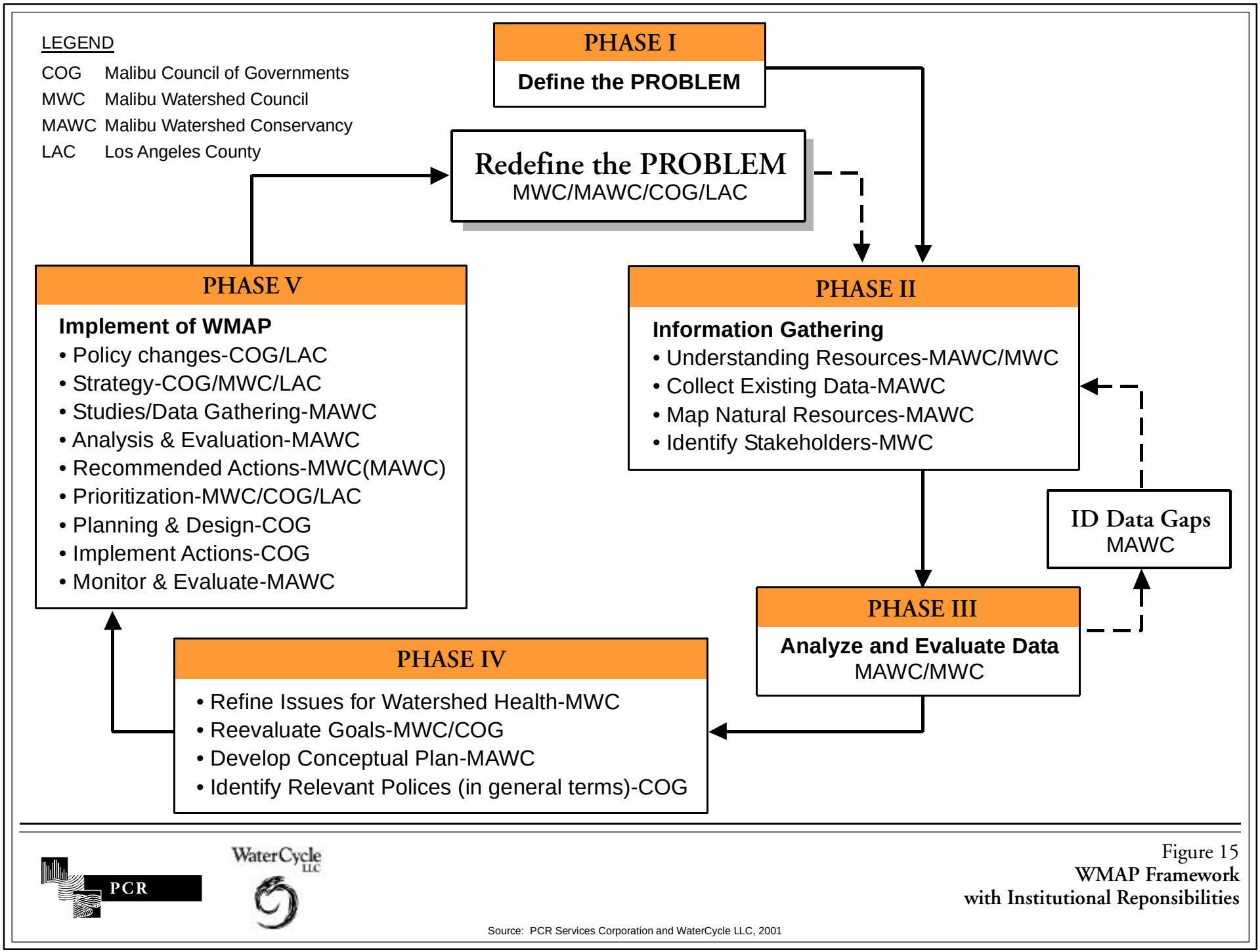
A Malibu Creek Watershed Wide monitoring program should be progresses based on the extensive research efforts already conducted to date. The Malibu Council of Governments, Heal the Bay, LVMWD, USC Sea Grant and SCAG have developed an EMPACT grant application for funding a comprehensive program for monitoring water quality and quantity. In this proposal, partnerships have been identified, objectives are defined, parameters for pollutants of concern are identified, and sampling methodologies tentatively agreed. This proposal has defined monitoring stations on a watershed basis for each tributary, which should be agreed upon with LARWQCB.

Sampling protocols have been established to provide a uniform framework and metholodgy, which will standardize the results of the field efforts. Much of the field sampling work is intended to be carried out by volunteers with training and supervision. Further work is needed to quantify level of effort and costs for installing flow gauges on all tributaries.

For a more detailed explanation of this program, see the text of the EMPACT grant application, available through the Calabasas Stormwater Management Program.

5.3 PRIORITIZING OTHER ACTIONS

The COG will need on-going advice (from the Conservancy) over actions and their priorities, which cannot ever be set in stone owing to the iterative nature of the framework and the frequent review of the perceived problems, data needs and revised strategy. Table 4, *Recommendations Action Items COG*, on page 72 lists numerous activities that are currently judged appropriate to address the perceived problems. As the initiative proceeds and more data are collected, current perceptions of problems, their causes and solutions are likely to change – hence



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WaterCycle LLC

Source: PCR Services Corporation and WaterCycle LLC, 2001

Figure 15
WMAP Framework
with Institutional Reponsibilities

Table 4
RECOMMENDED ACTION ITEMS

	GOALS	Improve WQ	Manage Water Quantity	Natural Resources	Reduce development WQ impacts	Reduce Health Risks	By Whom?	Lead?
1.0	**Policy and Planning**							
1.1	Utilize existing land conservancy for watershed studies, land acquisition of riparian corridor throughout the Malibu watershed. Conservancy and COG will develop strategy, and budget for integration of land management practices including flood defense, water quality improvement and wildlife habitat enhancement.	x		x	x	x	ALL	MAWC
1.2	Protect and enhance all existing wetlands and restore and create functional wetlands when appropriate.	x		x	x	x	ALL	
1.3	Promote the need for and implementation of riparian buffer zones at the municipal, and county level. Utilize Conservancy framework (See 1.1).	x		x	x	x	ALL	COG
1.4	Develop guidelines to promote use of native plant species on residential landscapes, rural county lands, urban public space, and commercial/industrial landscapes.		x	x			ALL	
1.5	Review all policies, ordinances and codes in light of the principles of sustainable development, as the planning process allows.	x	x	x	x	x	ALL	
1.6	Work regionally with other agencies and groups to research and apply for foundation and grant funding.	x		x			ALL	
1.7	Prioritize land parcels for acquisition in undeveloped areas that promote water quality and critical habitat protection.	x	x	x	x		ALL	MAWC
1.8	Watershed municipalities to integrate a watershed planning perspective into General Plans and local ordinances when General Plans are significantly rewritten.		x	x	x		ALL	
1.9	Secure agreement and funding for permanent watershed data archive.	x		x			ALL	MAWC
1.10	Establish voluntarily policy to condition house sales to require near zero leakage from domestic water pipes and all toilets to be low flush.	x	x	x	x	x	ALL	
1.11	Increase water quality protection enforcement programs through ordinance, codes and funding.	x	x		x	x	ALL	
1.12	Support State and federal voluntary guidance on septic system siting, performance, and monitoring.	x	x		x	x	ALL	
1.13	Promote reduction in exhaust emissions: provide natural gas and electric fueling stations in every jurisdiction, bike and foot transportation paths, and increase public transport when	x		x	x	x	ALL	

	GOALS	Improve WQ	Manage Water Quantity	Natural Resources	Reduce development WQ impacts	Reduce Health Risks	By Whom?	Lead?
	possible.							
1.14	Individual municipalities develop pervious surface requirements for new, redevelopment, and road infrastructure.	x	x	x	x		ALL	
1.15	Work regionally with other agencies/groups to advance knowledge relating to watershed management.	x	x	x	x		ALL	MAWC
2.0	**Watershed Studies and Programs**							
2.1	Cooperate with stakeholders in development of the WQ monitoring program, to develop protocols and locations and to fill gaps in WQ data.	x	x			x	ALL	COG
2.2	Cooperate with stakeholders to identify pollutants of concern from WQ analysis (RWQCB) based on 3 years of data uniformly sampled throughout watershed.	x	x			x	ALL	COG
2.3	Support Malibu NRCS in soils survey update and enable NRCS to digitize the resulting data.	x		x	x		ALL	COG
2.4	Analyze watershed hydrology using a model to characterize low flows via continuous simulation for all watershed streams, in order to provide a quantitative foundation for TMDL process.	x					ALL	LAC/ MAWC
2.5	Conduct/review Local Wetland Inventory and Reed Fringe Study for each lake and wetland area for entire watershed within Conservancy framework (See 1.1). Document cost/benefits of reed fringe enhancement for each lake.	x		x	x		ALL	COG
2.6	Conduct a geomorphic survey of tributary stream channels for channel: floodplain geometry relationships by stream order, slope and substrate, within Conservancy framework (See 1.1)	x		x	x		ALL	COG
2.7	Identify reference reaches for each subwatershed by drainage area, to determine channel hydraulic geometry, and to assist with monitoring for baseline water quality conditions.	x		x			ALL	COG/ MAWC
2.8	Map and digitize all stormdrains, culverts, and outfalls in the watershed.	x	x		x		ALL	COG, LAC
2.9	Inventory and map all State and Federal Highway and major thoroughfare stream crossings, and identify all direct storm drain connections.	x			x	x	ALL	COG
3.0	**Habitat Restoration Efforts (See 1.2)**							
3.1	Identify locations and opportunities for restoration and enhancement i.e., to remove floodplain fill, reconfigure channel and floodplain dimensions based on appropriate geomorphic criteria, and recover native riparian and floodplain plant community. (Cf restoration project Las Virgenes Creek MRCD).	x		x	x	x	ALL	COG/ MAWC

	GOALS	**Improve WQ**	**Manage Water Quantity**	**Natural Resources**	**Reduce develop-ment WQ impacts**	**Reduce Health Risks**	**By Whom?**	**Lead?**
3.2	Develop quantitative guidelines for wetland, streambank and floodplain habitat enhancement (within Conservancy Framework, see 1.1).	x		x	x	x	ALL	COG/ MAWC
3.3	Prioritize riparian habitat preservation and restoration efforts based on GIS analysis, geomorphic survey, and vegetation assessment (within Conservancy framework, see 1.1).	x		x			ALL	COG/ MAWC
3.3	Produce annual evaluation of implementation feasibility as well as success of wetland restoration and preservation activities for RWQCB annual report.	x	x	x			ALL	COG
3.5	Enhance, restore and create wetland and riparian habitat based on planning level findings of Action Items 3.1-3.3 (within Conservancy framework, see 1.1).	x	x	x	x	X	ALL	COG
3.6	Establish selective programs for monitoring and evaluation of natural resources initiatives and ensure appropriate archiving to allow public access and use of the data.		x				ALL	COG/ MAWC
4.0	**Reduce Excess Flows**							
4.1	Promote alternative water source to potable water where appropriate for toilets and irrigation.		x		x		ALL	
4.2	Establish demonstration projects to promote water source alternative to potable water at a local business, office building, and/or hotel.	x	x		x	x	ALL	
4.3	Develop education and public outreach program on sidewalk/driveway hosing practice. Target Homeowners Associations regarding dry cleanup of sidewalks and driveways, to discourage residents from washing cars, etc. in driveways.	x	x		x	x	ALL	
4.4	Promote programs in hotels/motels encouraging reuse of linens to reduce laundry costs and water use, and monitor hotel staff training to ensure maximum use of program.		x		x		ALL	
4.5	Storm drain discharges: identify and minimize dry weather sources entering storm drains	x	x		x		ALL	
4.6 – 4.9	Promote water conservation and water supply demand reduction practices with demonstration programs:		x		x		ALL	
4.6	Use of appropriate native plants in public landscapes for both xeric and moist water regimes.	x	x	x	x		ALL	
4.7	Promote ultra-low flush toilets and waterless toilets installation and maintenance in new public facilities.		x		x		ALL	
4.8	Use of stormwater retention designs into all new public facilities construction.		x		x		ALL	
4.9	Downspout disconnection program, based on soil survey GIS analysis to identify appropriate areas for disconnect programs.		x		x		ALL	

	GOALS	Improve WQ	Manage Water Quantity	Natural Resources	Reduce development WQ impacts	Reduce Health Risks	By Whom?	Lead?
4.10	Establish programs for monitoring and evaluation of excess flow reduction and ensure appropriate archiving to allow public access and use of the data.		x		x		ALL	
5.0	**Implementation Measures**							
5.1	Work with Los Angeles County to review County Development Code for grading practices to determine appropriate grading practices in Malibu watershed.	x		x	x		ALL	
5.2	Determine and implement 'buffer zone setbacks' from all construction entry to minimize soil and debris deposits on streets which drain to stream channel.	x	x		x		ALL	
5.3	Increase permeability on new urban streets and parking lots.	x	x		x		ALL	
5.4	Develop demonstration program in parking lane, present findings, and implement voluntarily, where feasible.	x	x		x		CLB	
5.5	Determine feasibility for implementing permeable pavements and downspout disconnection programs through GIS analysis of soils, financial concerns, and infrastructure safety.	x	x		x		COG	
5.6	Establish demonstration project to install and maintain trash filter baskets on each tributary of Malibu Creek.	x			x		CLB, LAC	
5.7	Promote litter enforcement with Los Angeles County Sheriff Department and California Highway Patrol.	x			x		ALL	
5.8	Post bilingual informative signs on litter reduction in areas most frequently visited.	x			x		ALL	
5.9	In cooperation with Malibu RCD, install demonstration project for livestock BMPs for horse owners and cattle pasture.	x		x	x	x	LAC CLB	
5.10–5.11	Develop and conduct both general and focused education programs watershed-wide. Specifically, improve outreach to:	x			x	x	ALL	
5.10	Horse and other livestock owners about how animal waste impacts water quality, and ways to minimize this source of pollution.	x			x	x	RCD?	
5.11	Septic system users (commercial and residential) about the need for carrying out regular maintenance to achieve optimal functioning of all septic systems.	x	x		x	x	ALL	
5.12	Establish selective programs for monitoring and evaluation of water quality initiatives and ensure appropriate archiving to allow public access and use (within conservancy framework, see 1.1).	x			x		ALL	
6.0	**Existing Programs**							
6.1	Stormwater legal authority ordinances.	x			x		ALL	LAC

	GOALS	Improve WQ	Manage Water Quantity	Natural Resources	Reduce development WQ impacts	Reduce Health Risks	By Whom?	Lead?
6.2	Prevent excess erosion and sedimentation along roadways and at construction sites and implement Wet Weather Erosion Control Plans (WWECP).	x			x		ALL	CLB/ LAC
6.3	BMP implementation at construction sites, including stormwater pollution prevention plans.	x			x		ALL	LAC
6.4	Regular education including industrial and commercial site visits, public agency training, and general outreach.	x			x		ALL	LAC
6.5	Regular ongoing maintenance, including street sweeping, catch basin cleaning, tree trimming, bike path maintenance, stormwater stenciling, etc.	x				x	ALL	LAC
6.6	Identify and eliminate illicit connections illicit discharges on a regular basis.	x			x		ALL	LAC
6.7	Post construction stormwater impacts mitigation vi structural controls as per SUSMP.	x			x		ALL	LAC
6.8	Education programs for children at schools						ALL	LAC
6.9	Progress existing watershed-wide voluntary guidance and incentives to reduce stormwater runoff from private property in coordination with LVMWD.	x	x		x	x	ALL	RCD

ACRONYMS:

AGH = City of Agoura Hills
CLB = City of Calabasas
MLB = City of Malibu
WLV = City of Westlake Village
LAC = Los Angeles County
RWQCB = Regional Water Quality Control Board
RCD = Malibu Resource Conservation District
LVMWD = Las Virgenes Municipal Water District

Source: PCR Services Corporation and WaterCycle LLC, January 2001.

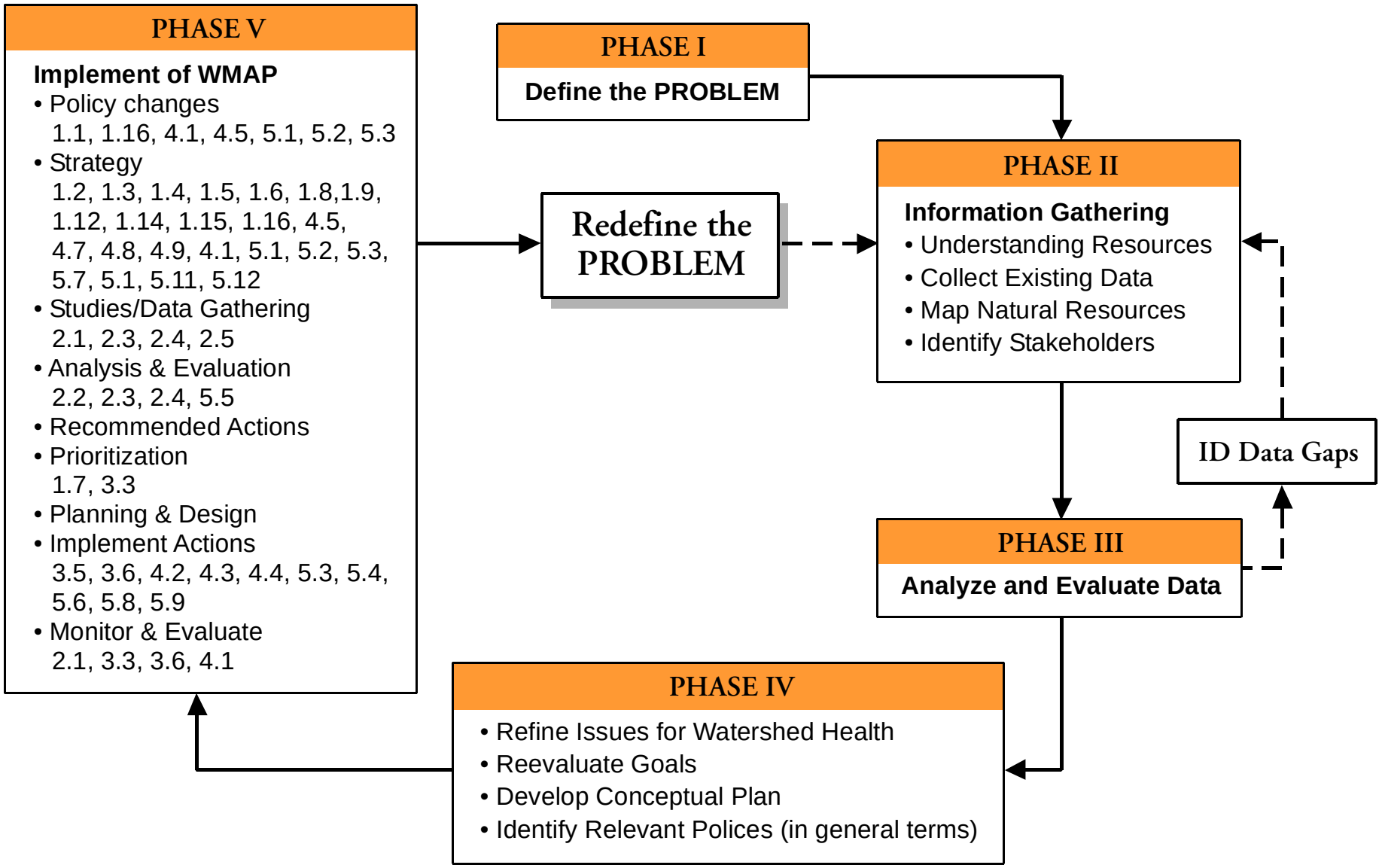
the iterative nature of the recommended framework. Figure 16, *Action Item Summary within Framework WMAP*, on page 78, shows how the current range of activities would fit into the several phases of the framework. The questions remaining are how to prioritize these activities, who should be involved, who should lead them, and when should they be carried out?

Prioritization is a multi-criteria issue, depending on institutional, economic, and socio-political influences as well as technical considerations. This report seeks to provide a mechanism for prioritization for technical issues, since variations in the other three influences will always provide opportunities that will lead to review of the priorities. However, this issue is important, and already has its own influence in decision-making circles. Prioritization is likely to evolve into a multi-purpose initiative for the entire water environment, since many of the recommended activities will affect flood defense and erosion control interests. When the benefits to these other functions are recognized, there will likely be calls for their sponsorship of the program that may invoke the second section of the Costa-Machado Water Act.

This chapter of the WMAP outlines action steps the COG and associated stakeholders will take to move forward towards the sustainable management of the watershed's resources. These action items are based upon the original 44 action goals developed by consensus in 1995 and published in the Malibu Creek Watershed Natural Resources Plan (USDA, 1995). The action items, listed in Table 4 of this chapter, reflect the COG's level of commitment towards achieving these goals.

The following sections address the three primary technical goals: water quality, water quantity, and natural resources. Each of the items in Table 4 have been listed under one or more of these three categories, where appropriate. The interwoven nature of the environment signifies that one item often may appear in support of more than one goal. Nevertheless, there is an initial screening of priorities – between those activities appearing once, twice or thrice – which provides useful substance for discussion among decision-makers. Another way in which prioritization could be achieved is to consider how the items support leading strategies, for example: reducing water imports, reducing impermeable areas, and minimizing pipes, ponds and outfalls. Figure 16, *Action Item Summary Within Framework WMAP*, on page 78, and Table 5, *Malibu Creek Watershed: Goals, Strategies, Tactics and Actions*, on page 79 shows how this could group the activities, leading to a ranking between them of 1 to 5. Again, this result should provide decision-makers with substance for discussion, and does not pretend to be anything other than a suggested ranking, from which informed discussion can lead to better decisions.

As a footnote to this section, one of the ubiquitous issues facing a group of decision-makers is the lack of information such as the size, capital and maintenance costs, likely performance and real or perceived 'side-effects' likely to affect social acceptability. All these apply to generic items such as source control and buffer zones, both of which have almost endless variety in their planning



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WaterCycle LLC

Figure 16
WMAP Framework with Table 4 Items

Source: PCR Services Corporation and WaterCycle LLC, 2001

Table 5
MALIBU CREEK WATERSHED: GOALS, STRATEGIES, TACTICS, AND ACTIONS

Goals of Strategies, Tactics, and Actions	Strategies	Tactics	Actions
Improve watershed health by restoring natural processes to:	1. Recover more natural hydrologic cycle (Master SWM Plan for each subwatershed)	1.1. Reduce impermeable areas and maximize infiltration/attenuation	1.4, 1.12, 1.15, 2.4, 4.5, 4.9, 5.3, 5.4, 5.5
A. Protect, enhance and restore ecosystem		1.2. Replace pipes, ponds and outfalls with Source Control BMPs	2.4, 2.7, 2.8, 2.9, 4.9, 5.3
B. Protect beneficial uses		1.3. Reduce importation of water from outside the Malibu Creek basin	1.10, 2.4, 4.1, 4.2, 4.3, 4.4, 4.7, 4.10
C. Protect recreation	2. Minimize harmful pathogens, toxins, sediments & nutrients	2.1. Prepare Source Control Plan for each watershed	2.4, 2.6, 2.8, 2.9, 3.1, 4.3, 4.5, 4.8, 4.9, 5.1, 5.2, 5.3, 5.4
		2.2. Prepare Pathogen/Toxics Plan for each watershed	1.13, 1.14, 2.1, 2.2, 2.8, 2.9, 5.3, 5.4, 5.9, 5.10-12
		2.3. Prepare Nutrient Plan for each watershed	1.2, 1.3, 1.13, 21., 2.5, 3.1, 4.6, 5.9, 5.10-12
		2.4. Prepare Erosion Control Plan for each watershed	2.2, 2.4, 2.6, 2.8, 2.9, 3.1, 4.3, 4.6, 5.1, 5.2, 5.3, 5.4
		2.5. Prepare Trash Plan for each watershed	2.9, 5.2, 5.3, 5.6, 5.7, 5.8
		2.6. Prepare Ecosystem Enhancement Plan for each watershed	1.2, 1.3, 1.4, 2.5, 2.7, 3.1, 3.2, 3.3, 3.5, 3.6, 4.6
	3. Education & Training	3.1. Education and Training	1.5, 1.16, 4.3, 5.10-12
	4. Institutional coordination	4.1. Institutional coordination	1.1 to 1.16
	5. Review policies, ordinances and codes in light of principles of sustainable development	5.1. Review policies, ordinance in light of principles of sustainable development	1.5

and design. Ways around this issue that have worked well include having a technical advisor at the stakeholder meeting, often making a presentation beforehand covering the information required, or making assumptions about the techniques or technology that can become specifications for the planning and design. The wary will avoid the trap of regarding any one type of source control or buffer zone, for example, as the only solution for a particular location. These techniques should be about blending with natural processes, and are therefore often combined so that they have complementary strengths.

5.4 NOTES ON RECOMMENDATIONS

The following notes on each of the recommendations in Table 4, which are repeated here for the reader's convenience, are meant to amplify their meaning and context under each of the three goals of Water Quality, Water Quantity and Natural Resources, and also to indicate a possible prioritization (from 1 to 3) among them. The limited field reconnaissance for this report revealed some issues, for example the trash in Malibu Creek State Park. A full survey of all streams would allow a relative priority to be attached to removing trash in the State Park.

5.4.1 Policies and Planning

In the first section of Table 4, the items under this section tend to be multi-purpose, and underpin most if not all activities. It is not surprising, therefore, to find that most of following appear under all three goals, indicating a high priority. To minimize repetition, these items are considered in the light of their effects on all three goals.

Water Quality:

- Create watershed conservancy to manage land programs, data, grant-writing, etc. (1.1);
- Protect and enhance existing and degraded wetlands, when appropriate (1.2);
- Promote need for and implementation of riparian buffer zones (1.3);
- Promote use and preservation of native plants through guidelines (1.4);
- Review policies, ordinances, etc in light of principles of sustainable development (1.5);
- Work regionally with other agencies and groups to research and apply for foundation and grant funding (1.6);
- Prioritize land acquisition for protection of land and water (1.7);
- Municipalities to integrate watershed planning perspective in to General plans and local ordinances when General Plan is significantly rewritten (1.8);
- Secure agreement and funding for permanent watershed data archive (1.9);
- Increase water quality protection through funding and enforcement of ordinances & codes (1.11);
- Support State/Federal voluntary guidelines on septic system siting, performance, monitoring (1.12);
- Promote reduction of exhaust emissions (1.13);

- Individual municipalities develop pervious surface requirements for new and redevelopment and road infrastructure (1.14);
- Work regionally w/other agencies/group to advance knowledge relating to watershed management (1.15);

Water Quantity:

- Create watershed conservancy to manage land programs, data, grant-writing, etc. (1.1);
- Protect and enhance existing and degraded wetlands, when appropriate (1.2);
- Promote need for and implementation of riparian buffer zones (1.3);
- Promote use and preservation of native plants through guidelines (1.4);
- Review policies, ordinances, etc. in light of principles of sustainable development (1.5);
- Work regionally with other agencies and groups to research and apply for foundation and grant funding (1.6);
- Municipalities to integrate watershed planning perspective in to General plans and local ordinances when General Plan is significantly rewritten (1.8);
- Secure agreement and funding for permanent watershed data archive (1.9);
- Establish voluntary policy to condition house sales to minimize leakage from domestic water pipes and all toilets to be low flush (1.10);
- Increase water quality protection through funding and enforcement of ordinances, codes, and funding (1.11);
- Work regionally with other agencies and groups to advance knowledge relating to watershed management (1.15).

Natural Resources:

- Create watershed conservancy to manage land programs, data, grant-writing, etc. (1.1);
- Protect and enhance existing and degraded wetlands, when appropriate (1.2);
- Promote need for and implementation of riparian buffer zones (1.3);
- Promote use and preserve of native plants through guidelines (1.4);
- Review policies, ordinances, etc in light of principles of sustainable development (1.5);
- Work regionally with other agencies and groups to research and apply for foundation and grant funding (1.6);
- Prioritize land acquisition for protection of land and water (1.7);
- Municipalities to integrate watershed planning perspective in to General plans/local ordinances when General Plan significantly rewritten (1.8);
- Secure agreement and funding for permanent watershed data archive (1.9);
- Work regionally with other agencies and groups to advance knowledge relating to watershed management (1.15).

Watershed Conservancy (item 1.1 in Table 4)

Formation of a **Malibu Watershed Conservancy** has already been discussed in Section 5.2.1 as a crucial element for the efficient and effective implementation of this entire WMAP initiative.

Water Quality Monitoring Program (2.1)

The Malibu Creek Watershed Wide monitoring program should be developed based on the extensive research efforts already conducted to date, especially the EMPACT grant application developed by the Malibu Council of Governments, Heal the Bay, Las Virgenes MWD, USC Sea Grant and SCAG. In this proposal, partnerships have been identified, objectives are defined, parameters for pollutants of concern are identified, and sampling methodologies tentatively agreed. This proposal defined monitoring stations on a watershed basis for each tributary, which should be agreed upon with LARWQCB. Much of the field sampling work is intended to be carried out by volunteers with training and supervision.

The LARWQCB has expressed their intent to develop a watershed-based water quality model for the Malibu Watershed. The EPA federal standard model is now BASINS, and this is the model which will be used to assess TMDLs in the coming years. BASINS will use the Malibu GIS and a continuous simulation hydrology model to characterize the flows of water spatially and temporally in the watershed and integrate with water quality data. The COG, will cooperate with the LARWQCB to identify water quality and quantity sampling locations, sampling protocols and parameters of concern to make best use of the public and private funds spent on water quality assessment and analysis. The Malibu Watershed Council and other stakeholders like Heal the Bay will also be encouraged to cooperate in this effort. This approach will enable the watershed stakeholders to increase the effectiveness of all water quality efforts, to better identify data gaps and take measures to remedy these gaps. Use of the BASINS model could improve the analysis of existing and future data, to make the data far more useable.

Wetlands (1.2)

The Malibu COG will commit to the protection and enhancement of existing wetlands and restore and create functional wetlands, when appropriate, through the establishment of policies that reflect this commitment. Wetlands are among the most productive areas on Earth, and support the lifecycles of many creatures that spend part of their lives away from wetlands. Therefore, protection, enhancement and restoration of wetlands is fundamental to wildlife habitat and water quality, and usually has a beneficial effect on water quantity, especially when, as in Malibu, they probably played an important attenuation role in pre-development times. It appears that more wetlands could be created in the upper watershed valleys to receive stormwater runoff, as well as to provide treatment to Tapia effluent in the lower watershed, allowing attenuation and infiltration where appropriate.

Riparian Buffer Zones (1.3)

The Malibu COG will promote the need for and the implementation of riparian buffer zones at the municipal and county level through policy level initiatives. Riparian buffer zones are essential to secure improved water quality and wildlife habitat in river corridors. Buffer zones in general (i.e., elsewhere in the watershed) have been largely ignored in the era of industrial farming and general development. Their loss has often resulted in local extirpation of species and lowering of ecosystem health through the gross simplification of the landscape and introduction of exotic species. In addition to filtering runoff pollutants and giving shade, and reinforcing streambanks, riparian zones can provide natural barriers against mammals trampling banks and defecating in streams. The local hydrology can also be improved, especially where a small channel is provided along the land side of the zone to intercept groundwater.

Native Plants (1.4)

The Malibu COG will develop guidelines to promote use of native plant species on residential landscapes, rural country lands, urban public space, and commercial and industrial landscapes. Incentives to encourage the use of native plants in these landscapes will be developed. Native plants are best adapted to the soils and climate of the area, are the basis of the local ecosystem and host the local mycorrhizal (fungal root) associates through which good water quality is maintained. Native plants can also thrive while maintaining biodiversity (unlike exotic species such as reed canary grass that can become a pest species), in areas designed for water quality treatment. The integrity of native plant communities, incorporating trees, undergrowth and soil mycorrhizae, is important for maintaining the local hydrological cycle.

Sustainable Development (1.5) and Stakeholder Involvement (1.6)

The Malibu COG will conduct a review of policies and ordinances in the light of principles of Sustainable Development (see Chapter 1 and Appendix A, The Natural Step for System Conditions) and will involve other stakeholders. The review process can stimulate rewarding discussion and substantial change in both the range and wording of policies and ordinances. The review will have a unique focus for the stakeholders. With proper facilitation, it should result in agreement over better economic, social, and environmental arguments to justify programs, as required by the Costa-Machado Water Act, and re-prioritization of resource allocation. It will therefore enable the research and applications needed for grant support. The Malibu COG will commit to work regionally with other agencies and groups to research and apply for foundation and grant funding to carry out the initiatives set forth in this WMAP, as well as other future activities.

Land Acquisition (1.7)

The Malibu COG will prioritize land parcels for acquisition in undeveloped areas that promote water quality and critical habitat protection. Land acquisition for protection of land and water has proved necessary wherever there is particularly sensitive and vulnerable habitat, or where

the landowner is unable or unwilling to take necessary steps to protect the resource. Prioritization requires criteria such as geomorphic and hydrologic data. The analysis recommended to prioritize the activities in Table 5 should provide a guide to land acquisition, while allowing for willing sellers, donations, and other opportunities. Land acquisition is usually found to be necessary to achieve the continuity of riparian buffer zones that will make a real difference to water quality, and also to protect and restore valuable habitat. Wetland mitigation banking is often associated with the latter to support the purchase and provide funds for restoration and maintenance of the lands, once acquired.

Watershed Planning Perspective: Protection For Water Quality (1.8)

Many of the institutional policy activities discussed, particularly the policy reviews, will be consolidated when the municipalities integrate a watershed planning perspective into the next significant rewrite of General plans/local ordinances. This will represent a major step forward in sustainable conservation and development. At the moment, conservation and restoration activities are vulnerable to land use changes and market-based management. Increased protection for water quality, achieved through implementation and enforcement of the appropriate ordinances, codes and funding (1.11), is also likely to benefit water quantity and natural resources. The watershed municipalities should commit to integrate a watershed planning perspective into the General Plans and local ordinances when General Plans are significantly rewritten.

Watershed Data Archive (1.9)

Despite the need to apply the precautionary and prevention principles in decision-making over development, the often-heard call is for all protection of natural resources to be based on 'good science'. This call ignores the fact that data on local conditions is nearly always absent or incomplete, and that the 'greenfield' site is rarely undamaged as wildlife habitat. Securing agreement and funding for a permanent watershed data archive is therefore needed if good science is to prevail in protecting the carrying capacities of natural resources. The Malibu COG will commit to securing an agreement and funding for a permanent watershed data archive. The archive would be maintained by an entity that will make it readily accessible to the public. The extent of this archive ranges from water quality data, soils, and hydrology of the Malibu sub-watersheds, GIS data and the comprehensive, regular condition surveys of the watershed's natural resources required for a full watershed management plan. The Data Archive can be made responsible for the data analysis if funding is provided for these tasks.

Reduce Water Imports (1.10)

Approximately one-third off all imported water used for domestic use is literally "flushed down the toilet." In an initiative to reduce the importation of water in the watershed, voluntary policies will be established in each municipality that conditions the sale of houses to require the replacement of all toilets to the low flush type and to require near zero leakage from domestic water pipes. This is a complex area; discussions with LVMWD staff revealed a great interest in the issues

and a potential for further initiatives to be identified through further discussion and comparison with experience of demand management elsewhere.

Stormwater Runoff (1.12)

Existing program managed by LACDPW. Measures to reduce stormwater runoff from private property have been termed 'good housekeeping' in accord with the Subsidiary Principle. Watershed-wide voluntary guidance and incentives (such as the national downspout disconnection program) to reduce stormwater runoff from private property will be developed.

Exhaust Emissions (1.13)

Water quality is also influenced by air quality. The Malibu COG and associated stakeholders will promote the reduction of vehicle exhaust emissions, for example, by promoting the use of public transport, electric and gas-powered vehicles, and good geographical distribution of recharging/filling stations.

Pervious surfaces (1.14)

When road surfaces are made pervious (with a pervious subgrade) both noise reduction (by about 50%) and a sharp reduction in accidents caused by spray from vehicle wheels in wet weather can result. Municipalities will develop pervious surface requirements for new development and redevelopment. This technology can both attenuate and improve the quality of road runoff, can greatly increase attenuation of flows from driveways, and with proper sand filtering with filter fabrics, provide suitable conditions for infiltration.

Knowledge of Watershed Management (1.15)

Building on the existing networking and co-operation between stakeholders, and most of the previous items, the MWC will be charged with the task of working regionally with other agencies and groups to advance knowledge relating to watershed management. This task can be progressed effectively and efficiently by adoption of the IdeaMapping methodology, in which stakeholders come together to share their understanding of issues, causes and effects, and the connectivity among them. This is one of the best ways in which to resolve differences and reach consensus, and can be developed into a sophisticated 'What-If?' tool for prediction of alternative outcomes.

5.4.2 Further Sections

Starting with **Water Studies and Programs**, further sections are amplified under the heading of each of the three goals in turn.

5.4.2.1 Water Quality Initiatives

Studies still needed:

Identify Pollutants of Concern (2.2)

Pollutants of concern have been identified in the EMPACT grant as: benthic community impacts, high coliform bacteria levels, shellfish harvesting advisories, swimming restrictions and beach closures, fish migration barriers, eutrophication, metals, ammonia, algae and scum. Once the watershed model(s) have been set up and a comprehensive monitoring program has been established, the model will greatly assist analysis with detection of pollutants. The COG will cooperate with RWQCB in 2004 with the analysis of water quality based on 3 years of data uniformly sampled within the comprehensive monitoring program described above (2.1). The Watershed Council may also provide valuable assistance in completing this task.

Watershed Hydrology Model (2.4)

The continuous simulation model mentioned in Section 2.1 is a key component of the coming TMDL framework. Standard volumetric measures of pollutants (g/mL, etc.) are converted to Load as a function of flows (cubic feet per second, etc.) to set Total Maximum Daily Loads. Much work is needed to characterize the range of low flows in each tributary. The COG will provide support and assistance to the LARWQCB to obtain the data required and to develop the watershed hydrology model.

Map Stormdrains and Outfalls (2.8)

The watershed GIS currently has a map from LACDPW on the locations and sizes of the major outfalls in the Malibu watershed. However, few data exist on the dimensions and catchment areas for these drains, and the list is far from complete. All stormdrains, culverts, and outfalls in the watershed impacting Malibu Creek and its tributaries will be mapped and located using GPS technology. This effort is complementary with the stream crossings inventory Action Item. The resulting map will be digitized and incorporated into the GIS database. This effort is an essential precursor to planning the elimination of some or all of the outfalls, should this be seen as being a cost-effective way to improve water quality.

Inventory Stream Crossings (2.9)

All road crossings of the Malibu drainage network will be mapped and located using GPS technology. All State and Federal highways and major thoroughfares will be identified and located where they intersect a stream channel. This work is complementary with Action 2.8, and facilitates detection of pollutant sources. The inventory of stream crossings will be conducted for a quantitative geomorphic evaluation of the hydraulic geometry of the channels where crossed, the volume of fill for each channel crossing and to map the direct storm drain connections impacting streams with some of the most degraded quality water.

Planning and Implementation Measures:

Planning:

Work with Los Angeles County to Review County Development Code (5.1)

The EPA has rated suspended sediments as the Number One pollutant of America's streams. The most significant source of fine sediments delivered to the Malibu stream and lake network is the massive land grading which is routinely practiced as a precursor to development. The COG will work with Los Angeles County to prepare a review of the County Development Code with respect to permitted grading practices. These will be reviewed in light of the unique geology and soils of the Malibu watershed, to determine appropriate grading practices permitted for new development applications. Permitted grading practices will specify the maximum volume of soils that can be re-contoured on a per acre basis, immediate protection for disturbed soils, steep slopes to be protected from disturbance and new technologies identified which retain the maximum volume of soils in an undisturbed condition. There is substantial scope for increased on-site retention of fine sediments where grading does occur, beyond the enforcement of existing BMPs, including topsoil stockpiling and soil bioengineering techniques.

Determine and Implement 'Buffer Set Backs' (5.2)

The COG will cooperate with LA County DPW to determine appropriate increased setbacks or 'no entry zones' from wetlands and riparian areas. Buffer zone setbacks (between construction and public zones such as sidewalks and streets) from all construction entry (ingress and egress areas) will be increased to minimize topsoil sediments delivered to the drainage area of any storm drain.

Soils Permeability Analysis (5.5)

A watershed-wide review of soils data will be conducted to determine the feasibility for implementing stormwater infiltration technology. The COG will invest in the required analysis in cooperation with the Natural Resources Conservation Service (NRCS). The soils update should be digitized to create a new GIS soils layer. The resulting GIS maps will be used to prioritize zones that can safely provide the greatest infiltration capability, and to progress implementation of permeable pavement. Areas with suitable soils and proximity to channel drainage areas will be prioritized for the downspout disconnection program, to reduce stormwater runoff delivery from existing development.

Implementation:

Permeable Urban Landscapes (5.3)

Again using the soils data on GIS, the COG will take the lead on identifying opportunities to increase permeability on new urban landscapes, parking lots and street parking lanes. Individual cities and the County will take the responsibility of implementing the identified opportunities. All

new developments and redevelopments will be assessed in light of the identified opportunities. New technologies have been developed to safely allow stormwater infiltration in parking lots and along street corridors, which provide functions of flow attenuation and water quality improvement. Extensive opportunities exist to install such features in new developments, and to retrofit existing development when upgrading is appropriate.

Demonstration Infiltration Project (5.4)

The City of Calabasas will develop a demonstration stormwater infiltration project. Appropriate circumstances could include a parking lot, street parking lane and/or commercial development. The project should document its assessment and design process, present project costs and other findings in a report and develop guidelines for voluntary implementation of the finding on other properties.

Demonstration Trash Baskets Project (5.6)

The City of Calabasas and Los Angeles County will provide leadership to establish a demonstration project to install and maintain trash filter baskets, where appropriate. Areas likely to benefit from this project are stream receiving waters downstream of major highways and shopping malls with fast food establishments. Project will report to the LARWQCB and to the public the installation, maintenance and monitoring costs, as well as trash basket effectiveness for the receiving water body.

Promote Litter Enforcement (5.7)

The COG and Los Angeles County will request assistance from the LA County Sheriff Department and California Highway Patrol to enforce existing litter laws, and to identify ways to increase effectiveness of litter control.

Bilingual Litter Signs (5.8)

Bilingual information signs on litter reduction will be posted in areas most frequently visited by Spanish and English speaking people, including at a minimum, frequently used parks along waterways, and shopping centers. Increase the number of trash facilities in high-use areas, and monitor the frequency of servicing will be needed to maintain the trashcans to prevent overflow.

Cooperate with Malibu RDC to install demonstration project for livestock BMPs for horse owners and cattle pasture (5.9)

Develop and conduct education programs to improve outreach to horse and other livestock owners on how animal waste impacts WQ & ways to minimize this source of pollution (5.10)

Educate Septic System Users (5.11)

The COG and associated stakeholders will develop and conduct education programs to improve outreach to septic system users about need for maintaining functioning septic systems. Implementation of annual permits and inspection for all septic systems in the watershed will be considered, along with system owner education as a component of the on-site visits.

Monitoring and Evaluation:

Monitor Water Quality Initiatives (5.12)

In order to determine that efforts to detect and improve water quality are cost-effective, the COG, in conjunction with LACDPW and Malibu Watershed Council, will establish selective programs for monitoring and evaluation of water quality initiatives. The stakeholders will ensure that the data resulting from these efforts is analyzed and made available through appropriate archiving to allow public access and use of the data.

5.4.2.2 Water Quantity

Water quantity plays a significant role in determining the ecosystems and water quality of the Malibu watershed. Urbanization can lead to low groundwater levels owing to increased local abstraction for water supply (a similar result to the effect of irrigated agriculture in rural areas) but Malibu's urbanization has been supported by huge amounts of water imported from outside the watershed. Only 25% flows through Tapia STP and joins the residue of the 75%, used for irrigation and other activities, contributing to groundwater levels.

The watershed's groundwater levels have rebounded since surface water of better quality largely replaced the use of groundwater nearly 40 years ago, so much so that plans for blending the two for high demand periods will also help to meet recycled water demand during peak summer months. It is ironic that damage to the environment caused by urbanization so prevalent elsewhere can also be caused by too much groundwater, and that some of the remedies (in particular, reducing use of potable water) are the same in both cases.

The Malibu watershed is a challenge in terms of satisfying the principles of sustainability, in particular the Subsidiary Principle, and deserves thorough research before creating a hydrologic model. The recommended items that follow are representative of the very many demand management and flow control initiatives that could probably apply. There are doubtless more effective actions, some which may have already been tried. Further research or feedback could certainly strengthen the following.

Studies still needed:

Watershed Hydrology (2.4)

The Malibu COG will facilitate and commit to conducting an analysis of the watershed hydrology, using a model to characterize low flows via continuous simulation for the upper watershed streams. Most of the Malibu upper watershed is characterized by significant soil moisture deficits throughout much of the year. Information is needed on the variation in soil moisture and infiltration in order to compute the watershed runoff response with accuracy. Interflow may also be an important parameter. Relatively few models address this issue competently. Those that do include the watershed model MIKE-SHE (from DHI America) that provides a complete package including the hydrodynamic model MIKE11 with water quality and sediment transport modules. On the West Coast, the EPA's Fortran-based HSPF (Hydrological Simulation Program-Fortran) is being widely used to provide the continuous simulation (over several years) of antecedent conditions required for low-flow modeling.

HSPF is a conceptual model that represents the watershed processes as a series of empirical equations. Although some direct measurements are possible (for example the degree of impermeability, from aerial photographs), many of the parameters used by these equations cannot be measured directly and therefore must be determined through calibration to observed flow data. This modeling effort will be seen as a long-term investment. Although there is only one gauge of long record in the watershed at present, calibration for the subwatersheds can be improved once results start coming from their proposed gauges, giving greater confidence in the model results.

Planning and Implementation Measures based on existing/acquired data:

Planning:

Alternatives to Use of Potable Water (4.1)

Demand management measures usually involve reuse and recycling in many forms, and Tapia STP has experimented with some of them, including the use of dry toilets and an irrigation telemetry service for large users. The Malibu COG and associated stakeholders will promote the use of suitable use of 'grey' water, perhaps groundwater, for new development through demonstration projects. New developments could be fitted with storage tanks, with pumps and filters where needed. Elsewhere, for example Santa Barbara, developers have been required to 'find' sufficient savings in existing development (for example, through replacing inefficient toilets with low-flush units) in order to service their new development.

Institutional Process and Use Audits (4.2)

The suite of source control measures also includes institutional process and use audits. These audits can identify means of production that use less water, and they may be directed to detect

leakages. Significant financial savings usually result for businesses, hospitals, hotels, schools etc. A program of audits with willing owners will be planned to ensure value for money.

Hosing Practices (4.3)

The common practices of hosing the domestic driveway rather than sweeping it with a broom, and using a hose to wash a vehicle, clearly increase potable water demand. Further education and a published outreach program on hosing practices will be conducted.

Reduce Demand for Laundry Services (4.4)

Nationwide and internationally, many hotels and motels encourage guests to reuse linens over a second night's stay, to reduce laundry costs and water use. However, room service personnel often ignore guest preference and renew used towels etc. every day. A good initiative is not working as well as it should. As part of an audit procedure to support these establishments in their efforts to conserve water and energy, dual language educational programs will be established. The hospitality industry should be targeted for increased voluntary implementation of this program.

Storm Drains (4.5)

Over-irrigated landscape areas that discharge to the street and enter storm drains during dry weather will be identified and minimized. This survey could be carried out during routine clearing of catch-pits for water quality maintenance. Where there is a practicable alternative (for example using porous, pollution-filtering drainage galleries to encourage infiltration) discharges from the stormwater system to streams will be blocked. To enable this, the outfall's catchment may have to be fitted with discharge control devices as well as replacing pipes with porous drainage galleries.

Implementation:

Demonstration projects will be established to:

a. utilize water sources alternative to potable water at local business, office buildings, hotels and schools (4.2);

b. use appropriate native plants in public landscape for both xeric and moist water regimes (4.6) and modify landscape maintenance practices to protect the soil's organic component;

c. fit ultra-low flush and waterless toilet installation and maintenance in new public facilities (4.7);

d. introduce storm water attenuation/retention/detention designs into all new public facilities construction (4.8);

e. ensure that a downspout disconnection program (4.9) is properly targeted in areas of permeable soils that can accept infiltration. See Appendix F, Downspout Disconnection.

Monitoring and Evaluation:

It is critical that initiatives to manage stormwater be subject to selective programs of monitoring and evaluation, and that the results are appropriately archived to allow the public data access and use (4.10). The selection of monitoring sites will be important to calibrate the hydrological model, as well as to allow evaluation of the initiative. The Malibu Watershed Council will ensure that annual evaluation reports are produced.

5.4.2.3 Natural Resources

Studies still needed: (items 2.1 and 2.2)

Watershed Studies and Programs

Understanding the natural resources present within the watershed is essential to manage effectively and to set priorities for preservation, restoration, and improvement efforts. Various biological and hydrological studies have been conducted including extensive work in the lower Malibu Creek and Lagoon (See Appendix G, *Summary Of Reference From Previous Studies)*. GIS coverages have also been developed for the watershed, including a vegetation map, geology, topography, streams, and land use. There will always be gaps in our knowledge of biologic and hydrologic resources and environmental requirements for the flora and fauna (See Chapter 3 of Ambrose, 2000 report). However, basic biological and hydrological information can be catalogued that will be useful in an overall understanding of natural resource dynamics within the watershed, and used as a foundation for planning and integrating management efforts.

Soil Survey Update and Digitizing (2.3)

Soil mapping of the watershed has been conducted and is available in published form from the Natural Resources Conservation Service (NRCS, 1968). The COG will provide much-needed support to NRCS to update the soils survey for Malibu Watershed, and assist with securing funding for the update and the work to digitize the soil survey results. Soils data are required in order to determine water infiltration and groundwater recharge areas and source and sink areas for sediments. Soils data are important for characterizing wetlands, wildlife habitats such as for steelhead, and for water quality. Delineated boundaries between soil units can also be used as indicators of historic floodplains and wetlands. Soil profile information is particularly important to determine permeability, soils strength and plasticity, stability for construction, and a gamut of other characteristics of interest to the building industry.

Owing to changes in soil taxonomy as well as land use alterations in recent years, an update of the soil survey is necessary. The NRCS is preparing to undertake this effort however, an additional funding mechanism is needed to complete the work and digitize the results. The resulting GIS layer will be a valuable planning tool for many efforts and jurisdictions. Support from the COG in this effort and the incorporation of this material in the GIS database will be valuable to assist in accomplishing goals set forth in the WMAP process.

Local Wetland Inventory and Reed Fringe Study of Lakes (2.5)

A detailed inventory of the wetlands for the entire watershed should be conducted (see Conservancy Framework) in order to understand the existing natural resources, the alteration of historic resources and for long-term planning and implementation of stormwater management. Some work of this nature has been completed including:

- the National Wetland Inventory Maps prepared by the US Fish and Wildlife Service in the mid-1970s;
- a vegetation map prepared in the UCLA study of the Lower Malibu Creek and Lagoon (Ambrose, 2000); and
- a wetland inventory of the Santa Monica Bay watershed (Josselyn et al., 1993).

The Ambrose report inventoried and mapped vegetation in the lower Malibu Creek. This information, however, is not yet available in digital format to be incorporated into the GIS database. The Josselyn study examined the historical wetland changes within the Santa Monica Bay watershed as well as conducted a macro-scale mapping efforts of the wetlands. In this study the wetlands were categorized by riverine, palustrine, and estuarine, and divided into subcategories based on intermittent or perennial flow, as well as vegetated or channelized streams. The next step in this process would be to conduct a more detailed inventory of the wetlands and stream channels.

Vital information to be collected should include:

- the soils delineation
- functional assessment of the aquatic habitat
- aerial photographs of the site both current and any historical aerial photographs available
- map of existing vegetation and extent of shading and standing wood
- extent of encroachment by exotic plant species
- existing buffers and the nature of land use/cover in the buffer zone
- degree and type of alteration
- stream bank heights, slopes, and composition for each stream and water body within the watershed.

This information can determine restoration priorities for the watershed, as well as identifying potential water quality improvement areas. The wetland inventory will be mapped and digitized into a GIS format.

In addition, a study of the cost and benefits fringe enhancement would provide for water quality and wildlife use will be conducted on each lake within the watershed.

Several lakes within the watershed are lined with a discontinuous ring of emergent wetland vegetation. This vegetation provides important water quality and wildlife benefits to the lakes. The reeds that are rooted in the submerged lake margins act as water quality filters to pollutant inputs from motorboats, and other sources. The standing vegetation provides bank protection by breaking up oncoming waves generated from boat traffic, increasing bank stability by the shear strength of their roots. Wildlife benefits include nesting and foraging sites for avian, invertebrate and amphibian populations where diverse habitats occur.

Geomorphic Survey (2.6)

A geomorphic survey of tributary stream channels for channel floodplain geometry relationships by stream order, slope and substrate, should be conducted (within Conservancy Framework, see 1.2). This program begins with a GIS study including aerial photos to characterize stream reaches within each subwatershed and the watershed long profile. The channel network should be analyzed for drainage density by vegetation cover, land use, substrate, and slope. Reach breaks are identified by features such as changes in slope, geology, soils, or landforms. The field survey will locate stream and floodplain cross-sections in each reach to represent the channel and floodplain conditions in that reach. Field surveyors should measure features such as the local long profile slope, pools, riffles, meanders, substrate of the bed and banks, and any human-made changes like stream crossings and outfalls (see Thorne, 1998). Cross-section data are related to the data from flow gauges, to characterize the channel and floodplain dimensions occupied by the range of expected flows. These data are fundamental to future stream restoration efforts, as the sizing of channel dimensions is the most critical set of parameters for successful stream restoration. This field survey data should map major sediment sources and rates of delivery to stream channels. These data will help with identification of sources of pollutants adsorbed to fine sediment particles.

Identify Subwatershed Reference Reaches (2.7)

From the GIS and field geomorphic survey, stream reaches identified as retaining the most natural condition are candidates for the status of 'reference reach'. Reference reaches are highly significant for correctly interpreting the channel dimensions needed for reaches impacted by human disturbances. Reference reaches are excellent candidates for water quality monitoring stations to establish background levels of 'pollutants' like selenium which occur naturally in the Malibu watershed. Once identified, reference reaches should be prioritized and protected or acquired into public lands to ensure protection from development pressures.

Analyze Watershed Hydrology (2.4)

The characterization of low flows in the upper watershed will provide pertinent data in stream and riparian restoration efforts. Riparian vegetation in California is uniquely adapted to the

environment in which it involved. The excess importation of water has resulted in a change in the vegetation type and community, including the domination of the exotic cane *Arundo donax* in the parts of the watershed. Understanding of the flow regime along with knowledge of current hydrologic conditions will allow some quantification of the impacts of wetland hydrologic alteration, as well as a quantitative framework in which hydrologic goals can be set.

Inventory and Map Roads and Outfalls (2.9)

In addition to providing valuable information for water quality protection, the mapping of the stream crossings and direct storm drain connections can assist in evaluating how those features affect the natural resources, including vegetation type, cover, as well as habitat type (open water, riparian forest, etc.) and associated wildlife and aquatic habitats.

Planning and Implementation Measures:

Planning:

Opportunities for Preservation and Restoration (3.1)

Using the information generated from the geomorphic survey and wetland assessment, in combination with the different GIS coverages already existing, potential preservation and enhancement areas will be identified within the watershed. Anticipated land use changes, soils and geology, potential sensitive species habitats, vegetation type, etc. will all be taken into consideration when determining areas prioritized for preservation and/or restoration. Locations and opportunities to remove floodplain fill, reconfigure channel and floodplain dimensions based upon appropriate geomorphic criteria, and the recovery of native riparian and floodplain plant communities will be analyzed and evaluated. Restrictions on new development in sensitive areas or those with recharge potential should also be considered.

Guidelines for Enhancement (3.2)

This planning level effort will require the identification of habitat types, restoration activities, and approximate acreages for wetland, streambank and floodplain habitat restoration activities, on a subwatershed basis. These quantitative guidelines will be determined from the assessment in Item 3.1, and will be developed to assist in setting priorities for implementation programs and funding.

Riparian Habitat Preservation and Restoration (3.3)

Riparian, floodplain, and wetland habitat preservation and restoration throughout the watershed will require long-term planning to ensure the maintenance of ecosystem integrity and watershed health. Restoration and preservation efforts will be prioritized in light of the findings of Action Item 3.1 and 3.2. Critical areas for preservation will be high on the list for land acquisition. Stream reaches that portray poor water quality and high degree of alteration will be high on the

priority list for restoration. Both this action item as well as Action Items 3.1 and 3.2 should be completed within the framework of the Malibu Watershed Conservancy. A report of findings will be made available to the public through this conservancy.

Implementation Feasibility and Evaluation of Success (3.4)

At the beginning of each fiscal year, restoration and preservation efforts feasible for implementation during the year will be identified and budgeted. This information will be submitted in the annual report to the RWQCB. An evaluation of the success of the previous year's projects will also be included in this report.

Implementation:

Wetland and Riparian Habitat (3.5)

Wetland, riparian and floodplain restoration, enhancement, and/or creation activities will be implemented based upon the outcome of planning level findings of action items 3.1 through 3.3. Efforts should be made to ensure that these activities are distributed throughout the subwatersheds, integrating water quality needs with wildlife habitat goals.

Monitor and Evaluate Natural Resources Initiatives (3.6)

To learn what can make the difference between success and failure in the unique Malibu Creek watershed, selective programs for monitoring and evaluation of these natural resources initiatives should be conducted. Such effort maximizes the cost-effectiveness of the initiatives. This will be an important remit of the Malibu Watershed Conservancy, which will ensure appropriate archiving to allow the public data access and use.

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APPENDIX A: THE NATURAL STEP'S FOUR SYSTEM CONDITIONS

In order for society to be sustainable, nature's functions and diversity are not systematically to be (1 – 3):

1. Subject To Increasing Concentrations Of Substances Extracted From The Earth's Crust

In a sustainable society, human activities such as the burning of fossil fuels, and the mining of metals and minerals will not occur at a rate that causes them to systematically increase in the ecosphere. There are thresholds beyond which living organisms and ecosystems are adversely affected by increases in substances from the earth's crust. Problems may include an increase in greenhouse gases leading to global warming, contamination of surface and ground water, and metal toxicity which can cause functional disturbances in animals.

In practical terms, this means substituting certain minerals that are scarce in nature with others that are more abundant, using all mined materials efficiently, and systematically reducing dependence on fossil fuels.

2. Subject To Increasing Concentrations Of Substances Produced By Society

In a sustainable society, humans will avoid generating systematic increases in persistent substances such as DDT, PCBs, and freon. Synthetic organic compounds such as DDT and PCBs can remain in the environment for many years, bio-accumulating in the tissue of organisms, causing profound deleterious effects on predators in the upper levels of the food chain. Freon, and other ozone depleting compounds, may increase risk of cancer due to added UV radiation in the troposphere.

This means systematically substituting certain persistent and unnatural compounds with ones that are normally abundant or break down more easily in nature, and using all substances produced by society efficiently.

3. Impoverished By Physical Displacement, Over-Harvesting, Or Other Forms Of Ecosystem Manipulation

In a sustainable society, humans will avoid taking more from the biosphere than can be replenished by natural systems. In addition, people will avoid systematically encroaching upon nature by destroying the habitat of other species. Biodiversity, which includes the great variety of animals and plants found in nature, provides the foundation for ecosystem services which are necessary to sustain life on this planet. Society's health and prosperity depends on the enduring capacity of nature to renew itself and rebuild waste into resources.

This means drawing resources only from well-managed ecosystems, systematically pursuing the most productive and efficient use of both those resources and of land, and exercising caution in all kinds of modification of nature.

4. Resources Are To Be Used Fairly And Efficiently In Order To Meet Human Needs Globally

Meeting the fourth system condition is a way to avoid violating the first three system conditions for sustainability. Considering the human enterprise as a whole, we need to be efficient with regard to resource use and waste generation in order to be sustainable. If one billion people lack adequate nutrition while another billion have more than they need, there is a lack of fairness with regard to meeting basic human needs. Achieving greater fairness is essential for social stability and the cooperation needed for making large-scale changes within the framework laid out by the first three conditions.

To achieve this fourth condition, humanity must strive to improve technical and organizational efficiency around the world, and to live using fewer resources, especially in affluent areas. System condition four implies an improved means of addressing human population growth. If the total resource throughput of the global human population continues to increase, it will be increasingly difficult to meet basic human needs as human-driven processes intended to fulfill human needs and wants are systematically degrading the collective capacity of the Earth's ecosystems to meet these demands. This means using all of our resources efficiently, fairly and responsibly so that the needs of all people on whom we have an impact, and the future needs of people who are not yet born, stand the best chance of being met.

APPENDIX B: WATER QUALITY DATA

ANALYTICAL RESULTS FOR CONVENTIONAL CONSTITUENTS, NUTRIENTS, AND MISCELLANEOUS CONSTITUENTS AT THE MALIBU CREEK WATERSHED RECEIVING WATER SITES

Location:		LC-1, Lindero Canyon				LV-1, Las Virgenes Cyn.		MC-1, Medea Canyon			
Storm Event Date:		11/10/97	1/29/98	5/5/98 DW	8/4/98 DW	12/6/97	5/5/98 DW	11/10/97	1/29/98	5/5/98 DW	8/4/98 DW
CONSTITUENT	*UNITS*										
BOD	mg/L	12		<8		4	<8	23		<8	
Total Organic Carbon	mg/L	33		5.3		14	7.3	26		4.7	
Conductivity	µmhos/cm	2610		645		991	1860	1550		824	
PH	std. Units	7.7		7.6		7.4	7.9	7.7		7.8	
Total Dissolved Solids	mg/L	2060		440		808	1580	1120		600	
Suspended Solids	mg/L	17		106		156	40	341		184	
Hardness	mg/L	1340		306		449	959	712		377	
Chloride	mg/L	198				36		113			
Ammonia-Nitrogen	mg/L	0.46		<0.1		<0.1	<0.1	0.17		<0.1	
Kjeldahl-Nitrogen	mg/L	2.9		0.6		2.6	0.9	6.1		0.9	
Nitrate Nitrogen	mg/L	<0.01		<0.01		2.71	0.34	0.73		<0.01	
Orthophosphate-P	mg/L	0.18		0.16		0.75	0.18	0.25		0.14	
Total Phosphorus	mg/L	0.24		0.35		1.06	0.28	0.64		0.34	
Dissolved Phosphorus	mg/L	0.19		0.31		0.75	0.21	0.25		0.15	
Total Coliform	MPN/100mL	30,000	11,000	160,000	2,200	17,000	14,000	90,000	7,000	30,000	13,000
Fecal Coliform	MPN/100mL	30,000	11,000	22,000	300	800	8,000	90,000	7,000	7,000	8,000
Fecal Streptococcus	MPN/100mL	30,000	11,000	>160,000	2,800	17,000	17,000	90,000	5,000	30,000	3,000

Source:

ANALYTICAL RESULTS FOR METAL CONSTITUENTS AT THE MALIBU CREEK WATERSHED RECEIVING WATER SITES

Location:		LC-1, Lindero Cyn.		LV-1, Las Virgenes Cyn.		MC-1, Medea Cyn.	
Storm Event Date:		**11/10/97**	**5/5/98 DW**	**12/6/97**	**5/5/98 DW**	**11/10/97**	**5/5/98 DW**
CONSTITUENT	*UNITS*						
Total Arsenic	µg/L	2.9	1.4	<0.5	2.6	4.1	4.8
Dissolved Arsenic	µg/L	1.8	0.8	<0.5	0.5	0.6	0.5
Total Cadmium	µg/L	2.8	0.6	7.8	1	2.7	0.5
Dissolved Cadmium	µg/L	2.2	<0.2	5.1	0.2	2.2	<0.2
Total Chromium	µg/L	8	10	34	4	26	15
Dissolved Chromium	µg/L	5	2	15	3	7	3
Total Copper	µg/L	26	11	18	10	81	13
Dissolved Copper	µg/L	14	5	17	10	39	5
Total Lead	µg/L	19	2	1.6	<1	22	1
Dissolved Lead	µg/L	15	1	<1	<1	20	<1
Unfiltered Mercury	µg/L	5.33	11	21	4.38	42.7	14.4
Filtered Mercury	µg/L	2.46	1.7	5.2	1.15	3.11	2.88
Total Nickel	µg/L	34	10	39	17	41	8
Dissolved Nickel	µg/L	34	<1	34	10	33	3
Total Selenium	µg/L	3	<0.5	6.1	1.4	2.3	<0.5
Dissolved Selenium	µg/L	2	<0.5	4.7	1.1	1.8	<0.5
Total Silver	µg/L	1.1	<0.2	1	0.2	1	0.3
Dissolved Silver	µg/L	0.8	<0.2	0.8	<0.2	0.6	<0.2
Total Zinc	µg/L	15	32	37	6	176	46
Dissolved Zinc	µg/L	20	5	34	5	135	9

Note: "DW" indicates that sampling was performed during dry-weather.

Source:

APPENDIX B

HEAL THE BAY TABLE 1

CLOSEST ROAD	DATE	AVG DO_MG/L	AVG DO_%SAT	AVG PH	AVG TURB__NTU	$NO_3 + N0_2$ -N PPM	NH_3-N PPM	PO_4 PPM	FLOW CFS	ENTERO CFU/ 100ML	NOTES
Cross Creek Rd.	11/7/98	8.15	77.65	8.40	1.25	8.80	2.40	2.43	NM		
Cross Creek Rd.	12/5/98	10.87	104.50	8.45	1.60	11.00	0.50	4.80	NM		
Cross Creek Rd.	1/9/99	11.62	105.70	8.30	0.63	0.73	0.05	2.00	NM		
Cross Creek Rd.	2/6/99	10.66	105.40	8.25	4.75	10.00	0.27	2.97	NM		
Cross Creek Rd.	3/6/99	13.81	133.65	8.30	1.85	10.33	0.04	2.02	NM		
Cross Creek Rd.	4/10/99	11.47	109.50	8.20	0.45	6.95	0.32	1.47	NM		
Cross Creek Rd.	5/8/99	12.30	129.80	8.30	0.92	7.70	0.10	2.17	NM		
Cross Creek Rd.	6/5/99	12.90	134.40	8.45	0.85	2.36	0.04	2.01	NM		Bullfrog tadpoles observed
Cross Creek Rd.	7/17/99	4.97	54.60	7.75	1.20	0.02	< 0.01	0.67	NM		little flow under crossing, at points US and DS the creek is flowing subsurface, decreased flows cause increased algae, also saw 2 school of mullet, 1 week ago the level 1 ft higher.
Cross Creek Rd.	8/7/99	6.50	70.25	8.35	1.00	< 0.01	< 0.01	0.59	NM		Bullfrog tadpoles observed, Large school of Mullet
Cross Creek Rd.	8/13/99	6.04	66.50	8.30	3.47	0.11	0.02	0.59	NM		little flow under crossing, at points US and DS the creek is flowing subsurface, decreased flows cause increased algae, mullet trapped in 8x20' pool DS.
Cross Creek Rd.	8/20/99	8.25	91.70	8.80	3.70	< 0.01	< 0.01	0.57	NM		stream separated by x-ing no flow mosquito fish (US), mullet trapped (DS)
Cross Creek Rd.	8/29/99	6.99	77.93	8.05	1.75	0.02	0.05	0.72	NM		stream separated by x-ing no flow, mullet trapped (DS)
Cross Creek Rd.	9/4/99	5.77	62.70	8.15	2.00	0.03	0.03	1.25	NM		
Cross Creek Rd.	9/10/99	5.50	59.35	7.90	1.97	0.04	0.07	1.32	NM		Saw mullet and mosquito fish, Bluegill in downstream pool .
Cross Creek Rd.	9/28/99	5.73	61.70	7.75	0.47	0.20	0.15	1.19	NM		heavier flow
Cross Creek Rd.	10/2/99	7.07	73.83	7.70	0.90	NM	7.05	1.10	NM		lots of duckweed up and down stream, 20% up stream and 20% down stream
Cross Creek Rd.	11/2/99	7.88	77.15	7.80	0.39	0.27	0.08	0.86	NM		upstream 10 coots? Duckweed_willow_wind blowing North upstream
Cross Creek Rd.	11/6/99	8.55	85.70	7.90	< 0.01	0.22	< 0.01	0.78	NM		
Cross Creek Rd.	12/4/99	NM	107.00	8.40	0.60	5.02	0.04	0.92	NM		
Cross Creek Rd.	12/20/99	NM	NM		NM	5.56	< 0.01	3.97	NM	41	split sample 4 nutrients and enterococcus only
Cross Creek Rd.	1/20/00	9.15	NM	7.75	1.28	9.56	0.02	4.60	NM	20.00	split sample 5
Cross Creek Rd.	2/5/00	10.32	103.10	8.10	0.55	13.05	0.14	4.72	NM	30.00	
Cross Creek Rd.	3/4/00	10.11	99.20	8.50	39.50	3.18	0.06	2.04	NM	1236.00	
Cross Creek Rd.	4/1/00	15.20	155.10	8.60	0.75	4.05	0.16	2.11	NM	10.00	
Cross Creek Rd.	5/6/00	13.91	149.15	8.40	0.40	0.53	< 0.01	0.97	NM	< 10	
Cross Creek Rd.	6/3/00	11.27	125.00	8.20	1.25	0.05	0.02	0.54	NM	74.00	
Cross Creek Rd.	7/8/00	8.11	87.90	7.90	1.43	< 0.01	< .01	1.18	NM	20.00	
Cross Creek Rd.	8/5/00	4.67	52.85	7.70	1.75	0.02	< .01	1.44	NM	10.00	

HEAL THE BAY TABLE 2

CLOSEST ROAD	DATE	AVG DO_MG/L	AVG DO_% SAT	AVG PH	AVG TURB_NTU	NO_3 + $N0_2$-N PPM	NH_3-N PPM	PO_4 PPM	FLOW CFS	ENTERO. CFU/100ML	NOTES
Las Virgenes/Piuma?	11/7/98	10.55	99.15	8.20	< 0.01	0.07	0.97	0.03	0.78		
Las Virgenes/Piuma?	12/5/98	8.79	72.25	8.25	0.40	0.09	0.13	0.08	3.39		
Las Virgenes/Piuma?	1/9/99	9.90	82.40	8.10	< 0.01	0.14	< 0.01	< 0.01	2.75		2 ft long portion of a 2" pvc pipe on bank
Las Virgenes/Piuma?	2/6/99	10.72	99.90	7.95	0.40	0.28	0.29	0.10	2.60		
Las Virgenes/Piuma?	3/6/99	11.72	107.20	8.10	0.45	0.04	0.01	0.04	1.79		Large sediment build up in stream and deposit on stream bank. 12-16" average flow
Las Virgenes/Piuma?	4/10/99	12.08	105.80	7.90	0.10	0.14	< 0.01	0.17	4.69		Large pieces of construction waste on bank
Las Virgenes/Piuma?	5/8/99	11.37	111.90	8.10	< 0.01	< 0.01	0.02	0.02	4.62		
Las Virgenes/Piuma?	6/5/99	9.52	92.55	8.00	0.02	0.25	< 0.01	0.15	1.65		
Las Virgenes/Piuma?	7/17/99	10.65	111.95	7.90	0.05	0.18	< 0.01	0.25	0.12		Conductivity meter kept bouncing from 19.99 to 4 or 5 so no accurate reading possible/ tadpoles, crayfish, minnows, lots of water bugs in moss/ frog right next to testing, frog sighting on turbidity kit!
Las Virgenes/Piuma?	8/7/99	11.55	120.60	8.35	0.27	< 0.1	< 0.01	0.14	NM		
Las Virgenes/Piuma?	9/4/99	4.22	44.15	7.90	0.65	0.07	0.03	< 0.01	NM		Creek trickles into a murky pool several inches deep. Stream flow significantly reduced
Las Virgenes/Piuma?	10/2/99	3.95	41.50	7.60	0.68	NM	0.19	0.06	NM		Not enough water in stream to submerge bottles. Sampled 10-15 miles east of where backbone Tr. Crosses creek. Pooled/ No Flow. West of Trail Dry.
Las Virgenes/Piuma?	11/6/99	NM	NM	7.80	15.00	< 0.1	0.05	0.11	NM		Flow not measured because there was not enough water to float orange peel. Water striders. For DO testing probe was in water only one inch deep.
Las Virgenes/Piuma?	12/4/99	10	87	7.85	2.10	0.22	< 0.01	0.18	NM		
Las Virgenes/Piuma?	12/20/99	NM	NM	NM	NM	0.20	0.05	0.15	NM	10.00	split sample 4 nutrients and enterococcus only
Las Virgenes/Piuma?	1/20/00	10.56	NM	7.80	< 0.01	< 0.01	< 0.01	0.10	0.58	52.00	Split Sample 5
Las Virgenes/Piuma?	2/5/00	10.45	97.15	8.05	< 0.01	0.12	0.03	0.19	0.51	122.00	
Las Virgenes/Piuma?	3/4/00	11.68	106.37	8.10	0.52	1.50	< 0.01	0.62	3.66	97.00	
Las Virgenes/Piuma?	4/1/00	11.21	111.85	8.30	0.11	0.95	0.09	0.09	NM	20.00	
Las Virgenes/Piuma?	5/6/00	9.58	97.05	8.10	3.00	1.29	0.14	0.18	4.76	135.00	
Las Virgenes/Piuma?	6/3/00	11.08	115.00	8.30	1.10	0.64	0.02	0.26	2.22	86.00	
Las Virgenes/Piuma?	7/8/00	8.84	NM	8.05	1.55	0.83	0.14	0.49	NM	216.00	
Las Virgenes/Piuma?	8/5/00	8.19	88.50	7.90	1.40	0.18	0.01	0.31	0.168	135.00	

HEAL THE BAY TABLE 3

CLOSEST ROAD	DATE	AVG DO_MG/L	AVG DO_%SAT	AVG PH	AVG TURB NTU	NO_3+N0_2-N PPM	NH_3-N PPM	PO_4 PPM	FLOW CFS	ENTERO CFU/100ML.	NOTES
Stunt Rd./ Red Rock Rd.	11/7/98	9.65	93.00	8.20	0.60	0.19	0.80	0.12	0.18		
Stunt Rd./ Red Rock Rd.	12/5/98	9.15	82.00	8.40	< 0.01	0.10	0.10	0.04	0.27		
Stunt Rd./ Red Rock Rd.	1/9/99	8.45	73.65	8.25	0.20	0.10	< 0.01	0.03	0.41		
Stunt Rd./ Red Rock Rd.	2/6/99	10.24	94.00	8.10	0.43	0.11	0.06	< 0.01	0.10		
Stunt Rd./ Red Rock Rd.	3/6/99	10.28	94.45	8.30	0.65	0.11	0.01	0.04	0.52		
Stunt Rd./ Red Rock Rd.	4/10/99	10.86	97.75	8.15	5.40	< 0.01	< 0.01	< 0.01	0.15		
Stunt Rd./ Red Rock Rd.	5/8/99	9.56	95.55	8.10	< 0.01	< 0.01	0.02	< 0.01	0.27		
Stunt Rd./ Red Rock Rd.	6/5/99	8.83	87.55	8.10	0.10	0.02	< 0.01	0.07	0.34		
Stunt Rd./ Red Rock Rd.	7/17/99	8.26	85.62	8.00	1.35	0.03	< 0.01	0.10	0.21		water striders present
Stunt Rd./ Red Rock Rd.	8/7/99	5.37	56.95	8.60	< 0.01	< 0.01	< 0.01	< 0.01	0.07		2 visible treefrog tadpoles
Stunt Rd./ Red Rock Rd.	9/4/99	7.21	74.25	8.35	< 0.01	0.05	< .01	< 0.01	0.22		
Stunt Rd./ Red Rock Rd.	10/2/99	8.21	83.50	8.00	< 0.01	NM	3.25	< 0.01	0.30		
Stunt Rd./ Red Rock Rd.	11/6/99	10.31	99.15	8.25	< 0.01	< 0.01	< 0.01	0.19	0.03		Several varieties of water bugs seen in water
Stunt Rd./ Red Rock Rd.	12/4/99	10.46	93.40	8.15	< .01	< .01	< 0.01	0.04	0.07		Leaves around margin; sycamore, oak, willow, alder.
Stunt Rd./ Red Rock Rd.	12/20/99	NM	NM	NM	NM	< 0.01	0.12	< 0.01	NM	< 10	split sample 4 nutrients and enterococcus only
Stunt Rd./ Red Rock Rd.	1/20/00	10.00	NM	8.00	0.05	0.02	< 0.01	0.02	0.30	< 10	split sample 5. Leaves 10% of biological floatables
Stunt Rd./ Red Rock Rd.	2/5/00	9.83	93.00	8.20	1.65	< 0.01	< 0.01	0.05	0.19	10.00	
Stunt Rd./ Red Rock Rd.	3/4/00	11.14	100.97	8.10	0.12	0.04	< 0.01	0.49	0.35	< 10	
Stunt Rd./ Red Rock Rd.	4/1/00	9.80	95.45	NM	0.89	0.02	< 0.01	0.05	NM	10.00	
Stunt Rd./ Red Rock Rd.	5/6/00	8.57	86.25	8.00	0.92	0.05	0.08	0.05	NM	< 10	
Stunt Rd./ Red Rock Rd.	6/3/00	8.07	86.85	8.15	0.93	0.02	0.05	0.09	4.51	41.00	
Stunt Rd./ Red Rock Rd.	7/8/00	7.77	NM	8.05	1.10	0.035	< .01	0.05	0.296	< 10	
Stunt Rd./ Red Rock Rd.	8/5/00	7.71	85.90	8.00	2.23	0.03	< .01	0.11	0.144	52.00	

HEAL THE BAY TABLE 4

CLOSEST ROAD	DATE	AIRT1_TIME	AVG DO_MG/L	AVG DO_%SAT	AVG PH	AVG TURB NTU	NO_3+N0_2-N PPM	NH_3-N PPM	PO_4_ PPM	FLOW_CFS_	ENTERO. CFU/ 100ML	NOTES
Crags Dr./Mulholland Hwy	11/7/98	15.5 C/2:06 pm	7.89	76.65	8.15	13.00	0.09	0.13	< 0.01	Not measured		
Crags Dr./Mulholland Hwy	12/5/98	13 C/1:12 pm	9.53	88.70	8.10	6.30	0.07	0.23	0.08	Not measured		Heavy flow recorded over the dam.
Crags Dr./Mulholland Hwy	1/9/99	21 C/12:30 pm	11.05	98.90	8.10	5.30	0.04	0.03	0.03	Not Measured		
Crags Dr./Mulholland Hwy	2/6/99	15 C/ 11:04 am	11.32	103.60	8.15	4.40	< 0.01	0.05	0.05	Not Measured		
Crags Dr./Mulholland Hwy	3/6/99	13.5 C/11:20 am	12.64	125.40	8.25	5.40	< 0.01	0.02	0.03	Not Measured		Water is muddy
Crags Dr./Mulholland Hwy	4/10/99	17 C/11:16 am	10.15	100.35	8.20	7.90	< 0.01	0.01	< 0.01	Not Measured		
Crags Dr./Mulholland Hwy	5/8/99	17.2 C/11:07 am	8.98	96.55	8.20	2.50	< 0.01	0.02	< 0.01	Not Measured		
Crags Dr./Mulholland Hwy	6/5/99	NM	10.47	115.35	8.20	7.15	< 0.01	0.02	< 0.01	Not Measured		Dam was flowing over both sides
Crags Dr./Mulholland Hwy	7/17/99	NM	8.72	105.35	8.20	8.00	< 0.01	0.05	0.38	Not Measured		Lots of debris up slope from water, possible high flows.
Crags Dr./Mulholland Hwy	8/7/99	25 C/12:27 pm	9.76	115.20	8.40	8.00	< 0.01	0.22	0.41	Not Measured		
Crags Dr./Mulholland Hwy	9/4/99	26 C/12:10 pm	10.02	114.25	8.40	9.25	< 0.01	0.04	0.37	Not Measured		
Crags Dr./Mulholland Hwy	10/2/99	27 C/12:50 am	10.56	121.50	8.30	8.10	NM	0.89	0.38	Not Measured		
Crags Dr./Mulholland Hwy	11/6/99	22 C/10:53 am	6.73	68.30	8.10	6.95	< 0.01	0.04	0.18	Not Measured		"there's some old guy watching us! Um, its scary over here."
Crags Dr./Mulholland Hwy	12/4/99	19 C/11:07 am	100.85	NM	8.40	4.90	< 0.01	0.01	0.08	Not measured		2 Styrofoam packages/boxes
Crags Dr./Mulholland Hwy	12/20/99	NM	NM	NM	NM	NM	< .01	< .01	< .01	Not measured	20.00	split sample 4 nutrients and enterococcus only
Crags Dr./Mulholland Hwy	1/20/00	19.5 C/11:44 am	11.27	110.50	8.20	5.85	< 0.01	0.22	0.01	Not measured	30.00	split sample 510 tennis balls, 4 large Styrofoam pieces, spray paint can
Crags Dr./Mulholland Hwy	2/5/00	18 C/ 11:50 am	11.77	108.67	8.40	5.60	< 0.01	< 0.01	0.09	Not measured	< 10	
Crags Dr./Mulholland Hwy	3/4/00	14 C/ 12:16 pm	10.35	99.30	8.30	7.10	0.90	< 0.01	0.14	Not measured	216.00	
Crags Dr./Mulholland Hwy	4/1/00	25.5 C/ 11:12 am	10.87	115.05	8.40	6.20	< 0.01	0.49	0.01	Not measured	< 10	
Crags Dr./Mulholland Hwy	5/6/00	20 C/ 10:55 am	9.65	109.80	8.10	5.55	0.09	0.01	0.09	Not measured	< 10	
Crags Dr./Mulholland Hwy	6/3/00	34 C/11:46 am	8.56	100.25	8.20	5.76	0.07	0.05	0.47	Not measured	< 10	A lot of ducks and snakes; one frog
Crags Dr./Mulholland Hwy	7/8/00	24 C/11:10 am	9.62	113.20	8.40	6.75	< .01	< .01	0.29	Not measured	282.00	
Crags Dr./Mulholland Hwy	8/5/00	35 C/ 11:18 am	9.11	115.50	8.20	4.75	< .01	< .01	0.38	Not measured	231.00	

HEAL THE BAY TABLE 5

CLOSEST_ROAD	DATE	AVG DO_ MG/L	AVG DO_% SAT	AVG PH	AVG TURB NTU	NO3+N02-N PPM	NH3-N PPM	PO4 PPM	FLOW CFS	ENTERO. CFU/100ML	NOTES
Malibu Canyon Rd.	11/7/98	9.87	91.60	8.05	< 0.01	9.10	1.19	0.34	3.47		
Malibu Canyon Rd.	12/5/98	10.50	95.10	7.80	16.00	2.66	0.42	0.62	4.79		
Malibu Canyon Rd.	1/9/99	12.57	110.80	8.10	0.18	6.20	0.03	0.28	5.39		
Malibu Canyon Rd.	2/6/99	9.34	88.80	7.90	2.25	5.30	0.15	0.48	3.98		
Malibu Canyon Rd.	3/6/99	16.95	160.60	8.30	1.00	6.73	0.01	0.19	3.11		low water level 10"
Malibu Canyon Rd.	4/10/99	12.65	119.00	8.00	< 0.01	3.38	< 0.01	0.30	2.88		
Malibu Canyon Rd.	5/8/99	13.56	138.30	8.15	0.15	3.80	0.08	0.14	1.94		
Malibu Canyon Rd.	6/5/99	9.82	97.25	8.00	0.75	3.20	0.03	0.45	3.60		
Malibu Canyon Rd.	7/17/99	10.46	116.30	8.20	1.85	1.60	< 0.01	0.64	1.93		small fish .5in in length
Malibu Canyon Rd.	8/7/99	10.64	109.65	8.35	0.53	4.60	< 0.01	0.37	2.32		1 ft. depth small fish look like mosquito fish, "filmy surface stuff" blocking flow, a lot of trapped leaves and debris, die-off of watercress much less pervasive algae along margins, leaves everywhere.
Malibu Canyon Rd.	9/4/99	10.67	108.85	8.25	1.46	4.30	0.01	0.37	2.54		
Malibu Canyon Rd.	10/2/99	11.36	112.80	8.00	0.25	NM	0.16	0.39	2.15		some reddish aquatic plant growing along edges, gambuzia are present, lots of flies, water striders
Malibu Canyon Rd.	11/6/99	8.46	81.50	8.00	0.73	5.34	< 0.01	0.45	2.41		The leaves were preventing flow
Malibu Canyon Rd.	12/20/99	NM	NM	NM	NM	6.60	0.04	0.36	NM	25.00	water results only
Malibu Canyon Rd.	1/20/00	11.73	110.40	8.10	0.40	5.72	< 0.01	0.47	2.15	41.00	split sample 5. Large debris pile upstream in willows; log piles in stream
Malibu Canyon Rd.	2/5/00	14.46	141.70	8.30	1.30	5.80	0.63	0.55	1.90	31.00	
Malibu Canyon Rd.	3/4/00	10.24	94.80	8.10	72.50	2.42	0.21	1.54	5.15	2909.00	
Malibu Canyon Rd.	4/1/00	NM	151.00	8.20	0.45	4.72	0.35	0.44	2.68	20.00	
Malibu Canyon Rd.	5/6/00	11.18	121.60	8.00	10.50	5.16	0.02	1.13	3.97	146.00	
Malibu Canyon Rd.	6/3/00	12.73	133.65	8.10	1.05	4.76	0.51	0.62	12.88	31.00	
Malibu Canyon Rd.	7/8/00	11.34	119.20	8.10	2.45	3.58	< .01	0.57	4.90	98.00	
Malibu Canyon Rd.	8/5/00	11.23	125.60	8.00	2.04	2.93	< .01	0.34	2.14	98.00	

HEAL THE BAY TABLE 6

CLOSEST_ROAD	DATE	AVG DO_MG/L	AVG DO_%SAT	AVG PH	AVG TURB_NTU	AVG COND_US	NO_3+$N0_2$-N_PPM	NH_3-N_PPM	PO_4_PPM	FLOW_CFS	ENTERO. CFU/100ML	NOTES
Unnamed/ Lost Hills Rd.	11/7/98	8.55	80.00	7.80	0.10	NM	0.03	0.25	0.20	0.60		
Unnamed/ Lost Hills Rd.	12/5/98	10.36	91.35	7.80	< 0.01	2950	< 0.01	0.09	0.24	0.62		
Unnamed/ Lost Hills Rd.	1/9/99	6.81	61.40	7.80	0.03	2700	< 0.01	0.01	0.15	0.66		Trash included barbed wire and fencing post. Stream bottom heavily sedimented. Dirt or rocks. 50% embedded. Lots of leaves
Unnamed/ Lost Hills Rd.	2/6/99	9.97	91.90	8.10	< 0.01	2900	< 0.01	0.06	0.18	0.52		
Unnamed/ Lost Hills Rd.	3/6/99	10.03	92.95	7.90	< 0.01	3100	< 0.01	0.03	0.15	0.28		Good orange! watch barbed wire in stream above cross section and as you enter stream
Unnamed/ Lost Hills Rd.	4/10/99	9.82	90.20	7.90	< 0.01	2900	< 0.01	< 0.01	0.17	0.50		
Unnamed/ Lost Hills Rd.	5/8/99	8.95	88.40	8.10	< 0.01	8100	< 0.01	0.03	0.16	0.47		
Unnamed/ Lost Hills Rd.	6/5/99	8.52	84.25	8.05	0.45	5455	< 0.01	< 0.01	0.18	0.43		
Unnamed/ Lost Hills Rd.	7/17/99	5.35	58.20	7.80	< 0.01	3350	0.01	0.05	0.30	0.11		
Unnamed/ Lost Hills Rd.	8/7/99	8.66	87.50	8.15	0.40	3510	< 0.01	< 0.01	0.19	0.15		some red algae growing on bottom
Unnamed/ Lost Hills Rd.	9/4/99	9.35	93.30	8.05	< 0.01	3650	0.03	< 0.01	0.30	0.25		
Unnamed/ Lost Hills Rd.	10/2/99	6.61	80.00	7.80	< 0.01	3380	NM	0.13	0.24	0.17		
Unnamed/ Lost Hills Rd.	11/6/99	8.59	89.73	7.70	0.15	3405	< 0.01	< 0.01	0.29	0.10		milky film covering stream
Unnamed/ Lost Hills Rd.	12/4/99	9.00	79.10	7.70	0.00	3245	< 0.01	< 0.01	0.23	0.08		substantial portions of the stream are covered in leaves
Unnamed/ Lost Hills Rd.	12/20/99	NM	NM	NM	NM	NM	< 0.01	0.12	0.21	NM	< 10	split sample 4 nutrients and enterococcus only
Unnamed/ Lost Hills Rd.	1/20/00	9.21	86.70	8.10	0.15	3350	0.01	< 0.01	0.24	0.16	< 10	split sample 5
Unnamed/ Lost Hills Rd.	2/5/00	9.26	87.45	7.80	< 0.01	3180	< 0.01	< 0.01	0.15	0.22	< 10	
Unnamed/ Lost Hills Rd.	3/4/00	8.91	79.50	8.00	0.08	3195	0.05	< 0.01	0.20	0.29	< 10	
Unnamed/ Lost Hills Rd.	4/1/00	9.33	93.55	7.80	0.48	3200	< 0.01	0.06	0.22	0.13	86.00	
Unnamed/ Lost Hills Rd.	5/6/00	8.78	88.55	7.80	0.27	3215	< 0.01	< 0.01	0.29	0.14	158.00	
Unnamed/ Lost Hills Rd.	6/3/00	9.11	93.30	8.00	0.85	3475	0.04	0.03	0.48	0.113	223.00	
Unnamed/ Lost Hills Rd.	7/8/00	7.50	76.90	8.00	8.30	3475	< .01	< .01	0.44	0.071	< 10	
Unnamed/ Lost Hills Rd.	8/5/00	7.41	82.60	8.00	5.40	4000	0.015	< .01	0.40	NM	4884.00	

HEAL THE BAY TABLE 7

CLOSEST_ROAD	DATE	AVG DO_MG/L	AVG DO_%SAT	AVG PH	AVG TURB_NTU	AVG COND_US	NO_3+N0_2-N_PPM	NH_3-N_PPM	PO_4 PPM	FLOW_CFS	entero. Cfu/100ml	NOTES
Cheseboro Rd.	11/7/98	9.50	92.45	8.00	0.77	NM	1.24	0.54	2.82	6.98		Dump site: tires, shopping cart, debris.
Cheseboro Rd.	12/5/98	9.74	89.15	7.90	2.70	2400	1.20	0.28	0.46	8.52		Trash included a shopping cart
Cheseboro Rd.	1/9/99	5.96	54.05	8.20	1.25	3050	1.13	0.05	0.15	4.76		Trash items: tire, license plate, bag, old clothes, random bits of plastic and paper.
Cheseboro Rd.	2/6/99	11.91	113.60	8.30	0.82	2700	0.96	0.03	0.12	6.54		
Cheseboro Rd.	3/6/99	13.19	126.35	8.10	0.42	2970	0.70	0.06	0.12	5.32		massive trash old couches, plates, clothes, shopping cart, road signs looks like people dump here
Cheseboro Rd.	4/10/99	12.59	121.25	8.20	0.23	2550	0.40	0.08	0.14	8.90		
Cheseboro Rd.	5/8/99	10.70	112.53	8.30	0.80	3060	0.58	0.12	0.09	NM		Flow measurements scratched due to bees
Cheseboro Rd.	6/5/99	8.88	88.95	8.10	1.30	4335	0.95	0.21	0.36	NM		
Cheseboro Rd.	7/17/99	9.34	103.65	8.00	1.55	2900	0.67	0.09	0.46	2.48		
Cheseboro Rd.	8/7/99	10.92	122.50	8.40	0.55	2910	1.28	< 0.01	0.31	NM		mostly fast food trash, 2 shopping carts, 1 mattress, 1PVC pipe, 1 sweater, 1 porno flick box
Cheseboro Rd.	9/4/99	10.40	110.95	8.20	0.91	3140	0.45	0.08	0.23	NM		Alternate Site due to Bees! New box of bees discovered
Cheseboro Rd.	10/2/99	7.20	92.25	8.00	0.55	3080	NM	0.08	0.28	2.74		
Cheseboro Rd.	11/6/99	9.90	100.40	8.00	2.30	2950	1.41	0.22	0.45	6.04		
Cheseboro Rd.	12/4/99	8.83	79.00	7.80	1.40	3035	0.73	0.09	0.16	4.42		Lots of garbage along stream
Cheseboro Rd.	12/20/99	NM	NM	NM	NM	NM	0.49	0.11	0.12	NM	272.00	split sample for nutrients and enterococcus only
Cheseboro Rd.	1/20/00	9.72	94.40	8.30	1.45	3050	0.46	0.10	NM	5.44	132.00	split sample 5. Trash = moderate on bank; looks great after coastal cleanup day!
Cheseboro Rd.	2/5/00	NM	NM	8.20	1.25	2855	0.49	0.19	0.58	5.69	41.00	
Cheseboro Rd.	3/4/00	9.73	94.30	8.20	7.90	1860	1.14	0.09	0.34	16.11	459.00	
Cheseboro Rd.	4/1/00	8.29	84.45	8.00	0.75	2915	0.87	0.07	0.38	11.05	31.00	
Cheseboro Rd.	5/6/00	9.31	98.55	7.95	0.78	2850	0.89	0.15	0.34	7.14	122.00	
Cheseboro Rd.	6/3/00	9.72	106.50	8.20	1.40	2880	0.71	0.06	0.54	6.012	84.00	
Cheseboro Rd.	7/8/00	8.91	96.80	8.20	2.05	2950	0.77	0.04	0.67	3.57	213.00	
Cheseboro Rd.	8/5/00	7.03	79.70	7.90	2.20	2910	0.73	0.09	0.44	5.99	657.00	

APPENDIX C: MALIBU CREEK WATERSHED 303(D) LIST OF POLLUTANTS OF CONCERN

MALIBU CREEK WATERSHED 303(D) LIST OF POLLUTANTS OF CONCERN

Water Body Name	Hydr Unit	Priority	Size	Unit Name	Pollutant of Concern	Source Name	Start TMDL	End TMDL	Comments
Malibou Lake	404.24	Medium	69	Acres	Copper	Nonpoint Source			Elevated levels of copper in tissue.
Malibou Lake	404.24	Medium	69	Acres	Org. enrichment/ Low D.O.	Nonpoint Source			
Malibou Lake	404.24	Medium	69	Acres	Eutrophic	Nonpoint Source	0193	1202	
Malibou Lake	404.24	Medium	69	Acres	Algae	Nonpoint Source			
Malibou Lake	404.24	Low	69	Acres	Chlordane	Nonpoint/Point Source			Elevated levels of chlordane in tissue.
Malibou Lake	404.24	Low	69	Acres	PCBs	Nonpoint Source			Elevated levels of PCBs in tissue.
Malibu Beach	404.21	Medium	0.53	Miles	Beach Closures	Nonpoint Source			
Malibu Beach	404.21	High	0.53	Miles	DDT	Nonpoint Source			Fish Consumption Advisory for DDT.
Malibu Creek	404.21	Medium	9.5	Miles	Nutrients (Algae)	Nonpoint/Point Source	0193	1202	
Malibu Creek	404.21	Low	9.5	Miles	Fish barriers	Dam Construction/ Operation			
Malibu Creek	404.21	Low	9.5	Miles	Trash	Nonpoint Source			
Malibu Creek	404.21	Low	9.5	Miles	Scum/Foam-unnatural	Nonpoint/Point Source			
Malibu Creek	404.21	High	9.5	Miles	High Coliform Count	Nonpoint/Point Source			
Malibu Lagoon	404.21	Medium	32.5	Acres	Eutrophic	Nonpoint/Point Source	0193	1202	
Malibu Lagoon	404.21	Medium	32.5	Acres	Shellfish Harvesting Adv.	Nonpoint/Point Source			
Malibu Lagoon	404.21	Medium	32.5	Acres	Benthic Comm. Effects	Nonpoint/Point Source			
Malibu Lagoon	404.21	High	32.5	Acres	Swimming Restrictions	Nonpoint/Point Source			
Malibu Lagoon	404.21	High	32.5	Acres	High Coliform Count	Nonpoint/Point Source			
Malibu Lagoon	404.21	High	32.5	Acres	Enteric Viruses	Nonpoint/Point			

Water Body Name	Hydr Unit	Priority	Size	Unit Name	Pollutant of Concern	Source Name	Start TMDL	End TMDL	Comments
						Source			
Malibu Lagoon Beach (Surfrider)	404.21	Medium	0.66	Miles	Beach Closures	Nonpoint Source			
Malibu Lagoon Beach (Surfrider)	404.21	High	0.66	Miles	DDT	Nonpoint Source			Fish Consumption Advisory for DDT.
Malibu Lagoon Beach (Surfrider)	404.21	High	0.66	Miles	High Coliform Count	Nonpoint Source			
Malibu Lagoon Beach (Surfrider)	404.21	High	0.66	Miles	PCBs	Nonpoint Source			Fish Consumption Advisory for PCBs.
Medea Creek Reach 1 (Lake to confl. with Lindero)	404.23	Low	3.01	Miles	Selenium	Nonpoint Source			
Medea Creek Reach 1 (Lake to confl. with Lindero)	404.23	Medium	3.01	Miles	Algae	Nonpoint Source			
Medea Creek Reach 1 (Lake to confl. with Lindero)	404.23	Low	3.01	Miles	Trash	Nonpoint Source			
Medea Creek Reach 1 (Lake to confl. with Lindero)	404.23	High	3.01	Miles	High Coliform Count	Nonpoint Source			
Medea Creek Reach 2 (above confl. with Lindero)	404.24	Low	5.44	Miles	Selenium	Nonpoint Source			
Medea Creek Reach 2 (above confl. with Lindero)	404.24	Medium	5.44	Miles	Algae	Nonpoint Source			
Medea Creek Reach 2 (above confl. with Lindero)	404.24	Low	5.44	Miles	Trash	Nonpoint Source			
Medea Creek Reach 2 (above confl. with Lindero)	404.24	High	5.44	Miles	High Coliform Count	Nonpoint Source			
Lindero Creek Reach 1	404.23	Low	2.2	Miles	Selenium	Nonpoint Source			
Lindero Creek Reach 1	404.23	Medium	2.2	Miles	Algae	Nonpoint Source			
Lindero Creek Reach 1	404.23	Low	2.2	Miles	Trash	Nonpoint Source			
Lindero Creek Reach 1	404.23	Low	2.2	Miles	Scum/Foam-unnatural	Nonpoint Source			
Lindero Creek Reach 1	404.23	High	2.2	Miles	High Coliform Count	Nonpoint Source			
Lindero Creek Reach 2 (above Lake)	404.23	Low	4.8	Miles	Selenium	Nonpoint Source			
Lindero Creek Reach 2 (above	404.23	Medium	4.8	Miles	Algae	Nonpoint Source			

Water Body Name	Hydr Unit	Priority	Size	Unit Name	Pollutant of Concern	Source Name	Start TMDL	End TMDL	Comments
Lake)									
Lindero Creek Reach 2 (above Lake)	404.23	Low	4.8	Miles	Trash	Nonpoint Source			
Lindero Creek Reach 2 (above Lake)	404.23	Low	4.8	Miles	Scum/Foam-unnatural	Nonpoint Source			
Lindero Creek Reach 2 (above Lake)	404.23	High	4.8	Miles	High Coliform Count	Nonpoint Source			
Las Virgenes Creek	404.22	Low	11.47	Miles	Selenium	Nonpoint Source			
Las Virgenes Creek	404.22	Medium	11.47	Miles	Nutrients (Algae)	Nonpoint Source	0193	1202	
Las Virgenes Creek	404.22	Medium	11.47	Miles	Org. enrichment/ Low D.O.	Nonpoint Source			
Las Virgenes Creek	404.22	Low	11.47	Miles	Trash	Nonpoint Source			
Las Virgenes Creek	404.22	Low	11.47	Miles	Scum/Foam-unnatural	Nonpoint Source			
Las Virgenes Creek	404.22	High	11.47	Miles	High Coliform Count	Nonpoint Source			
Triunfo Canyon Creek Reach 1	404.24	Low	4.06	Miles	Lead	Nonpoint Source			
Triunfo Canyon Creek Reach 1	404.24	Low	4.06	Miles	Mercury	Nonpoint Source			
Triunfo Canyon Creek Reach 2	404.25	Low	1.98	Miles	Lead	Nonpoint Source			
Triunfo Canyon Creek Reach 2	404.25	Low	1.98	Miles	Mercury	Nonpoint Source			
Lake Sherwood	404.26	Medium	213	Acres	Mercury	Nonpoint Source			Elevated levels of mercury in tissue.
Lake Sherwood	404.26	Low	213	Acres	Ammonia	Nonpoint Source			
Lake Sherwood	404.26	Medium	213	Acres	Org. enrichment/ Low D.O.	Nonpoint Source			
Lake Sherwood	404.26	Medium	213	Acres	Eutrophic	Nonpoint Source	0193	1202	
Lake Sherwood	404.26	Medium	213	Acres	Algae	Nonpoint Source			
Lake Lindero	404.23	Low	13.56	Acres	Selenium	Nonpoint Source			Elevated levels of selenium in tissue.
Lake Lindero	404.23	Medium	13.56	Acres	Eutrophic	Nonpoint Source	0193	1202	
Lake Lindero	404.23	Low	13.56	Acres	Specific conductivity	Nonpoint Source			

Water Body Name	Hydr Unit	Priority	Size	Unit Name	Pollutant of Concern	Source Name	Start TMDL	End TMDL	Comments
Lake Lindero	404.23	Low	13.56	Acres	Chloride	Nonpoint Source			
Lake Lindero	404.23	Low	13.56	Acres	Odors	Nonpoint Source			
Lake Lindero	404.23	Medium	13.56	Acres	Algae	Nonpoint Source			
Lake Lindero	404.23	Low	13.56	Acres	Trash	Nonpoint Source			
Lake Calabasas	405.21	Medium	28	Acres	Copper	Nonpoint Source			Elevated levels of copper in tissue.
Lake Calabasas	405.21	Low	28	Acres	Zinc	Nonpoint Source			Elevated levels of zinc in tissue.
Lake Calabasas	405.21	Low	28	Acres	Ammonia	Nonpoint Source			
Lake Calabasas	405.21	Medium	28	Acres	pH	Nonpoint Source			
Lake Calabasas	405.21	Medium	28	Acres	Org. enrichment/ Low D.O.	Nonpoint Source			
Lake Calabasas	405.21	Medium	28	Acres	Eutrophic	Nonpoint Source			
Lake Calabasas	405.21	Low	28	Acres	Odors	Nonpoint Source			
Lake Calabasas	405.21	High	28	Acres	DDT	Nonpoint Source			Elevated levels of DDT in tissue.

APPENDIX D: UK NATIONAL RIVER ASSOCIATION GUIDANCE NOTES

Introduction

The Environment Agency was created in 1996. It took over all the powers and duties of the National Rivers Authority, the Waste Regulations function of the County Councils and air quality functions from Her Majesty's Inspectorate of Pollution. It has a wide range of duties and powers relating to environmental management and improvement in the quality of air, land and water. As far as land use planning is concerned, it is a statutory consultee under the Town and County Planning Acts. It has the right to be consulted on development plans and on a range of planning applications. Over the last few years the emphasis has shifted from commenting on planning applications towards influencing development plans. We have also become involved in the preparation of Regional Planning Guidance with the result that the current round of RPGs contains comprehensive sets of environmental policies. The advantage is that subsequent development plans can be audited for compliance with their regional policies. This in turn will reduce the number of planning applications, which might infringe the Agency's interests. The interface between the Environment Agency and the planning system is set out in the document *'Liaison with Local Planning Authorities'*. The most important sections are set out below:

'Although the Environment Agency operates within an extensive regulatory framework, it must be recognized that our actual controls in respect of development are limited. The Agency is therefore dependent upon effective planning legislation to ensure the protection of the environment and to prevent future problems arising as a result of development.

The Agency liaises with Local Planning Authorities in order to:

- Advise on where proposed development may pose a risk to the public or to property from pollution and/or flooding;
- Protect the environment from any possible adverse effects of potential development;
- Wherever possible, enhance the environment in conjunction with development proposals.

Regional Planning Guidance

The Agency will promote our aims and objectives through contact with Planning Conferences and Government Offices at the regional level in the preparation of Regional Planning Guidance (RPG's). We recognize the value of including relevant issues and guidance at all levels of development planning.

Development Control

Nationally, the Agency comments on nearly 100,000 planning applications each year. Local Planning Authorities are responsible under Town and Country Planning legislation for consulting the Agency on certain planning applications and have discretionary powers regarding the referral of others.

Planning Appeals

The Agency may become involved in an Appeal if any one of the following situations arise:

- An objection made by the Agency is included as a reason for refusal;
- An objection made by the Agency was not included as a reason for refusal, but the Agency decides to follow up its objection as a third party, either by a written representation or by appearing at a hearing or public inquiry;
- A recommended condition was objected to by the appellant.

When required the Agency will appear at Examinations in Public and local Plan Inquiries to support Local Planning Authority policies which accord with our aims and objectives.

Local Environment Agency Plans (LEAPs)

LEAPs are non-statutory plans, which will complement areas of environmental policy and regulation for which Local Authorities have executive responsibility. First and foremost LEAPs provide an assessment of the work that the Environment Agency needs to do in a local area.'

The Environment Agency has a statutory duty to contribute towards the achievement of sustainable development. One method has been actively to promote good practice in sustainable construction. However sustainable development is also seen as including economic and social issues as well as environmental issues. The Agency has established a reputation of working closely with local planning authorities and the development industry to achieve environmental enhancements through the planning system. It is now seeking ways of working with potential new partners to establish how an enhanced environment can facilitate economic growth and alleviate social exclusion through the regeneration of the run down parts of our towns and cities. This will contribute to the re-development of 'brownfield' sites. Sir John Harman, Chairman of the Environment Agency, has summarized the position in the following terms:

- The Agency should be involved in urban regeneration;
- The Agency is concerned about the quality of life;
- Poor health and poor environmental quality go together;

- The environment has a key role in solving poverty; and
- We have a supporting rather than a leading role in social issues.

[Speech to Urban Lifestyles Conference – Institute of Landscape Architects – Newcastle 2000]

Similarly the House of Commons Select Committee into the Environment Agency (5) recognized that "a damaged environment impairs quality of life and at worst may threaten long-term economic growth".

Just as the preparation of the Regional Planning Guidance for the South East is reaching its conclusion so the development of the Spatial Development Strategy for London is just beginning. It is therefore an opportune moment to review how effective the intervention of the Environment Agency in regional planning has been to date and what its prospects may be for the future.

The Regional Planning Guidance for the South East

The current round of Regional Planning Guidance has presented the Environment Agency with an unparalleled opportunity to influence the town and county planning system from the top downwards. Furthermore it is a useful channel for promoting sustainable development.

SERPLAN – The London and South East Regional Planning Conference – was asked to provide advice on updating the strategy for the region (RPG 9). In 1996 the Environment Agency was invited to serve on SERPLAN's Natural Resources Group which was charged with advising on a range of environmental and infrastructural matters. It was quite unusual for any body outside local government to be involved directly with SERPLAN.

Over the next two years SERPLAN prepared *'A Sustainable Development Strategy for the South East'* (13). Its aim was to produce a more sustainable pattern of development and focused on making better use of the urban areas of the region with a less dispersed pattern of development and a reduced need for travel. Housing provision was to be more closely related to the potential for economic growth. All this would enhance the environment and protect the countryside.

The strategy was based on six policy themes:

Theme 1
Environmental Enhancement and Natural Resource Management
Theme 2
Encouraging economic success
Theme 3
Opportunity and Equity
Theme 4
Regeneration and Renewal

Theme 5
Concentrating Development
Theme 6
Sustainable Transport

The Environment Agency was involved in the policies in *Theme 1* which contained a range of policies which treats the region's environment as one of its key assets. A high quality environment was seen as essential/to the regions future prosperity. The Agency held a series of meetings with SERPLAN. Experts from our Thames, Anglian and Southern Regions provided advice on water resources, water quality, flood management, waste management, coastal issues, conservation, biodiversity, air quality, contaminated land and sustainable construction.

Much of the input was based on *'Thames Environment 21 – The Environment Agency strategy for land use planning in the Thames region*'. [Published in March 1998] (1). The scope and purpose of this initiative in regional environmental planning was set out in the Regional General Managers Preface:

'Thames Region is already intensively developed and faces pressures for further large-scale development. The Thames Environment 21 strategy provides an approach to achieving sustainable development in these demanding circumstances. It gives the key environmental issues that the Agency wishes to see addressed through the land-use planning system in Thames Region and indicates the enhancement and mitigation measures that are required from developers if the environment is to be protected and enhanced in the way we all want.

Thames Environment 21 will make a significant contribution to regional planning in terms of all the major environmental issues facing the Region. We are particularly keen to discuss these issues on a continuing basis with the Regional Standing Conferences, the London Planning Advisory Committee (LPAC), and the Government Offices for London and the South East. Thames Environment 21 will also assist in providing environmental input to the initial work of the future Greater London Authority and Regional Development Agencies.

We are discussing with the Regional Planning Conference for the South East (SERPLAN), the position concerning water resources. This is one of the most critical environmental challenges facing the Region and could be a constraint on future development.'

Of the eleven environmental policies those relating to water resources, flood management and the conservation of resources were seen as the most critical for promoting sustainable development in the region. The key points are:

Water Resources

The South East is the driest part of the country. The demand/supply balances of the water companies are narrower than in other parts of the country. In certain parts of the region potential shortfalls of supplies to serve the anticipated levels of housing development can be envisaged.

Flood Management

Pressures for development could result in new housing being built in areas at risk from flooding. Climate change could raise this risk. The Agency provides local planning authorities with indicative flood plan maps. The Agency is seeking to supplement this basic information with an indication of the relative risk of flooding of specific sites, and how such a risk might be managed.

Sustainable Construction

The policy on Conservation of Resources itemizes aspects of sustainable design, which should be provided through development plans, design guides and good practice notes.

'The design of development will be a major influence on the extent to which new development is sustainable, and will cumulatively be regionally significant. Aspects of sustainable design include:

- Use of waste prevention and minimization techniques or failing that the installation of pollution abatement technology to reduce emissions to air and water;
- Control measures for surface water drainage as close to its source as possible (including the attenuation of runoff to prevent flooding or erosion of watercourses);
- Building designs, which facilitate the use of renewable energy;
- The use of combined heat and power (CHP);
- Energy efficient installations, including passive solar design for buildings and improved insulation;
- Water efficient installations, including the use of grey water systems;
- The use of renewable and recycled materials during construction; and
- Design to facilitate recycling systems, including energy from waste.'

The Environment Agency has already taken the initiative in promoting sustainable construction. In April 1999 it published *'Enhancing the Environment – 25 Case studies from Thames Region'* (3). It has encouraged both local planning authorities and developers to build

environmental enhancements into their development proposals. The scope for enhancements includes the following:

River restoration and channel enhancement;
Surface water run off attenuation and source control;
Reed bed treatment for surface water;
Conservation, fisheries and landscape enhancements;
Enhanced recreation and education provisions;
Flood plain compensation schemes;
River bank enhancement works;
Clean up of contaminated land.

We have also assisted the Thames Valley Economic Partnership in producing '*Quality Living Smarter Housing*' (15). This is designed to show how pressures for housing in the Thames Valley can be achieved in a more sustainable manner and with less environmental impact than is the case with conventional housing. It provides examples of energy efficiency, water efficiency, sustainable urban drainage, landscape and garden design which contribute to energy conservation in buildings and minimal water use for gardens.

The Environment Agency has therefore already made good progress in promoting sustainability into the built environment.

The Crow Report

The Public Examination into the Regional Planning Guidance in the South East took place at Canary Wharf in May – June 1999 before a panel chaired by Professor Stephen Crow (12). The Environment Agency was invited to discuss 'The Development and Supply of Infrastructure – Waste and Water'.

A crucial aspect of debate was related to the level of housing proposed in the period up to 2016. The issue was whether SERPLAN's capacity based approach involving 'Plan, Monitor and Manage', was the correct one or whether the full demographic projections based on the Governments 'Projections of Households in England to 2016' should prevail. 'Plan, Monitor and Manage' was derided as 'fudge, dither and panic', and the Panel recommended the full demographic basis for housing provision. However, the Minister for Planning, Nick Raynesford, has since indicated that the Government had abandoned the "predict and provide" approach of Professor Crow, and that it would support "Plan, Monitor and Manage".

ANNUAL HOUSING NG RATES TO 2016

	LONDON	ROSE	TOTAL
RPG9 1994 Additional Dwellings 1991-2006	17,333	39,667	57,000
1992 Household Projects 1991-2016	23,000	44,120	67,120
SERP500 Dec 1999			
a) Baseline	22,000	34,480	56,480
b) Indicative Range to be planned for	22,000	35,680	57,680
	22,000	36,560	58,560
Report of Panel (Crow Report)	22,000	54,925	76,925
Draft RPG	23,000	43,000	66,000

The Panel considered water resources, water quality and flood management in the light of the higher figure. It took the view that water supply was but one factor influencing the location of new development. 'Social and economic considerations may often be more important and if they are then it is simply up to the water companies to do their duty cheerfully'.

The Panel did nevertheless recommend that RPG should 'encourage active conservation of water…. to ensure that all new developments meet these high standards of water efficiency'.

There was general agreement that development posed an unacceptable risk to the quality of water in the region's rivers. The Panel recognized that water quality was a material factor in considering future development allocations.

The reaction to the 'Crow Report' was split between the development industry, which was surprised and pleased at the recommendations for greater levels of housing, and SERPLAN and the local planning authorities who faced problems in finding sites for the additional development. The Environment Agency registered its concerns with the Government Office of the South East (GOSE) that a greater amount of housing aggravated its problems in terms of water supply and quality, and perhaps also increased the number of people who might be at risk from flooding, should additional development be permitted in the region's floodplains.

The Draft RPG

The Draft Regional Planning Guidance in the South East (RPG9)(4) was published in March 2000 to general criticism all round. The housing figures were broadly as recommended by the Panel. The guidance however, sought to minimize the impact on the environment by encouraging higher densities in urban areas. The public however expressed concern about the potential impact of development on the high quality environment in the South East.

SERPLAN not only challenged virtually every policy but also decided to recommend their original housing figures, as these had a coherent robust basis. Furthermore they expressed concern that their theme-based approach had been abandoned.

The Environment Agency raised many detailed criticisms and also stressed that the RPG could result in an unacceptable gradual erosion of the environment. It also objected to the failure of the RPG adequately to promote sustainable development. In particular water resources were not treated as a constraint on development and the policy on water quality had been omitted altogether.

In a press release accompanying its response the Agency said:

'…it is worried that proposed levels of growth in the region will result in unacceptable detriment to the environment unless the pressures they produce are managed to achieve a sustainable outcome'.

'The Agency is particularly concerned that there are insufficient water resources in areas such as the Thames Basin and Ashford in Kent to support planned development. It has also pinpointed towns such as Basingstoke, Ashford and Aylesbury where river water quality may be downgraded as sewage treatment works struggle to cope with increased volumes of effluent'.

At the time of writing the final RPG is awaited. It was due at the end of 2000 but there was a feeling that the contentious nature of the housing numbers could result in a considerable delay in publication.

The Spatial Development Strategy for London

The Greater London Authority took office in July 2000. The Environment Agency had been working for a year before this with the shadow organization to ensure that the environment is treated as a critical part of the city's natural capital. We monitored the GLA Bill through parliament to make sure that the Environment Agency would be consulted on the various strategies that the GLA will have to prepare. We also held conferences and breakfast meetings to identify the environmental issues that are of most concern to Londoners (2). Several 'cross –cutting' themes emerged as being of prime concern to Londoners. These were:

- London as a world class city;
- The health of its citizens and the influence of environmental conditions on their well being;
- The need to foster environmental awareness and civic pride;
- The role that ecological networks could play in urban regeneration;
- Concerns about capacities of sites and the potential density of development taking place on them.

The Agency is now engaged with the GLA in seeing how these issues may be developed and given expression in the GLA's strategies. Work is at an early stage but it is possible to give an indication of the potential that these crosscutting themes may open up.

The role that Ecological Networks could play in Urban Regeneration

London's waterways, including the Thames tributaries, substantially coincide with the city's Metropolitan Open Lands. A high proportion of Sites of Special Scientific Interest lie in these areas. The river corridors therefore offer a network for nature conservation, biodiversity and recreation. There will be an emphasis on restoring missing links in the network. The completion of the Thames path through the city provides an excellent example of what can be achieved in this respect. In this Report a recent report has indicated that although the quality of river water has improved across the country as a whole, there are significant cases in London where river quality is poor. This is caused by combined sewer overflows and plumbing of foul sewage into surface water drains. Water quality is an important element in urban regeneration. The development of waterside sites in, for example Leeds (7), Newcastle and Salford could not have taken place without the prior improvements in water quality.

Many of the locations for future major developments are adjacent to London's waterways. Whether they will be treated as a liability or an asset will depend on whether sufficient improvements in water quality can be achieved. Integrating phased improvements in water quality into the Town and Country planning system is a challenge that the Environment Agency is trying to address.

The Town and Country planning system has traditionally dealt with spatial issues. It has relied on constraints that can be readily shown on a map as its basis for environmental protection. Increased public pressure for addressing a wide range of environmental issues is resulting in an integration of urban physical planning and environmental management.

The River Ecosystem scheme, whilst a useful measure of water quality for the purposes of the Environment Agency, does not readily translate into land use planning. A better approach would be to recognize that incremental improvements to water quality do open up additional opportunities for land uses and development in general and for activities related to the waterside in particular.

The following progression would provide local planning authorities with specific objectives to be achieved during the lifetime of their development plans.

Threshold	Outcome
1) Very poor water quality	Developers turn their backs on the river and it has no recreational appeal.
2) Activities of volunteer groups in clearing rubbish and planting reeds, stabilizing banks and encouraging community projects	A less intimidating environment encourages access and a presumption against depositing litter and waste.
3) Upgrading of water quality so that it does not smell	Developers are prepared to face the river rather than back onto it.
4) Upgrading of water quality to a basic fishery standard	Wildlife returns, as do anglers and basic forms of waterside recreation. A waterside location becomes a significant selling point for properties.
5) Upgrading to good quality fisheries	Developers are prepared to make water a major feature of development. Contact water sports become possible and restaurants, bars and cafes are attracted to the waterside.

The next step will be draft policies for local planning authorities which will give practical effect to this high level aspiration.

A local planning authority could for example aim to move from Stage 2 to 3 within the first five years of a development plan and then from Stage 3 to 4 in the second five years. This would link into a phased program of urban regeneration.

The Health of London's Citizens and the Influence of Environmental Conditions Upon their Well being. (6)

Sustainable development is seen as including economic and social issues as well as the environment. Significant swathes across London suffer from declining industries, social exclusion and degraded environments.

London is a world-class city: a world-class financial center, a world cultural center, and a world heritage center. Nevertheless it contains some of the worst concentrations of urban deprivation and unemployment in the country in terms of both extent and intensity. Parts of inner London including the Lea Valley are characterized by above average unemployment rates, high levels of social deprivation, low skills levels, low educational attainment, poverty, poor health prospects, dependence on declining industries and derelict urban fabric.

Urban regeneration has been built on linking economic issues with land use planning. However, social issues in general and social exclusion in particular have not so far been well integrated into either economic or land use planning. Regeneration has been most successful where local authorities have moved away from their role of service providers and have acted as a catalyst for creating partnerships. The new Greater London Assembly has limited direct powers and its success will depend on how far it is able to develop this catalytic role.

The Government is committed to reducing health inequality (16). However, the gap between the health of rich and poor is widening. The Government's thinking appears to be less than wholly joined up. However, the Social Exclusion Unit looking at the relationships between poverty, health and regeneration, does not recognize the effects of environmental conditions (11).

Planning Policies

A number of areas of regional significance are identified in the Draft Regional Planning Guidance for the South East (4) as Priority Areas for Environmental Regeneration (PAERs). The criteria for designation include above average unemployment rates, high levels of social deprivation, low skills levels, dependence on declining industries, derelict urban fabric, peripherality and insularity. These areas need tailored regeneration strategies, backed up by appropriate resources, to address their problems and maximize their contribution to the social and economic well being of the region.

The Draft Regional Planning Guidance seeks to adopt an all-embracing approach to these issues by including the following policies:

The quality of life in urban areas, including suburban areas, should be raised through significant improvement to the urban environment, making urban areas more attractive places in which to live, work, shop, spend leisure time and invest, thus helping to counter trends to more dispersed patterns of residence and travel. (Q2)

Health, education and other social infrastructure requirements need to be taken into account fully in development planning throughout the Region. (Q6)

In order to address strategic spatial inequalities around the region, particular attention should also be given to actively supporting economic regeneration and renewal in Priority Areas for Economic Regeneration (PAERs). (RE7)

Similarly PPG3 states:

'The Government intends that everyone should have the opportunities of a decent home. They further intend that there should be greater choice of housing and that housing should not reinforce social distinctions…Now housing and residential environments should be well designed and should make a significant contribution to providing urban renaissance and improving the quality of life'.

It is clear that the planning policies are comprehensive in their approach to social and health issues but that mechanisms implementing these policies have some way to go.

Tackling these issues is going to involve creating a range of new partnerships. The Environment Agency is used to working closely with local planning authorities, the development industry, the water companies, and environmental interest groups. To deal with overlapping social

and environmental issues will mean involving bodies such as the Department of Health, the British Medical Association, health trusts, Directors of Public Health and Education and the Voluntary sector. The catalytic role of the Greater London Authority should encourage these linkages to be forged.

The Lea Valley

In order to examine the significance of the overlap between these social and environmental issues more fully, we have been studying a specific part of London which is characterized both by social exclusion and by relatively poor environmental conditions.

The Lower Lea Valley (from the M25 to the Thames) presents a major opportunity for improving economic, social and environmental conditions (8). Significant incidences of deprivation and social exclusion are matched by poor water quality, air quality problems, and concentrations of contaminated land.

Until the 1970s the area was a significant manufacturing center and relatively prosperous. The Lea Valley was home to a profusion of important industries including the design and manufacture of ships, boats, explosives, armaments, porcelain, bricks, perfume, chemicals, plastics, furniture, floor and wall coverings, vehicles and their accessories, rubber commodities, footwear, clothes, alcoholic beverages, musical instruments, office equipment, electronic and electrical goods. Many well-known companies disappeared from the Lea Valley. These include Bryant & Mays, Ediswan Lamps, Belling, Thermos, Thorn EMI, Royal Small Arms, JAP, Lebus Furniture and Gestetner (10).

The loss of Lea Valley industries in recent years has been caused by shifts in the manufacturing base. A rapid decline began in the 1970s, which resulted in a downturn in the local economy and social deprivation, with an urgent need for regeneration through public/private partnership.

Regeneration

The whole area enjoys Objective 2 status. This means that European funds can be made available for projects, which will initiate the social and economic regeneration of the area on a basis of matched funding. All six London Boroughs in the Lea Valley have submitted bids under the various Single Regeneration Budget 'rounds'. Single Regeneration Budget funding enables substantial private sector investment to be levered into the area for the benefit of the local community. Most of the Single Regeneration Budget bids reflect the fact that parts of the Lea Valley are amongst the most deprived in the country. The baseline information for one typical submission includes the following crucial statistics:

- A registered unemployment rate of 16% and 28% for black and ethnic minorities;

- A mean weekly income per household of £169.80;
- The standardized mortality ratio for men aged 15-64 is 76% higher than the national average and for women 50% higher;
- Illness rates are 40% higher than the national average;
- No direct public transport route to a general hospital providing outpatients and A&E services;
- The number of recorded crimes and offences per 1000 people is more than twice the figure for the borough and two and a half times the national average;
- 58% of people feel unsafe at night when walking alone;
- poor housing is the greatest source of local dissatisfaction (37%);
- a tenure mix where only 11% are owner occupiers or leaseholders (72% are council tenants);
- whilst Key Stage 2 and GCSE results are improving in most cases, they are still in a number of instances considerably below the national average.

In recent years a 'halo' effect from regeneration in Docklands and Stratford has taken place. This has been enhanced by the opening of the Jubilee Line extension. House prices in the London Boroughs of Newham and Tower Hamlets are rising rapidly, which may prove to be a spur for regeneration.

However this has not prevented the proximity of deprivation and poverty in, for example the Crossways estate in Tower Hamlets next to the conspicuous wealth of Canary Wharf. Priority is given to tackling the issues set out above. Environmental measures often consist of nothing more than improvements to the housing stock. Nevertheless there is substantial scope for improving the underlying situation relating to water quality, air quality, and contaminated land in the valley as a whole.

Water Quality

A fundamental problem for water quality in the Lea is the shallow gradient and consequent low velocity leading to de-oxygenation. The multiple sources of pollution of the River Lea demonstrate how complex it is to achieve significant improvements in water quality. They are: effluent from Sewage Treatment Works, stagnation, surface water run-off, combined sewer overflows, misconnection of domestic plumbing, discharge of untreated sewage at times of heavy flow and saline incursions at times of high incoming tides when salt water can sometimes flow over the top of Bow Locks.

Where the river and navigation are separate, flows are always low in the navigation and consequently water conditions are poorer. This does seem to pose a problem for Tower Hamlet's proposals to open up access to Limehouse Cut as part of its improvement to the Crossways Estate.

The Lea Valley Partnerships is running a project, which includes river restoration, habitat provision, and bankside improvements. They have a Single Regeneration Budget of £5m for a seven-year program to make a fundamental difference to water quality in the lower Lea. The quantity of surface water run-off from a largely urban catchment will prevent further improvements in water quality, as will the high bacteriological content which will pose a risk to health.

A prevalent issue is the misconnection of foul sewage to surface drains often through DIY plumbing. Tracing the source is not easy because of the large number of cases involved. Conversely there are instances of roof and surface water discharges connected to foul sewers. Where a foul sewer connects to a combined system surcharging can occur and foul sewage is discharged through combined sewer overflows into urban watercourses, with attendant health hazards.

Most of the water in the southern part of the lower Lea is of a quality only suitable for coarse fish populations. There are, however, reaches of poorer quality, which are likely to limit even these.

Thames Water has already made a considerable investment in its Abbey Mills Pumping Station. Its function is to pump sewage from the deep level sewers of north London into the Northern Outfall Sewer. The original building housing the pumps is a fine example of Victorian gothic design, which is now being restored to its former glory. However, to protect the River Lea against the failure of its ageing equipment, a new £26m pumping station has been constructed. This new station not only deals with existing sewers but also the new North London Flood Relief Sewer which provides 40,000 cubic meters of storage reducing the risk of flooding to approximately 800 dwellings.

The Asset Management Plan process will mitigate one irregular but highly undesirable occurrence. In times of heavy rainfall the Abbey Mills pumping station discharges raw, if dilute, sewage from the Northern Outfall Sewer into the River Lea. In future storage will be provided for the first 3 minutes worth of effluent and all effluent will be screened.

The quality of effluent from Deephams Sewage Treatment works is high but, because it discharges into the static water of the Lea and deoxygenation takes place. A fixed 'bubbler' is to be installed at Edmonton which will pump oxygen in at times of storm when surface water run-off is at its worst.

Further improvements will depend on:

a. Whether source control measures are included in major development projects;

b. Whether water companies are able to track down misconnections of foul sewage into surface drains;

c. Whether the problems of combined sewer overflows can be addressed;

d. The extent to which phosphate removal at Sewage Treatment Works upstream will reduce algal growth;

e. How soon British Waterways are able to provide additional gates at Bow Locks to prevent silt and salt water from entering the Lea Navigation and Limehouse.

Land Contamination

The Government's policy is to encourage the redevelopment of 'brownfield' sites. The Agency wishes to encourage the use of such sites as it can provide a positive contribution towards sustainable development with environmental, economic and social benefit, and the prudent use of a finite resource.

There are extensive old landfills, some of which are unlicensed. Local planning authorities have to publish a contaminated land strategy by July 2001. Until then, it is illegal to identify unlicensed sites in public. These are a serious issue in the Lea Valley. The proposed after-use of such sites determines the level of remediation.

In assessing the proposed remediation the Agency's comments as a consultee in the planning process are limited to the impact of the work on the aspects of environment for which the Agency has responsibility. Issues of risk to future inhabitants rest with the Environmental Health Department of the Local Authority.

Advice is now available (14), to ensure that appropriate action is taken to deal with existing contamination where it poses unacceptable risks to human health or to the environment. It stresses that even where expert assessment may indicate tolerable levels of risk, community perceptions may be very different.

The Lea Valley Park Authority

The Authority was set up in 1967. Since then, it has concentrated on transforming many areas of neglected desolation. It has acted as a direct provider of services. The emphasis is now to shift to developing the park and its open spaces for informal leisure and recreation. It will also promote formal sports and leisure. Its role will shift to that of leader, enabler, and facilitator in line with the new philosophy for local government of 'Best Value'. (9).

Plans are being formulated to build a stadium for the World Championship Athletics in 2005. It will be on the site of the Pickett's Lock Leisure Center. At present, feasibility studies are being carried out by the Lea Valley Park Authority. A planning application is expected in April 2001. Concern has been expressed about the construction of an Olympic standard athletics stadium adjacent to the Edmonton Incinerator which is about to be substantially expanded. However, the potential impact of the emissions would be insignificant against a background of vehicle emissions. The flue from the new incinerator will result in faster hotter emissions, which will rise further before spreading out. The effect will be to reduce levels of air pollution in the immediate surroundings.

Conclusions

Active participation in regional planning has been a novelty for the Environment Agency and the benefits are becoming apparent. There are significant comparisons and contrasts of our experiences between the Regional Planning Guidance for the South East and the Spatial Development Strategy in London.

The Environment Agency's involvement with RPG9 was essentially concerned with the Agency's functions. Originally SERPLAN sought advice on water resources and flood risk. But the scope of our advice was subsequently substantially widened. The Greater London Authority has initially sought advice on water issues. However our input is likely to develop on the lines of the crosscutting themes set out above.

The RPG process has been lengthy – more than four years to date. In contrast the GLA is required to produce its strategies to a very short timetable. Whereas SERPLAN's strategy was comprehensively thought through the GLA is bound to restrict itself to identifying issues with back up material from earlier studies by the London Planning Advisory Committee.

RPG will provide advice for local planning authorities to prepare their development plans. Should the advice be ignored and policies on key issues omitted there is a sound basis for challenging the content of development plans. The Environment Agency finds that this additional safeguard is very useful. Having its interests covered by development plan policies has proved very helpful. We have, for example found that where there is no policy which protects the floodplain from development, our advice on individual applications for development in the flood plain has not always been heeded. However, where there is such a policy our advice is only ignored under very rare circumstances. The GLA's strategies, whilst they will provide some advice to London Boroughs, will also seek to influence a range of issues which are normally outside the scope of land use planning.

There is little doubt that the Environment Agency has improved its effectiveness in the Town and Country Planning System through its involvement in regional planning. This applies not only with its functions but also through policies covering sustainable construction which to date has been the most obvious manifestation of making a contribution towards sustainable development.

The author is grateful to the Environment Agency for permission to contribute to this chapter. The views are those of the author and do not necessarily reflect the policies of the Environment Agency.

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APPENDIX E: PROPOSITION 13 EXECUTIVE SUMMARY

Nonpoint Source Pollution Control and Watershed Programs
Implementation Grants
Division of Water Quality
State Water Resources Control Board

EXECUTIVE SUMMARY

The purpose of this document is to announce the availability of water quality grants that the Division of Water Quality, State Water Resources Control Board (SWRCB), intends to offer in calendar year 2001 with funds made available through the passage of the Costa-Machado Water Act of 2000 (Prop 13). The Request for Proposal package includes the four exhibits: (1) Chapter 6, Article 2, Watershed Protection Program, (2) Chapter 7, Article 2, Nonpoint Source Pollution Control Program, (3) Chapter 7, Article 5, Coastal Nonpoint Source Control Program, and (4) the Application Reference Document (ARD). Attached are brief summaries of Exhibits I, II, and III. Please read the enclosed materials carefully and contact your Regional Water Quality Control Board (RWQCB) (see attached contact list) to determine your eligibility for funding by these programs.

REQUEST FOR PROPOSALS
COSTA-MACHADO WATER ACT OF 2000 (PROP 13) SFY 2000-01 GRANTS

EXHIBIT I – Watershed Protection Program ($8,400,000)
EXHIBIT II – Nonpoint Source Pollution Control Program ($9,200,000)
EXHIBIT III – Coastal Nonpoint Source Control Program ($2,200,000)
EXHIBIT IV – Proposition 13 RFP Application Reference Document (ARD)

Deadline for Proposals: All proposals must be received by the SWRCB by the close of business or postmarked by the U.S. Postal Service no later than February 1, 2001. Proposals sent by any express courier service (Federal Express, UPS, U.S. Mail Next day, etc.) must arrive by close of business (5:00 p.m.) February 1, 2001 at 1001 I Street, 15th Floor, Sacramento, CA. Late proposals, those that arrive after 5:00 p.m. February 1, 2001 (except packages with U.S. postmarks of February 1, 2001), will be disqualified. (The SWRCB receives the original and 11 copies of each proposal.)

Proposals should be sent or delivered to ATTN: Julie Bock, Cal EPA (Joe Serna, Jr. Building), State Water Resources Control Board, Division of Water Quality, 1001 I Street, 15th Floor, Sacramento, California, 95814.

Although this entire Request for Proposal (RFP) package serves to solicit requests for all three subaccounts, a separate application is required for each subaccount.

All text in italics is taken directly from Prop 13. The complete text of each subaccount is reprinted in the ARD, Section 12.

After reading these materials, if you have any questions or need further assistance, please contact your RWQCB contact listed in the attached list. If you are unable to reach your RWQCB or SWRCB contact, you may call the following staff who will direct your call to the appropriate staff.

Julie Bock
Watershed Pollution Prevention Section
Division of Water Quality
916/341-5906

- or -

Monica Torres
Watershed Projects Support Section
Division of Water Quality
916/341-5494

This document and other reference documents are available from the RWQCBs, the SWRCB, or electronically from the SWRCB Home Page at http://www.swrcb.ca.gov/prop13/index.html.

RWQCB Prop 13 Contacts for Assistance or Information

Janet Blake or Robert Klamt
NORTH COAST REGION (1)
5550 Skylane Boulevard, Suite A
Santa Rosa, CA 95403
(707) 576-2805 – Blake
(707) 576-2693 - Klamt
FAX: (707) 523-0135

Linda Spencer or Dale Hopkins
SAN FRANCISCO BAY REGION (2)
2101 Webster Street, Suite 500
Oakland, CA 94612
(510) 662-2420 – Spencer
(510) 622-2362 – Hopkins
FAX: (510) 622-2460

Alison Jones or Sorrel Marks
CENTRAL COAST REGION (3)
81 Higuera Street, Suite 200
San Luis Obispo, CA 93401-5427
(805) 542-4646 – Jones
(805) 549-3965 – Marks
FAX: (805) 543-0397

Raymond Jay (Nonpoint Source [NPS] and Coastal NPS)
Shirley Birosik (Watershed Protection Program)
LOS ANGELES REGION (4)
320 West 4th Street, Suite 200
Los Angeles, CA 90013
(213) 576-6689 – Jay
(213) 576-6679 – Birosik
FAX: (213) 576-6686

Jerry Bruns, Jeanne Chilcott, Val Connor, or
Rudy Schnagl
CENTRAL VALLEY REGION (5S)
3443 Routier Road, Suite A
Sacramento, CA 95827-3098
(916) 255-3093 – Bruns
(916) 255-3088 – Chilcott
(916) 255-3111 – Connor
(916) 255-3101 – Schnagl
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Dennis Heiman
CENTRAL VALLEY REGION
REDDING OFFICE (5R)
415 Knollcrest Drive
Redding, CA 96002
(530) 224-4851
FAX: (530) 224-4857

Betty Yee
CENTRAL VALLEY REGION
FRESNO OFFICE (5F)
3614 East Ashlan Avenue
Fresno, CA 93726
(559) 445-5128
FAX: (559) 445-5910

Cindy Wise
LAHONTAN REGION (6SLT)
2501 South Lake Tahoe Blvd.
South Lake Tahoe, CA 96150
(530) 542-5408
FAX: (530) 544-2271

Doug Feay
LAHONTAN REGION
VICTORVILLE OFFICE (6V)
15428 Civic Drive, Suite 100
Victorville, CA 92392
(760) 241-7353
FAX: (760) 241-7308

John Carmona
Ben Zabinsky
COLORADO RIVER BASIN
REGION (7)
73-720 Fred Waring Drive, Suite 100
Palm Desert, CA 92260
(760) 340-4521 – Carmona
(760) 776-8981 – Zabinsky
FAX: (760) 341-6820

Wanda Smith or Hope Smythe
SANTA ANA REGION (8)
3737 Main Street, Suite 500
Riverside, CA 92501-3339
(909) 782-4468 – Smith
(909) 782-4493 – Smythe
FAX: (909) 781-6288

Mark Alpert
Bob Morris
Bruce Posthumus
SAN DIEGO REGION (9)
9771 Clairemont Mesa Blvd., Suite A
San Diego, CA 92124
(858) 467-2963 – Alper
(858) 467-2963 – Morris
(858) 467-2964 – Posthumus
FAX: (858) 571-6972

The names in **BOLD** are the primary contacts. Please call them first when calling the RWQCB contacts.

SWRCB Contacts

Ken Harris
Division of Water Quality
1001 I Street, 15th Floor
Sacramento, CA 94244-2130
(916) 341-5500
FAX: (916) 341-5470

Jean Ladyman
Division of Water Quality
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(916) 341-5475
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GENERAL SUMMARY OF REQUEST FOR PROPOSAL EXHIBITS

Request For Proposal	For Projects of this Type:	Geographic Area	Who is eligible to Apply	Amounts that can be requested	Matching Funds Required	Total Amount Available This State Fiscal Year
Watershed Protection Program **(Exhibit I)**	Watershed Planning Implementing nonpoint source pollution control projects that are consistent with local watershed plans and Regional Board water quality control plans **Note**: funding priority will be given to the projects that result in the development of local watershed plans	Statewide	Municipalities, Local agencies, Nonprofits **NOTE**: State and Federal Agencies are not eligible	$50,000 minimum to $5,000,000 maximum	**none**	$8,400,000
Nonpoint Source Pollution Control Program **(Exhibit II)**	Implementing nonpoint source pollution control projects that are consistent with local watershed plans and Regional Board water quality plans	Statewide	Local agencies, Nonprofits **NOTE**: State and Federal Agencies are not eligible	$50,000 minimum to $5,000,000 maximum	**Yes**—On Capitol Cost portion of the project	$9,200,000
Coastal Nonpoint Source Pollution Control Program **(Exhibit III)**	Implementing nonpoint source pollution control projects that are consistent with local watershed plans and Regional Board water quality plans	near coast areas (boundaries of Regional Boards 1, 2, 3, 4 ,8 ,and 9 only)	Municipalities, Local agencies, Nonprofits, Educational Institutions **NOTE**: State and Federal Agencies are not eligible	$50,000 minimum to $1,000,000 maximum (this RFP only)	**Yes**—On Capitol Cost portion of the project	$2,200,000

PROPOSITION 13

Chapter 6
Article 2. Watershed Protection Program

A. Appropriation - $90,000,000

B. Allocation

1. 60% to projects in Los Angeles, Orange, Riverside, San Diego, San Bernardino and Ventura Counties
2. 40% to projects in counties other than those listed above.
3. At least $35,000,000 for grants to small communities (10,000 persons or less). If the Board determines that any of the funds made available for grants under this section will not be encumbered on or before January 1, 2007, the Board may use these funds for other purposes of this article.
4. $2,000,000 to the Pajaro River Watershed Flood Prevention Authority for a hydrologic study with regard to the Pajaro River Watershed.
5. $1,000,000 to the county of Sonoma to develop and implement community-based watershed management activities that will protect, restore, and enhance the environmental and economic value of the Russian River Watershed in the County of Sonoma.
6. $5,000,000 for the Clover Creek Flood Protection and Environmental Enhancement Project to provide for the acquisition, restoration, and conservation of low-flow stream channel, open water, seasonal wetlands, riparian habitat, oak woodland regeneration, and grassland meadow preservation.
7. $2,000,000 to rehabilitate and improve the Clear Lake Watershed by funding one or more of the following projects or activities: Clear Lake Basin 2000 Project, aeration, wetlands restoration, fishery enhancement, and wastewater treatment, or for grants warded by the board to local public agencies for any of these purposes. The first priority for funding under this subdivision is for a grant award to fund eligible expenses of the Basin 2000 Project.
8. Not more than 5% of the total amount may be used to pay for administration of this article.

C. Grant Amounts

1. Not to exceed $5,000,000 per project for projects that implement methods for attaining watershed improvements or for a monitoring program described in a local watershed management plan. Minimum project amount will be $50,000.
2. Not to exceed $200,000 to municipalities, local agencies, or nonprofit organizations for the development of local watershed management plans. Minimum project amount will be $50,000.
3. Grants may be awarded to meet nonfederal matching funds for 205(j) or 319(h).
4. At least 85 percent of the total amount in the subaccount shall be used for capital outlay projects.

D. Requirements of the Board

1. Make available the project final report to interested federal, state, and local agencies and other interested parties.

2. Prepare and submit to the governor a biennial report regarding the implementation of this article.

3. Terminate any project not providing proposed watershed benefits.

E. Purposes of the Article

1. Develop local watershed management plans or
2. Implement projects that are consistent with local watershed management and regional water quality control plans.

F. Grant Recipients

A municipality, local agency, or nonprofit organization may only receive a grant under this article if the Board determines that both of the following apply:

The municipality, local agency, or nonprofit organization has adequate legal authority to manage the grant money.

The municipality, local agency, or nonprofit organization is a member of a local watershed group.

They must also:

1. Secure public agency approvals, entitlements and permits.
2. Notify adjoining landowners of their request for funding and the scope of the project.

G. Project Elements

In awarding grants under this article, the board shall consider the extent to which projects do the following:

1. Consider the entire ecosystem to be protected or restored.
2. Include definable targets and desired future conditions.
3. Include community decision making by affected stakeholders in project design and fund allocation.
4. Help protect intact or nearly intact ecosystems and watersheds.
5. Maximize use of restoration funds.
6. Include an education component, if appropriate.
7. Obtain written permission from landowners of the parcel of land upon which the project is proposed to be carried out.
8. Projects shall be designed to withstand substantial flooding.
   a. Include a 10-year maintenance program.
   b. Demonstrate the potential to provide watershed benefits for 20 years.

Available for Projects in FY 2000-01: approximately $8,400,000

There may be errors and omissions in this summary. For actual 2000 Bond Language, refer to Exhibit IV, Application Reference Document, of the Request for Proposal package.

Chapter 7
Article 2. Nonpoint Source Pollution Control Program

A. Appropriation - $100,000,000

B. Allocation
1. 60% to projects in Riverside, Ventura, Los Angeles, San Diego, Orange, and San Bernardino Counties. 40% to all other Counties.

2. 79114.2. "Notwithstanding any other provision of this article, the sum of five million dollars ($5,000,000) is hereby appropriated from the subaccount, to the board to be used by the board, after consultation with the Department of Food and Agriculture, for loans, not to exceed five hundred thousand dollars ($500,000) per loan, to provide low interest loans to finance the construction of projects designed to manage animal nutrients from animal feeding operations. Grants may be made available to local public agencies to pay for the cost of developing ordinances, regulations, and elements for their General Plan or other planning devices to assist in providing uniform standards for the permitting and operation of animal feeding operations within their jurisdictions. These funds may also be used for the preparation of the related environmental reviews that may be necessary under the California Environmental Quality Act (Division 13 (commencing with Section 21000) of the Public Resources Code) for approval of the devices."

3. $10,000,000 to be used as follows:
   (1) $2,000,000 for research and pesticide source identification.
   (2) $8,000,000 for mitigation measures to protect water quality from potential adverse effects of pesticides, which measures have the ability to provide benefits for a period of 20 years as determined by the Board after consultation with the Department of Pesticide Regulation and the Office of Environmental Health Hazard Assessment.
   (3) The Board shall adopt regulations to carry out this section.

4. Not more that 5% of the total amount may be used to pay for administration of this article.

C. Grant Amounts

1. Not to exceed $5,000,000 for local agencies or nonprofit organizations.

2. 5% may be awarded for demonstration projects that are intended to prevent, reduce, or treat nonpoint source pollution.

D. Loan Amounts

The sum of $5,000,000 is appropriated to be used by the board for loans not to exceed $500,000 per loan to provide low interest loans to finance the construction of projects designed to manage animal nutrients from animal feeding operations.

E. Purpose of the article is to provide grant funding for projects that protect the beneficial uses of water throughout the state through the control of nonpoint source pollution.

F. Eligible Projects

1. Consistent with local watershed management plans.
2. Projects identified in the Board's "Initiatives in NPS Management."
3. Consistent with the "Integrated Plan for Implementation of the Watershed Management Initiative."
4. Implements management measures and practices identified by the Board pursuant to its nonpoint source pollution control program's 15-year implementation strategy and five-year implementation plan.

G. Project Elements

1. Demonstrate a capability of sustaining water quality benefits for a period of 20 years.
2. Have defined water quality or beneficial use goals.

There may be errors and omissions in this summary. For actual 2000 Bond Language, refer to Exhibit IV, Application Reference Document, of the Request for Proposal package.

3. Use best management practices, management measures, or both.
4. If the project consists of capital expenditures for construction, the grant recipient shall provide matching contributions as follows:

Project Capital Cost/Capital Cost Match by Recipient

$1,000,000 to $5,000,000 inclusive	20%
$125,00 to $999,999 inclusive	15%
$1 to $124,999 inclusive	10%

5. Provide a monitoring and reporting plan.
6. Prepare a final report.

Available for Projects in FY 2000-01: approximately $9,200,000

There may be errors and omissions in this summary. For actual 2000 Bond Language, refer to Exhibit IV, Application Reference Document, of the Request for Proposal package.

Article 5. Coastal Nonpoint Source Control Program

A. Appropriation - $90,000,000

B. Allocation

1. 60% to projects in Riverside, Ventura, Los Angeles, San Diego, Orange, or San Bernardino Counties.
2. 40% to projects in the counties not described above.
3. $4,000,000 to the City of Huntington Beach.
4. $3,000,000 to the San Diego County Water Authority for environmental studies and engineering studies for the San Diego Regional Conveyance Facility.

C. Grant Amount – not to exceed $5,000,000

D. Loan Amount – no to exceed $5,000,000 (**for this RFP $1,000,000)** to municipalities, local public agencies, educational institutions, or nonprofit organizations.

E. Requirements of the Board

1. Provide opportunity for public review and comment in awarding funds pursuant to this article.
2. May, in consultation with the California Coastal Commission, adopt regulations to implement this article.

F. Purpose of this Article

Restoring and protecting the water quality and environment of coastal waters, estuaries, bays, and near share waters and ground waters.

Grants may be awarded for any of the following projects:

1. A project designed to improve water quality at public beaches and to make improvements for the purpose of ensuring that coastal waters adjacent to public beaches meet the bacteriological standards set forth in Article 2 (commencing with Section 115880) of Chapter 5 of Part 10 of Division 104 of the Health and Safety Code.
2. A project to provide comprehensive capability for monitoring, collecting, and analyzing ambient water quality, including monitoring technology that can be entered into a statewide information base with standardized protocols and sampling, collection, storage and retrieval procedures.
3. A project to make improvements to existing sewer collection systems and septic systems for the restoration and protection of coastal water quality.
4. A project designed to implement storm water and runoff pollution reduction and prevention programs for the restoration and protection of coastal water quality.
5. A project that is consistent with the state's nonpoint source control program, as revised to meet the requirements of Section 6217 of the federal Coastal Zone Act Reauthorization Amendments of 1990, Section 319 of the federal Clean Water Act (33 U.S.C. Sec. 1329), and the requirements of Division 7 (commencing with Section 13000).

In addition to the grants, the board <u>may</u> make loans not to exceed $5,000,000 per project to municipalities, local public agencies, educational institutions, or nonprofit organizations.

<u>Only projects located with the boundaries of the coastal Regional Water Quality Control Boards (RWQCBs) (North Coast RWQCB, San Francisco Bay RWQCB, Central Coast RWQCB, Los Angeles RWQCB, Santa Ana RWQCB, and San Diego RWQCB) are eligible under this program.</u>

G. Project Elements

1. Submit to the Board a monitoring and reporting plan that does all of the following:
   a. Identifies the nonpoint source or sources of pollution to be prevented or reduced by the project.
   b. Describes the baseline water quality or quality of the environment to be addressed.

There may be errors and omissions in this summary. For actual 2000 Bond Language, refer to Exhibit IV, Application Reference Document, of the Request for Proposal package.

c. Describes the manner in which the project will be effective in preventing or reducing pollution and in demonstrating the desired environmental results.

2. Secure public agency approvals, entitlements, and permits.
3. If the project consists of capital expenditures for construction, the grant recipient shall provide matching contributions as follows:

Project Capital Cost/Capital Cost Match by Recipient

$1,000,000 to $5,000,000 inclusive	20%
$125,00 to $999,999 inclusive	15%
$1 to $124,999 inclusive	10%

4. Award no more than 25% of the grant in advance of expenditures.
5. Consistent with coho salmon, steelhead trout, or other threatened or endangered aquatic species recovery plans.
6. Demonstrate capability of contributing to sustained, long-term water quality environmental restoration or protection benefits for a period of 20 years.
7. Prepare a final report.

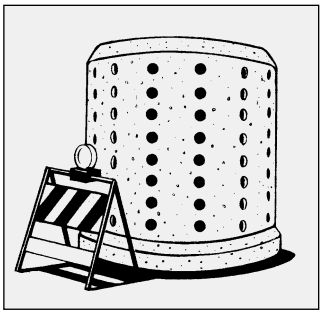
Available for Projects in FY 2000-01: approximately $2,200,000
Reference Document, of the Request for Proposal package.

There may be errors and omissions in this summary. For actual 2000 Bond Language, refer to Exhibit IV, Application Reference Document, of the Request for Proposal package.

APPENDIX F: DOWNSPOUT CONNECTION PROGRAM

Things to Remember While Examining Your Downspouts

Is it possible to disconnect a downspout to the driveway?



Yes. New separated storm sewers and large sumps have been installed in many streets to prevent street runoff from entering the combined sewer system and causing overflows. If your neighborhood streets have been sumped, you can route a downspout to the driveway with just an elbow if the driveway slopes toward the street and away from any houses. If you are not sure if your neighborhood streets have been sumped please call 503-823-5858.

Can any material be used when disconnecting downspouts from the combined sewer?

No. You should use durable, gutter-grade materials. Black flex hose, roll-out hose, and other plastic material (other than PVC and ABS) are not considered long-wearing and therefore will not be acceptable material for the Downspout Disconnection Program. Only "Flex-A-Spout" brand corrugated hose is accepted due to the fact it is UV protected.

Can I get around obstacles and slope problems using basic downspout material?

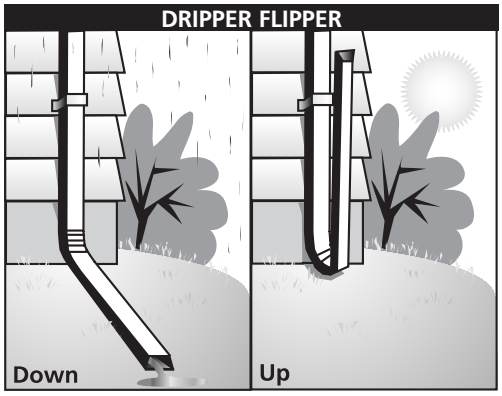
Yes. Be creative; you can use a combination of elbows and extensions to help route water away from property lines, trees, shrubs, and pathways to a safe location.

Can I use a rainbarrel, pond, or drainage swale to redirect stormwater runoff?

Yes. Downspout disconnection can be a great source of water for your landscape. Rain barrels are simple to install. Other methods include drainage swales, recirculating streams, pools, or ponds. Call 503-823-5858 for more information.

Is there a downspout extension that can be moved out of the way when I mow my lawn?

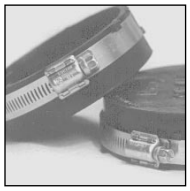
Yes. A "Dripper Flipper" is simply an elbow and an extension that has been hinged together so that it can be flipped up against the house when you need access during dry weather. Or you can install a Gutter World brand "Flex-A-Spout" which is a corrugated polyethylene hose that can be attached to the end of the downspout. These products can be found in some hardware and home improvement stores; we recommend you call first to make sure the item is in stock.



Do I have to seal the combined sewer standpipe?

Yes. The standpipe must be sealed to prevent things from getting in or out of the sewer pipe. In most cases, you should be able to use a wing nut test plug. You can also use a simple rubber cap secured by a hose clamp.

Plug



Cap

Are there other options for downspouts that cannot be disconnected to simple surface systems?

Yes. Downspouts can sometimes be relocated to a more appropriate drainage location. Environmental Services staff can help you determine if this would be a reasonable option for your property.

Roof runoff can also be directed to an underground dry well which would allow the water to soak into the soil. This system can be installed in places where downspout extensions are not appropriate because of space requirements or drainage concerns. City permits and inspection are required for this option.

One is better than none! Even if you disconnect just one downspout, you will help make our rivers cleaner.

ENVIRONMENTAL SERVICES
CITY OF PORTLAND
CLEAN RIVER WORKS
Dean Marriott, Director
Please call 503-823-5858 (TDD 823-6868) for assistance or information

ES 0004 1-2000

APPENDIX G: SUMMARY OF REFERENCE FROM PREVIOUS STUDIES

Much work has already been accomplished within the Malibu Creek watershed that directly relates to water quality/quantity issues as well as habitat management. Within the Framework outlined in Section 1 above, the studies, goals, and accomplishments completed to date are identified.

Phase II. Understanding Resources – Information Gathering

Water Quality

Los Angeles Regional Water Quality Control Board (LAWQCB)1994 Basin Plan - study of water quality within Malibu watershed – used existing water quality data

Heal the Bay, CA State Coastal Conservancy & Graduate Dept. of Landscape Architecture (CSU Pomona), 1998. Malibu Creek Watershed: A Framework for Monitoring, Enhancement & Action. Designed citizen volunteer water quality monitoring program for Malibu Watershed

Monitoring and Modeling Subcommittee, 1999, ongoing. *Watershed-wide Monitoring Program*. Completion of draft plan calling for the coordination of existing monitoring programs and supplementary monitoring for entire watershed.

County of Ventura, 1997-1998. *Malibu Creek Watershed Runoff Characterization Study*. Monitored water quality at three locations for water quality during 2 consecutive years, during a total of 5 storm events.

Water Quantity

Las Virgenes Municipal Water District & American Water Works Association Research Foundation, 1998. Water Conservation Study. Gathered information on water use in individual homes in Malibu watershed.

Natural Resources

Josselyn, M. S. Chamberlain, P. Goodwin, & K. Cuffe, 1993. Wetland Inventory and Restoration Potential, Santa Monica Bay Watershed, Santa Monica Bay Restoration Project.

Manion, B. Sean & J. H Dillingham, 1989. Malibu Lagoon: A Baseline Ecological Survey. Topangas-Las Virgenes Resource Conservation District Publication.

Las Virgenes Municipal Water District, 1997-1999. *Steelhead Protection Studies.* Examined temperature ranges in Malibu Creek to determine acceptable limits for steelhead; compiled data on steelhead in Malibu Creek; performed water audit of riparian vegetation in Malibu Creek to determine minimum flow requirements to sustain steelhead.

Entrix, Inc., 1994. Characteristics of Pool, Channel Form, and Surficial Fine Sediment Over Time, Malibu Creek, Los Angeles County.

T. P. Keegan, 1990. Malibu Creek-Santa Monica Mountains, Steelhead Investigations. Prepared by Entrix, Inc., Walnut Creek, CA.

United States Department of Agriculture. Soil Conservation Service, 1994. Comprehensive Malibu Creek Watershed Mediation Effort.

Swift, Camm C., J. L. Nelson, C. Maslow, & T. Stein, 1989. Biology and Distribution of the Tidewater Goby *Eucyclogobius newberryi* (Pisces: Gobidae) of California. In: Contributions in Science. 404:1-19. Natural Museum of Los Angeles County.

Resource Conservation District of Santa Monica Mountains, 1996-current. Effects of San Breaching the Sand Barrier on Biota at Malibu Lagoon. Survey of avifauna, fish, and monitoring of water quality parameters.

Orme, A., *et al.*, 2000. *Hydrology and Morphodynamics, 1997-98.* Ch 2 in: Lower Malibu Creek and Lagoon Resource Enhancement and Management Final Report to the California Coastal Conservancy. Examined estuary-lagoon-barrier morphodynamics of the Lower Malibu Creek and Lagoon.

Rundel, P., 2000. *Vegetation.* Ch 4 in: Lower Malibu Creek and Lagoon Resource Enhancement and Management Final Report to the California Coastal Conservancy. Assessed and mapped vegetation in Lower Malibu Creek and Malibu Lagoon.

Phase III. Evaluate and Assess Resources & Inputs

Water Quality

Los Angeles Regional Water Quality Control Board (LAWQCB) 1994 Basin Plan – list of water quality impairments in Malibu watershed.

Santa Monica Bay Restoration Project, 1994. The Review of Monitoring and Response Protocol for the Malibu Creek Watershed, prepared by Heather Trim.

Ambrose, Richard F., Irwin H. (Mel) Suffet, and Shane S. Que Hee. March 1995. *Enhanced*

Environmental Monitoring Program at Malibu Lagoon and Malibu Creek. University of California, Los Angeles. Assessed the anthropogenic input into Malibu Creek & Lagoon on the physical, chemical, and biological processes in the Creek and Lagoon.

Santa Monica Bay Restoration Project, 1992. Pathogens and Indicators in Storm Drains Within the Santa Monica Bay Watershed.

Warshall, Peter, & Philip Williams & Associates, Ltd., 1992. Malibu Wastewater Management Study, A Human Ecology of the New City.

LVMWD, 1997-2000. Malibu Creek Discharge Avoidance Study. Assessment of the options for disposal of tertiary treated wastewater from Tapia treatment plant.

Suffet, I.H, & S. Sheehand, 2000. *Eutrophication*. Ch. 5 in: Lower Malibu Creek and Lagoon Resource Enhancement and Management Final Report to the California Coastal Conservancy. Developed Malibu Lagoon Eutrophication Model to predict nutrient loading into Malibu Lagoon under different hydrodynamic conditions and biological mechanisms.

Gerba, C. J. Naranjo & P. Orosz-Coghlan, 2000. *Management Pathogen Study*. Ch. 6 in: Lower Malibu Creek and Lagoon Resource Enhancement and Management Final Report to the California Coastal Conservancy. Study to assess the occurrence of pathogenic protozoan parasites and enteric virus in lower Malibu Creek and the surf zone.

Venkatesan, M.I, 2000. *Hydrologic Alteration and Human Disturbance*. Ch. 7 in: Lower Malibu Creek and Lagoon Resource Enhancement and Management Final Report to the California Coastal Conservancy. Study examined possible hydrologic connection between City of Malibu storm drains and septic systems to the lower Malibu Creek and estuarine lagoon.

City of Malibu, 1999. Septic Tracer Study. Assessment of septic system input to lower Malibu Creek and Lagoon from Cross Creek shopping center.

Heal The Bay, 1999. Septic Systems in Malibu. Estimated number of multi-family and commercial septic systems located in Lower Malibu Creek watershed. Summary of actions included in report.

Natural Resources

Franklin, Robert F. & Soyka Dobush, 1989. Malibu Creek Steelhead Habitat Assessment and Recommendations for Fish Passage. Prepared by ENTRIX for California Trout Inc.

Humbolt State University, 1989. Overview of Wetland Opportunities of Malibu Creek Watershed. Environmental Resources Engineering Department.

United Stated Department of Agriculture, Natural Resources Conservation Service, 1995. Malibu Creek Watershed, Technical Documentation. Nitrogen and Phosphorous Analysis, Final Plan.

Army Corps of Engineers, Steelhead Recovery Task Force. Feasibility Study: Evaluation of Rindge Dam for Removal. Reconnaissance study to determine support level among stakeholders in removing Rindge Dam. Study not started.

Ambrose, R. J. Lilien, & G. Coffman, 2000. *Wetland Restoration.* Ch 9 in: Lower Malibu Creek and Lagoon Resource Enhancement and Management Final Report to the California Coastal Conservancy. Potential restoration areas in the Lower Malibu Creek and Malibu Lagoon were identified and assessed.

Phase IV. Set Management Goals for Watershed

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Phase V. Set and Implement Management Practices and Policies to Achieve Goals

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Resource Conservation District, Santa Monica Mountains, 1997. Stable and Horse Management in the Malibu Creek Watershed, A Manual on Best Management Practices for the Reduction of Non-Point Source Pollution.

City of Malibu, 2000. Urban Runoff Treatment Facilities at Malibu Lagoon. Installed treatment facility to treat urban runoff from one of main discharge points into Malibu Lagoon.

Ambrose, R. & J. Lilien, 2000. *Management Alternative* & *Summary of Management and Restoration Alternatives*. Chs. 8 & 10 in: Lower Malibu Creek and Lagoon Resource Enhancement and Management. Final Report to the California Coastal Conservancy. Chapter 8 presents the environmental problems of the

Lower Malibu Creek and Malibu Lagoon in terms of biota, habitat, and water resources. Alternatives for managing these problems were developed and evaluated for feasibility, cost effectiveness, environmental impact, and potential for controversy. Chapter 10 summaries both Chapter 8 and 9 (Wetland Restoration) of the document to identify critical issues for pursuit of future management and restoration options, as well as the resolution of inconsistencies, and the development of clear directives for agencies and stakeholders.

Natural Resources

Ambrose, R. 1999. Lower Malibu Creek and Barrier Lagoon System Resource Enhancement and Management. Assessed lower Malibu Creek watershed and lagoon, recommended management alternatives for restoration implementation, protection, and management activities.

Resource Conservation District of Santa Monica Mountains, Heal The Bay, 1991. *Tidewater Goby Reintroduction to Malibu Lagoon.* Project reintroduced 54 tidewater gobies into Malibu Lagoon.

Resource Conservation District of Santa Monica Mountains, 1995-1996. *Restoration of Malibu Lagoon Bird Peninsula and Mud Flats.* Removed fill material within lagoon to restore aquatic & mudflow habitat.

Resource Conservation District of Santa Monica Mountains, 1996-1998. *Sediment Reduction and Streambank Stabilization – Las Virgenes Creek.* Restored a 200-foot section of Las Virgenes Creek to reduce sedimentation.