# ATTACHMENT B

# City of Albany Watershed Management Plan

# October 1998

# City of Albany

## Watershed Management Plan

Prepared by the City of Albany
in consultation with
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Balance Hydrologics, Inc.
Botanical Consulting Services

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**LETTER OF TRANSMITTAL**

DATE: August 14, 1998

TO: City Council

FROM: Bill Ekern, Community Development & Environmental Resources Director

The development and completion of the City's Watershed Management Plan is a significant achievement for the City of Albany. The technical analysis prepared by Mattern & Associates, which is included in the Technical Appendices, provides a detailed study of the City's storm water infrastructure. However, beyond the analysis of pipes and capacity, this Plan provides a framework to understand the link between these pipes and the creeks that carry the water to the San Francisco Bay. This is important because it places the City's treatment and handling of storm water in the context of its impact on the environment. To this end, this document is a powerful long-term planning tool.

It is important, however, to understand that the programs and projects identified in the Plan will still require detailed engineering design. The Plan identifies deficiencies, opportunities, and needs based on a global analysis of the City. At such time as projects are funded, the additional engineering analysis will confirm elements such as location, pipe size, and cost.

As this Plan makes clear, the cost of improving the environment cannot be taken lightly. Hard decisions regarding funding and priorities face the Council in the years to come.

# EXECUTIVE SUMMARY

## Introduction

The purpose of this document is to provide a comprehensive overview of Albany's drainage systems so as to guide the City in making improvements to these systems. The Watershed Management Plan will become an element of the City's Clean Water Program. It is the intention of the plan to integrate the engineered drainage structures with the natural creek channels in the overall approach to managing and improving in Albany's watersheds.

The City's Clean Water Program is composed of several elements: the National Pollutant Discharge Elimination System (NPDES) permit, a federally mandated program; urban creeks, an environmental restoration program; and storm drain/flood control, a public health and safety program.

Albany's creeks, the NPDES program and the City's storm drain/flood control measures need to be planned and managed as an integrated program. By integrating each of the discrete elements of storm water flow, the entire water system benefits. Creeks benefit from fewer pollutants; storm drains work more efficiently with better filtration mechanisms; and the City complies with its federal permits when all of the systems work in concert.

Storm water that originates in five watersheds flows through Albany via a variety of drainage systems and empties into San Francisco Bay. A watershed is the land over which water flows on its way to the lowest geologic point. In the case of Albany this is the San Francisco Bay. Watersheds are defined by topographic features such as the slight increases and decreases in elevation throughout the City. (See Figure 1)

The purpose of a storm drain system is to drain water from surfaces to prevent flooding. The system collects water running on the City streets and directs it into pipes that carry it to the City's creeks. In some instances the storm drain inlets are located directly over the creeks, where they have been buried in culverts. Most of the City's storm drain system was built in the 1920s and 1930s in conjunction with the development of the residential neighborhoods. (See Figure 2)

The City's storm drain system suffers from two deficiencies. (1) The original engineering of the system did not take future upstream development into consideration and the system has inadequate capacity to prevent public and private property damage due to flooding. Annual flooding occurs that damages public and private property. (2) The system has inadequate or non-existent facilities to separate pollutants from storm water. The system directly discharges almost all sources of urban water pollution into the creeks and, ultimately, the San Francisco Bay. Thus, the issue of water quality is important, both in terms of the environment and infrastructure.

In cases where pipes are under-sized, the system often fills with debris and backs up, creating flood conditions. As a result, intensive maintenance is necessary to remove debris from the storm drain system. The pipes that are located at street corners, such as those in Solano Avenue, were designed for smaller flows and now require continuous cleaning by City crews. In an effort to reduce areas of historic flooding, the City's maintenance crew focuses considerable effort and technology on clearing the small inlets and culverts that are prone to flooding. Besides creating nuisances for residents and businesses, flooded intersections and culverts create potentially hazardous situations and property damage.

The last three winters have demonstrated the need for improved storm drain systems. In several locations storm waters overwhelm the system forcing water and mud to flow overland through yards and private property.

The Plan describes existing conditions (including known problems and theoretical deficiencies) and recommends opportunities for improvements to the overall storm drain system of the City. It provides a vision for enhancement of the watersheds. Watershed project recommendations are provided and prioritized. The Plan is organized by watershed, so that projects, programs, and issues can be evaluated in the context of potential impact and benefit within the watershed.

**Approach**

In January 1997, the City Council authorized staff to issue a Request for Proposals to develop a Watershed Management Plan. In response to this request, twelve proposals were received. Staff interviewed five consulting firms and recommended the team led by Mattern and Associates. Mattern and Associates, which was involved in the preparation of the El Cerrito Storm Drain Master Plan, teamed with three other consulting groups (Wolfe Mason Associates, Balance Hydrologics, Inc., and Botanical Consulting Services) to provide a comprehensive approach to the watershed issues in Albany. The Council awarded a contract to Mattern and Associates in April 1997, and work began in May 1997. On June 19, 1997, a public meeting was held to solicit input from residents and businesses regarding drainage problems that affect them, or ones they know of.

The three main elements of the Plan are Storm Drainage and Flooding, Creek Restoration, and Water Quality. Included in each of these sections are extensive file and field research. Field studies were conducted by Mattern & Associates, Wolfe Mason Associates, Balance Hydrologics, Inc., and Botanical Consulting Services.

The City of Albany has a long history of concerns about its watershed areas. In 1977, the Albany Landuse Committee and the Albany Planning & Zoning Commission prepared a Creek Restoration Program report. This report recommended that the City encourage controlled access to creeks in public and semipublic areas, improve wildlife habitat and enhance visual qualities in industrial and commercial areas. The report suggested short-term projects that included planting suitable vegetation, stream cleanup, establishing cooperation with other agencies, and public education. Suggested long-term programs included requiring creek restoration as part of development, and public acquisition of property along creeks.

File research indicated that no storm drain master plans exist for Albany. Storm Drain Master Plans are complete for the cities of Berkeley and El Cerrito. Because these cities share watersheds with Albany, these studies were reviewed. The Watershed Management Plan includes information from these plans.

A number of studies have been prepared for individual sites in Albany. This Watershed Management Plan relies on and references the plans for these sites. On Codornices Creek these sites include the former Villa Motel property (between San Pablo Avenue and Kains Avenue) and University Village between San Pablo Avenue and the Union Pacific Railroad tracks. Along Cerrito Creek, studies evaluated opportunities adjacent to the El Cerrito Plaza and the Albany Hill Creekside Park.

An evaluation of flooding conditions in Codornices and Village Creeks within and adjacent to the University Village property, including a hydrology analysis and hydraulic study, was prepared in 1993 for the University of California by Philip Williams & Associates. Philip Williams & Associates supplemented the 1993 report with an additional hydraulic analysis of various flood control alternatives in October 1997 (draft). These reports are included by reference.

As part of the storm drain evaluation, a field review was made of the existing storm drain system to confirm the type, size, and condition of existing pipes and culverts. The depths to inverts (i.e., flow line) of pipes were measured. Surface elevations of access points were obtained with Global Positioning System (GPS) methods to allow determination of pipe inverts and slopes.

Storm drain maps were prepared showing the location of existing storm drains, using 1997 topographic maps as the base map. A storm drain database was created with information about each pipe segment, and each drainage sub-area in the City. Ultimately, this database will be linked to the orthophoto map files for planning and ease of information transfer.

A field review was also performed of all existing creek channels in the City. A video tape record was made of the creek conditions, and an assessment was made of bed materials, bank materials, channel dimensions, and structures near the creeks. An inventory was made of existing vegetation and wildlife habitats in and near the creeks.

## Hydraulic Analysis

A hydrology analysis was performed for the entire city to estimate water flows at various points in the storm drain system. For evaluation purposes 118 sub-areas averaging 7 acres (about 2 city blocks) each were identified. The analysis of system capacities is used to evaluate deficiencies, based on criteria discussed below, and to provide a basis for determining maintenance priorities and recommended improvements.

The level of flood protection provided by a drainage system is called its design storm frequency. This is expressed as an average period that it is predicted will occur between larger storm events that exceed the drainage system capacity. The 10-year storm has the probability of occurring once in ten years, or a ten percent chance of occurring in any year. Likewise, the 100-year storm has the probability of occurring once in 100 years, or a one percent chance of occurring in any year. It is also possible, although generally unlikely, to have two 10-year storms or even two 100-year storms in a single year.

Drainage criteria recommended for planning storm drain improvements for the City of Albany are the 10-year storm for areas less than one square mile, and the 25-year storm for larger areas. These standards are comparable to criteria used by counties and other cities near Albany.

Hydrology methods used for the evaluation were the rational method, using criteria developed by the Alameda County Flood Control District. The rational method is the most widely used and accepted method for analysis of small urban watersheds. This analysis method measures the average depth of rainfall in an area over a given time period. The resulting calculation gives a resulting flow measured in cubic feet per second (cfs). The method is generally accepted as being reasonably accurate for drainage planning purposes in watersheds up to one square mile in drainage area. The watershed areas defined for the analysis of the storm drain system in Albany were small enough that the rational method of estimating peak storm runoff is appropriate.

## Storm Drain Condition

Generally, the field surveys identified three primary storm drain pipe materials: concrete, corrugated metal pipe (CMP) and vitreous clay (VCP). The storm drain maps catalogue each type within each watershed.

Based on inspection of the storm drain system, the condition of concrete pipes appears to be good. The condition of clay pipes is generally good, but some pipes are cracked or have offset joints causing debris to accumulate or soil surrounding the pipes to wash into the drain. A few CMP drains are in poor condition, and are a high priority for replacement.

Many areas of Albany lack underground storm drains, and storm runoff is carried in street gutters and shallow cross street drains. Some of these gutters carry large flows, which might be more appropriately carried in underground systems in areas where local ponding affects traffic or pedestrian safety. Many of the street cross drains cause significant maintenance problems, generally because of corroding pipe material, flat slopes, and difficult access. This Plan recommends that funding be allocated annually for these storm drain improvements, as part of ongoing drainage facility maintenance.

**Watershed Overview**

The watersheds of the City drain into five creeks. These are Codornices Creek, Village Creek, Marin Creek, Middle Creek, and Cerrito Creek. All of these watersheds also drain areas from outside Albany, including the neighboring cities of Berkeley, El Cerrito, and Richmond.

There are five creeks that flow within and along Albany's borders from the Berkeley hills to the San Francisco Bay: Cerrito, Codornices, Marin, Middle, and Village. Cerrito and Codornices Creeks serve as the northern and southern borders of Albany and traverse residential private properties from the eastern Albany border to San Pablo Avenue in a combination of buried and open channels. These creeks are above ground for most of their length from San Pablo Avenue to the Bay. Two creeks, Middle and Village, are predominantly underground and generally run through private property, including underneath houses and businesses. Marin Creek runs through a culvert in the center of Marin Avenue, the Gill Tract, Albany Middle School and U.S.D.A. properties.

Reviewing City maps it is apparent that large sections of the creeks in Albany are not publicly owned or accessible. The current City urban creek efforts, therefore, focus on two areas. First is providing information and education to property owners along the creeks to aid them in improving and retaining the natural elements of the creek. Second is working in areas under public ownership (such as within University Village and along the Creekside Park) to improve public access and to restore the riparian habitat.

During the building of Albany through the 1950s, creeks were placed in culverts, buried, and built over, severing the tie between the creeks and the wildlife that depend on them. During the last three years, community interest in restoring creeks has increased, spurred by City outreach and education. The community support to restore Albany's creeks is evidenced by attendance at events such as Creek Forums, volunteers at creek clean-up events, and local activist groups providing regular water quality monitoring of the creeks. The outreach and education efforts in 1995 and 1996 led to the formation of the Friends of Five Creeks, a volunteer group whose goal is to improve the quality of Albany's creeks. The efforts of these groups and the City contributed to the passage in November 1996 of Measure R, which provides funding for creek restoration, as well as open space and recreation fields.

Codornices Creek Watershed

Codornices Creek Watershed is located along Albany's southern boundary between Albany and Berkeley. The Codornices Creek Watershed extends from the Berkeley hills to the San Francisco Bay near Golden Gate Fields. At some time in the past, the City of Berkeley diverted a portion of the water in this drainage area into the Marin Creek watershed. Only about 4% of the drainage area is located in Albany. Figure 1 shows the relationship of the total watershed to that portion located in Albany.

Storm drains with insufficient capacity to carry the 10-year design storm (i.e., those pipe systems considered deficient) in this area include those on Dartmouth Avenue, Posen Avenue, and Peralta Avenue. These projects are identified in the Codornices Creek Watershed section as recommended storm drain projects (SD) SD-5 and SD-18.

East of San Pablo Avenue, Codornices Creek's channel has been altered as it traverses the mostly residential neighborhoods of Albany and Berkeley. In this reach (or creek section), bed and bank materials generally consist of poured concrete or concrete debris. Downstream of San Pablo Avenue the channel is wider and shallower, generally having earthen banks.

Existing conditions observed in the creek include several areas where structures or debris may block flows, vegetation is growing in the channel, and a few areas of erosion. Recommendations for restoration, repair, or resolution of these conditions are identified as creek restoration projects (CR) CR-3, CR-6, and CR-15. The areas most suitable for habitat enhancement are areas downstream of San Pablo Avenue. Creek restoration opportunities include the former Villa Motel site located between Kains Avenue and San Pablo Avenue. This project is CR-6.

The most serious flooding problem in the watershed is located between 6th Street and Interstate-80. These problems are generally caused by low culvert capacity at Interstate-80, the Union Pacific Railroad crossing, Fifth Street, and Sixth Street. The street crossing culverts are located on City of Berkeley streets just outside the University Village housing site. It should be noted that this area is presently identified as being within the 100-year flood plain as defined by the Federal Emergency Management Agency (FEMA) through its Flood Insurance Rate Map (FIRM).

Vegetation habitat in Codornices Creek consist of Central Coast riparian scrub, coast live oak woodland, and coastal freshwater marsh in the upper portions, and coastal brackish marsh and northern coastal salt marsh in the lower areas. A number of native tree species are present in the upper parts of the creek.

Village Creek Watershed

Village Creek is a relatively small watershed located almost entirely within Albany.

The watershed is in an area south of Marin Avenue and generally the middle of the 1000 block of the north-south streets located between San Pablo Avenue and the eastern Albany border. The entire drainage system east of San Pablo Avenue is contained in storm drain pipes. See Figure 1 for the location of this watershed.

Many of the storm drains in this basin have serious capacity deficiencies. Critical issues with storm drain projects in this watershed revolve around the location of some drain pipes on private property and beneath houses. Recommended priority projects for this system are SD-1 (A-C).

At some point in the past an overflow channel was constructed to benefit Codornices Creek. This overflow channel connects with the Village Creek channel at the western edge of University Village to discharge through the Union Pacific Railroad right-of-way and on into San Francisco Bay.

Flooding problems are experienced in the area near the Union Pacific Railroad tracks and upstream of Interstate-80. These problems are caused by overflows that occur in the Codornices Creek overflow channel, low culvert capacity at Interstate-80 and the Union Pacific Railroad crossing, and lack of vegetation management in the channel on private property.

Open creek sections are located west of San Pablo Avenue and east and west of the Union Pacific Railroad tracks. Generally the banks remain earthen. Existing vegetation habitat includes ornamental trees, freshwater marsh, and riparian scrub.

The existing creek sections have moderate to high opportunities for habitat enhancement. This Management Plan recommends creek restoration projects at various creek sections, including the existing culvert through the University Village housing site. Recommended projects adjacent to University Village are CR-11 and CR-17. CR-11 is located on the Union Pacific Railroad property. CR-17 involves property owned by the University of California. Both are outside the immediate control of the City of Albany.

Marin Creek Watershed

Marin Creek is located along Marin Avenue, and extends from Berkeley to the San Francisco Bay near the Interstate-80/Buchanan Street interchange. About 27% of the watershed is located within Albany. Changes to the storm drain system in Berkeley have transferred water into the Marin Creek watershed from areas that historically drained into either Codornices Creek or Middle Creek. The former creek is entirely contained in culverts and pipes. Figure 1 shows the extent of the watershed extending into the City of Berkeley.

Issues with the existing storm drain system include:
- capacity deficiencies at the Interstate-80 crossing,
- the drain from Washington Avenue and Kains Avenue west to San Pablo Avenue,
- the drain in San Pablo Avenue from Washington Avenue south to Solano Avenue,
- the drain on Madison Street from Solano Avenue south to Buchanan Street,
- local drainage on Solano Avenue,
- drainage on Cleveland Avenue at Washington Avenue and Solano Avenue, and
- the southeast corner of Marin Avenue and Curtis Street.

There are no existing open creek areas in the Marin Creek watershed, and no existing habitat. Creek restoration opportunities would be limited to removing the existing culvert. An opportunity exists west of San Pablo Avenue through the University of California Gill Tract, the Albany Middle School play fields, and the United States Department of Agriculture Research Center. Because the City is pursuing additional playfields, it is not considered feasible to open the creek within Middle School Park. The cost of relocating the baseball fields would include removal of the tennis courts and the removal of the grove of trees at the southwest corner of the park.

<u>Middle Creek Watershed</u>

The Middle Creek watershed is located north of Solano Avenue to approximately Brighton Avenue. About 90% of the drainage area is within Albany. A significant portion of the historic Middle Creek drainage area now flows into the Marin Creek storm drain because of drainage improvements in the City of Berkeley. Figure 1 shows this watershed.

Storm drain capacity deficiencies include;
- the existing drains at San Pablo Avenue under the Albany Bowl building,
- the drain in Portland Avenue, and
- local drains on Portland Avenue at Santa Fe Avenue, and Washington Avenue at Santa Fe Avenue.

These projects are identified as SD-9, SD-12, SD-14, and SD-16

Open creek sections include a small section west of Masonic Avenue, and from Adams Street west to Cerrito Creek. Existing vegetation habitat includes Central Coast riparian scrub. The section of the creek west of Adams Street is considered to have high potential for habitat enhancement and creek restoration. This section of the creek is one of the few in the City on publicly owned land, as it is immediately adjacent to the Albany Hill Creekside Park.

<u>Cerrito Creek Watershed</u>

Cerrito Creek flows along the northern boundary of Albany. It is generally perceived as the boundary between Albany and the cities of El Cerrito and Richmond. Only about 2% of the watershed area is located in Albany. Much of the actual creek flow is in these other cities, with only the southern creek bank at some locations lying within the city limits of Albany. The expanse of this watershed outside of Albany is demonstrated in Figure 1.

There are few existing storm drains in this watershed, and no identified capacity problems. Areas in El Cerrito west of San Pablo Avenue have experienced flooding problems because they are in areas subject to the 100-year flood, but there are no flooding problems on the Albany side of the creek.

Existing vegetation habitat in the upstream areas includes remnants of Central Coast riparian scrub, coast live oak woodland, and coastal freshwater marsh. West of San Pablo Avenue, habitat includes native riparian trees, riparian scrub, coastal freshwater marsh, coast live oak woodland, coastal brackish marsh, and northern coastal saltmarsh.

Habitat enhancement opportunities include areas west of San Pablo Avenue and adjacent to the El Cerrito Plaza. The most likely sections for creek restoration include the areas adjacent to the future Albany Middle School, El Cerrito Plaza, and Albany Hill between San Pablo Avenue and Pierce Street. These are identified as creek projects CR-2, CR-4, CR-5, CR-8, CR-12, CR-14, and CR-16.

**Storm Water Management Alternatives**

Water Quality

The 1987 re-authorization of the Federal Clean Water Act requires cities throughout the United States to obtain a National Pollutant Discharge Elimination System (NPDES) permit. The NPDES permit enables the City to discharge storm water to the San Francisco Bay. Fifty percent of water pollution is estimated to originate from "non-point" sources, i.e., various and dispersed locations. These sources include automobile fluid leaks and spills, residential and commercial fertilizer and insecticides, street litter, animal waste, and hundreds of other sources of solid and chemical waste that is deposited onto streets, parks, and lawns. This pollution is washed off surfaces, carried by rain to the creeks, and then to the San Francisco Bay.

Through its permit the City is responsible for the quality of the water that flows over the land within City boundaries and into the Bay. Alameda County, through the County-wide Clean Water Program, administers the NPDES permit for all cities in Alameda County.

The NPDES permit requires cities to meet minimum performance standards in the areas of maintenance, public information, new development, industrial inspections, and illegal discharge enforcement, primarily through Best Management Practices (BMPs). These BMPs and the minimum standards for implementing them are outlined in the Alameda County Storm Water Management Plan. The City of Albany, over the past two years, has met and exceeded these standards through the concerted and combined efforts of the Fire Department and the Community Development & Environmental Resources Department.

The NPDES permit fee and the programs required through it were not specifically funded for many years. Storm drain fees of $22.60 per household now provide annual funding of $158,000 to the City's Clean Water Program. The FY1998/99 budget commitment to the Clean Water Program includes $10,000 repayment to the Sewer Fund for development of the Watershed Management Plan, $30,000 for small, specific storm drain projects, $14,400 for the continuing efforts of public outreach and education, $20,600 for the annual NPDES permit fee, and $83,000 for labor costs associated with street sweeping and maintenance of the storm drain system and creeks.

Water quality data in Albany has been obtained in previous studies and by community volunteer groups for Codornices Creek and Cerrito Creek. Although the testing methods are not consistently performed under rigorous scientific controls, results show that both streams are generally healthy. A review of water quality in the open reaches of Cerrito, Codornices, Village, and Middle Creeks in August 1997 as part of the development of this Watershed Management Plan, showed that water quality varied in the range from acceptable to excellent.

The studies included in this Watershed Management Plan evaluated opportunities to implement innovative and/or standard techniques for improving water quality, called Best Management Practices (BMPs). Locations for implementation of BMPs for water quality improvements in Albany are limited due to the built out and urban nature of the city. Some BMPs might be incorporated into redevelopment of larger parcels, such as the proposed Albany Middle School and the El Cerrito Plaza sites on Cerrito Creek, and along Codornices Creek in conjunction with the planned housing and site improvements at University Village. In general, however, no opportunities for capital projects such as detention ponds or infiltration basins could be identified. A possible demonstration project to reduce erosion at the outfall of the Madison Street drainage pipe is discussed in the Middle Creek Watershed section.

Innovative Solutions to Storm Runoff Control

A primary concern of the City was to not merely develop a plan that places pipes in the ground to carry water directly to the creeks and eliminate any potential benefits of storm water. An analysis was made of opportunities to incorporate developing technologies and open space to reduce the rate of storm runoff. No specific locations were identified that provide on a cost-effective basis sufficient area to construct systems for the detention or retention of storm flows. The available land under public control is generally street right-of-way and the cost of reconstructing public streets, coupled with the long-term cost of maintenance, made detention systems unfeasible.

Storm runoff in an urban setting affects the overall functioning of the storm drain system. Because of the increase in impervious surface that accompanies urban development, rain has less opportunity to soak into the ground than prior to development. The time it takes water to move from one point to another is significantly reduced, which results in overwhelmed pipes and creeks. Rather than attempting to retard large volumes of water through detention ponds, it is often effective to control the rate at which runoff leaves an individual piece of property. A multitude or community of efforts can be effective in increasing the time it takes water to move from one point to another.

There are a number of methods for reducing the rate of storm runoff in Albany. These include roof-downspout systems, parking lot perimeter trenches, composite pavement material for parking lots and streets, and modification of street areas. These could be implemented either as conditions of approval for private development or by incorporation into public works projects. To accommodate these improvements, new standard specifications and drawings should be developed and approved by the City.

As the City implements public projects that reduce paved area, such as the Ordway Street demonstration project, which narrows the access to Ordway Street from Marin Avenue, a low-lying, low-maintenance planting scheme could be developed and constructed. New curb and gutter lines would control street drainage, while the planted area would provide an opportunity to encourage groundwater infiltration without risking damage to the roadway section. It is likely the Citywide Transportation Plan will identify a number of specific sites where median planters or round-abouts could be constructed to reduce the impact of traffic in residential neighborhoods. These sites are small, generally only a couple of hundred square feet, but they may most visibly represent the City's commitment to capturing any and all opportunities to improve water quality and reduce the rate of storm runoff.

Although there are theoretical solutions to retard the rate of storm runoff, designs and specifications must address low soil permeability, lack of available open space because of the built-out urban density, and relatively small residential lots. Goals for runoff control should consider a long-term approach, with implementation of small, demonstration sites considered as opportunity presents itself.

### Rights and Responsibilities of Property Owners

Because most of the creeks course through private property, the City cannot effectuate improvements to a considerable portion of the watershed. To address this issue, the Community Development & Environmental Resources Department prepared a booklet for private property owners. In this publication, are outlined resources for private property owners to draw upon, as well as an enumeration of the property owners' responsibilities to maintain creeks and clean water. This booklet is included in the Technical Appendices.

Because of the relationship of the creeks to private property and the fact that the City of Albany does not have any identified easements for maintenance or access to the creeks on private property, improvement or maintenance projects are the sole responsibility of the adjacent property owner. This does not mean that property owners can simply effectuate changes to the creeks. The City's Zoning Code (Chapter XX of the Albany Municipal Code) clearly identifies the requirements and process by which any work can occur along the creek corridors. In fact, the City has established a Watercourse Combining district that overlays the residential and commercial properties that front both Cerrito Creek and Codornices Creek to more clearly define rights and responsibilities. Further, any work that impacts the actual stream bed requires permits from the California Department of Fish and Game. There are some reaches of the creeks, generally near the freeways that are tidally influenced, which means that work in those areas may be subject to federal jurisdiction, including the Department of Fish & Wildlife and the Army Corps of Engineers.

**Recommendations**

The storm drain and creek restoration projects recommended by this Watershed Management Plan are shown on the following tables in order of priority. Priority is based on several criteria. These criteria include mitigating the potential for public or private property damage and the opportunity for enhancement of a planned improvement project (i.e., other development or construction occurring at the site). For storm drain projects, those projects with the greatest potential for mitigating potential public or private property damage rank highest. For creek restoration, those projects that combine the benefits of flood control improvements, with opportunity (i.e., potential near term development of adjacent properties), and habitat enhancement rank highest. (See Figures 3 and 4)

The projects identified and recommended by this Plan are consistent with the Joint Watershed Goals Agreement (July, 1995). These goals were signed by the City Councils of Albany, Berkley, El Cerrito, and Richmond in recognition of the overlapping of watersheds between jurisdictions. The cities committed to:

1. remove culverts and other obstructions to fish and animal migration;
2. use creek corridors as transportation routes for pedestrians and bicycles;
3. eliminate conditions that pollute rainwater as it flows to creeks and eliminate conditions that prevent rainwater from soaking into the ground; and
4. instill widespread public awareness of the value of developing infrastructure along lines that promote healthier watersheds.

| Recommended Storm Drain Projects | | | | |
|---|---|---|---|---|
| **Short Term** | | | | |
| Project Number | Project Site | Drain Size | Length (Feet) | Project Cost Estimate |
| SD-1A | Neilson Street to Santa Fe Avenue | 24" | 700 | $315,000 |
| SD-1B | Ramona Avenue between Santa Fe Avenue and Key Route Boulevard. | 36" | 1,120 | $504,000 |
| SD-1C | Albany Terrace between Tevlin Street and Neilson Street | 21" | 550 | $151,000 |
| SD-2 | Solano Avenue between Pomona Avenue and San Pablo Avenue | 18" - 24" | 2,000 | $500,000 |
| SD-3 | Cleveland Avenue between Washington Avenue and Buchanan Street | 18" | 950 | $238,000 |
| SD-4 | Solano Avenue from San Pablo Avenue to Madison Avenue and Madison Avenue to Buchanan Street | 24" | 1,370 | $411,000 |
| SD-5 | Posen Avenue between Ordway Street and Codornices Creek | 21" | 1,400 | $220,000 |
| SD-6 | Madison Avenue from Clay Street north | 18" | 300 | $75,000 |
| SD-7 | Marin Avenue at Curtis Street | | | $35,000 |
| SD-8 | Sonoma Avenue at Peralta Avenue | | | $35,000 |
| SD-9 | Washington Avenue at Santa Fe Avenue | | | $35,000 |
| SD-10 | Other Sites | | | $70,000 |
| SD-11 | Drainage Inlet Structures | | | $50,000 |

| Recommended Storm Drain Projects | | | | |
|---|---|---|---|---|
| Long Term | | | | |
| SD-12 | San Pablo Avenue between Clay Street and Adams Street (Middle Creek) | 48" | 450 | $160,000 |
| SD-13 | San Pablo Avenue from Solano Avenue to Washington Avenue and Washington Avenue to Evelyn Avenue | 18" | 1,780 | $445,000 |
| SD-14 | San Pablo Avenue between Clay Street and Portland Avenue and Portland Avenue from San Pablo Avenue to Talbot Avenue | 21" | 2,000 | $550,000 |
| SD-15 | Between Key Route Boulevard and San Pablo Avenue (Village Creek) | 36" | 1,750 | $780,000 |
| SD-16 | Portland Avenue between the Ohlone Greenway and Carmel Avenue | 24" | 1,290 | $390,000 |
| SD-17 | San Pablo Avenue from Codornices Creek to Dartmouth Avenue and Dartmouth Avenue to Talbot Avenue | 21" | 1,200 | $330,000 |
| SD-18 | Codornices Creek at I-80 | 72" | 800 | $720,000 |
| SD-19 | Village Creek at I-80 | 48" | 1000 | $450,000 |
| SD-20 | Local drainage sites | | | $35,000/yr |

| Recommended Creek Projects | | | | |
|---|---|---|---|---|
| **Short Term** | | | | |
| Project Number | Project Site | Project type | Length (Feet) | Project Cost Estimate |
| CR-1 | Codornices Creek: Between Fifth Street and the Union Pacific Railroad Tracks | Restore creek | 600 | $120,000 |
| CR-2A | Cerrito Creek: Between San Pablo Avenue and Pierce Street | Restore creek | 2,100 | $400,000 |
| CR-2B | Middle Creek: Between Cerrito Creek and the Orientation Center for the Blind | Enhance ment | 200 | $95,000 |
| CR-3 | Codornices Creek: Between Tenth Street and Fifth Street | Restore creek; new bridge | 1,500 | $420,000 |
| CR-4 | Cerrito Creek: Between San Pablo Avenue and Kains Avenue | Relocate creek | 300 | $465,000 |
| CR-5 | Cerrito Creek: Between San Pablo Avenue and Adams Street | Enhance ment | 200 | $245,000 |
| CR-6 | Codornices Creek: Between San Pablo Avenue and Tenth Street | Enhance ment | 300 | $160,000 |
| CR-7 | Codornices Creek: Between San Pablo Avenue and Kains Avenue | Restore creek | 300 | $95,000 |
| **Long Term** | | | | |
| CR-8 | Cerrito Creek: Between Spokane Avenue and the Ohlone Greenway | Open creek channel | 700 | $700,000 |
| CR-9 | Village Creek: Between San Pablo Avenue and Eighth Street | Enhance ment | 700 | $380,000 |
| CR-10 | Codornices Creek: Between the Union Pacific Railroad tracks and Eastshore Highway | Restore creek | 700 | $195,000 |
| CR-11 | Village Creek: Railroad tracks west to Eastshore Highway | Enhance ment | 350 | $90,000 |
| CR-12 | Cerrito Creek: Between Spokane Avenue and Key Route Boulevard | Remove concrete | 225 | $260,000 |
| CR-13 | Middle Creek: At the Ohlone Greenway | Open creek | 100 | $235,000 |
| CR-14 | Cerrito Creek: West of Interstate 80 to San Francisco Bay | Enhance ment | 500 | $50,000 |

| | | | | |
|---|---|---|---|---|
| CR-15 | Codornices Creek: Between Kains Avenue and eastern Albany city limits | Education and bridge | 3,600 | $105,000 |
| CR-16 | Cerrito Creek: Between Key Route Boulevard and the Berkeley border | Education 3 bridges | 1,400 | $312,000 |
| CR-17 | Village Creek: Between Eighth Street and the Union Pacific Railroad tracks | Remove concrete | 1,500 | $875,000 |
| CR-18 | Codornices Creek: Golden Gate Fields to San Francisco Bay | Enhance ment | | $30,000 |
| CR-19 | Marin Creek: Between San Pablo Avenue and the USDA Facility | Remove concrete | | $780,000 |

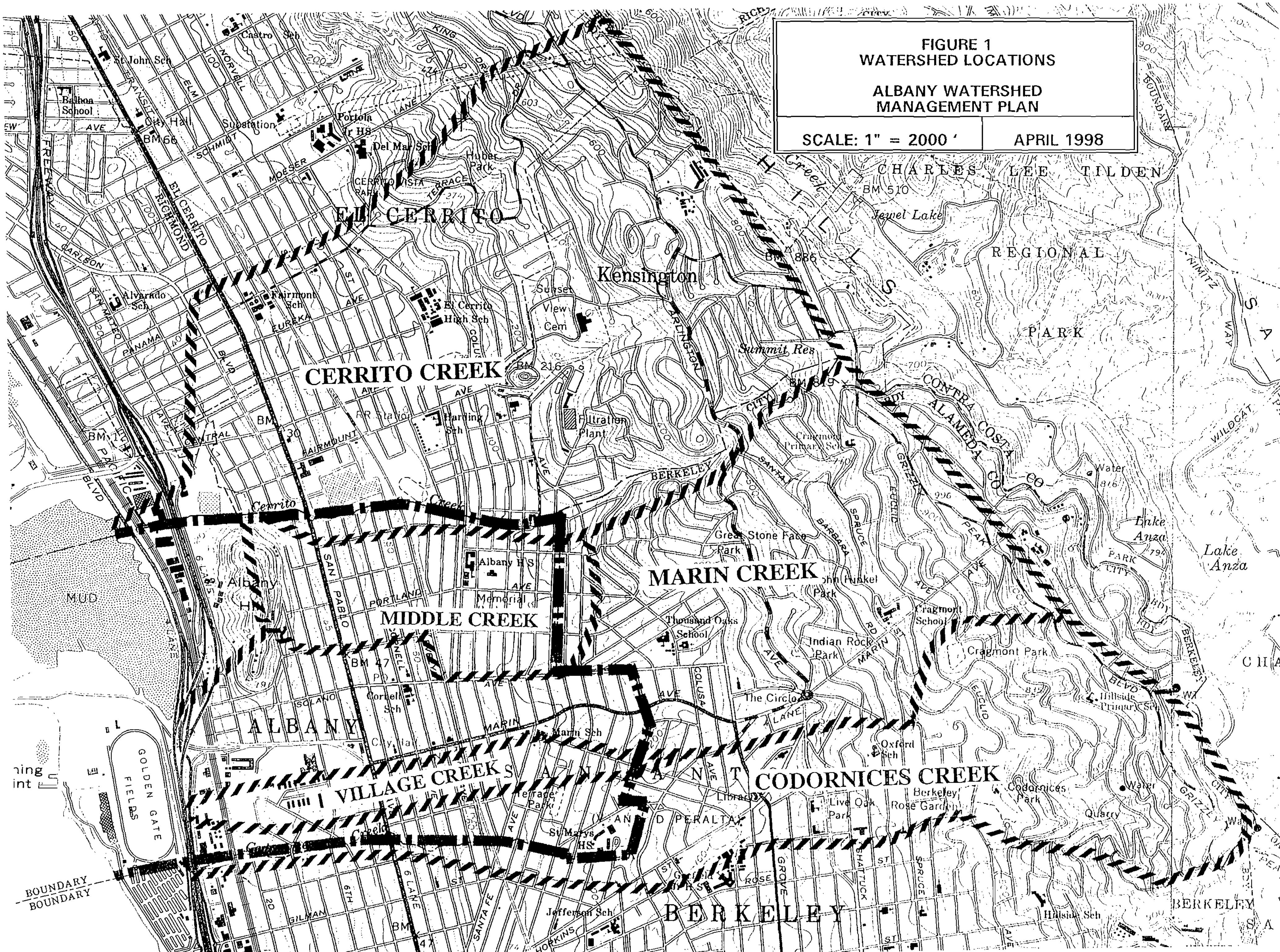



FIGURE 1
WATERSHED LOCATIONS

ALBANY WATERSHED
MANAGEMENT PLAN

SCALE: 1" = 2000 ' | APRIL 1998

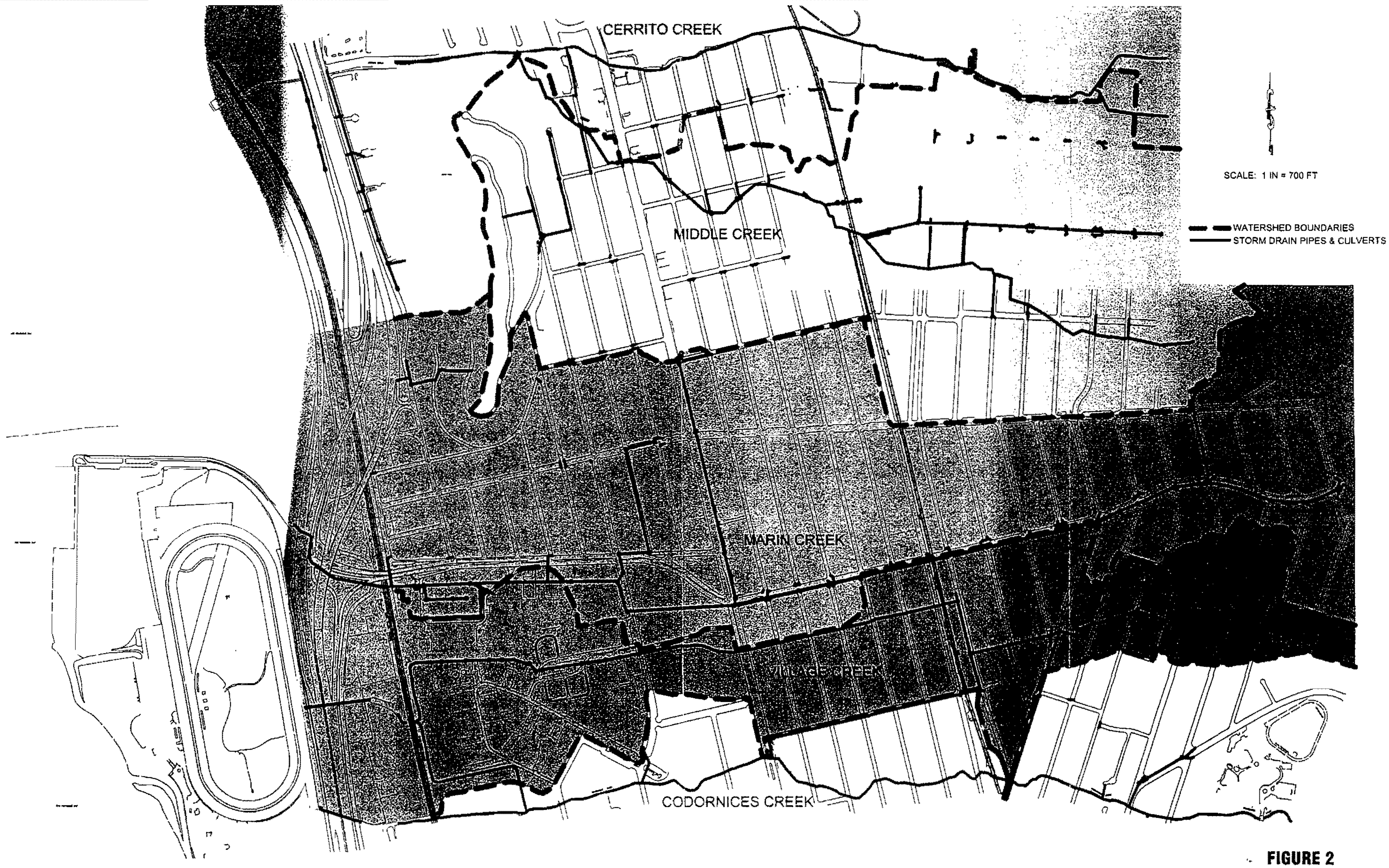



**FIGURE 2**

**ALBANY WATERSHED MANAGEMENT PLAN** **EXISTING DRAINAGE SYSTEM**

MATTERN & ASSOCIATES

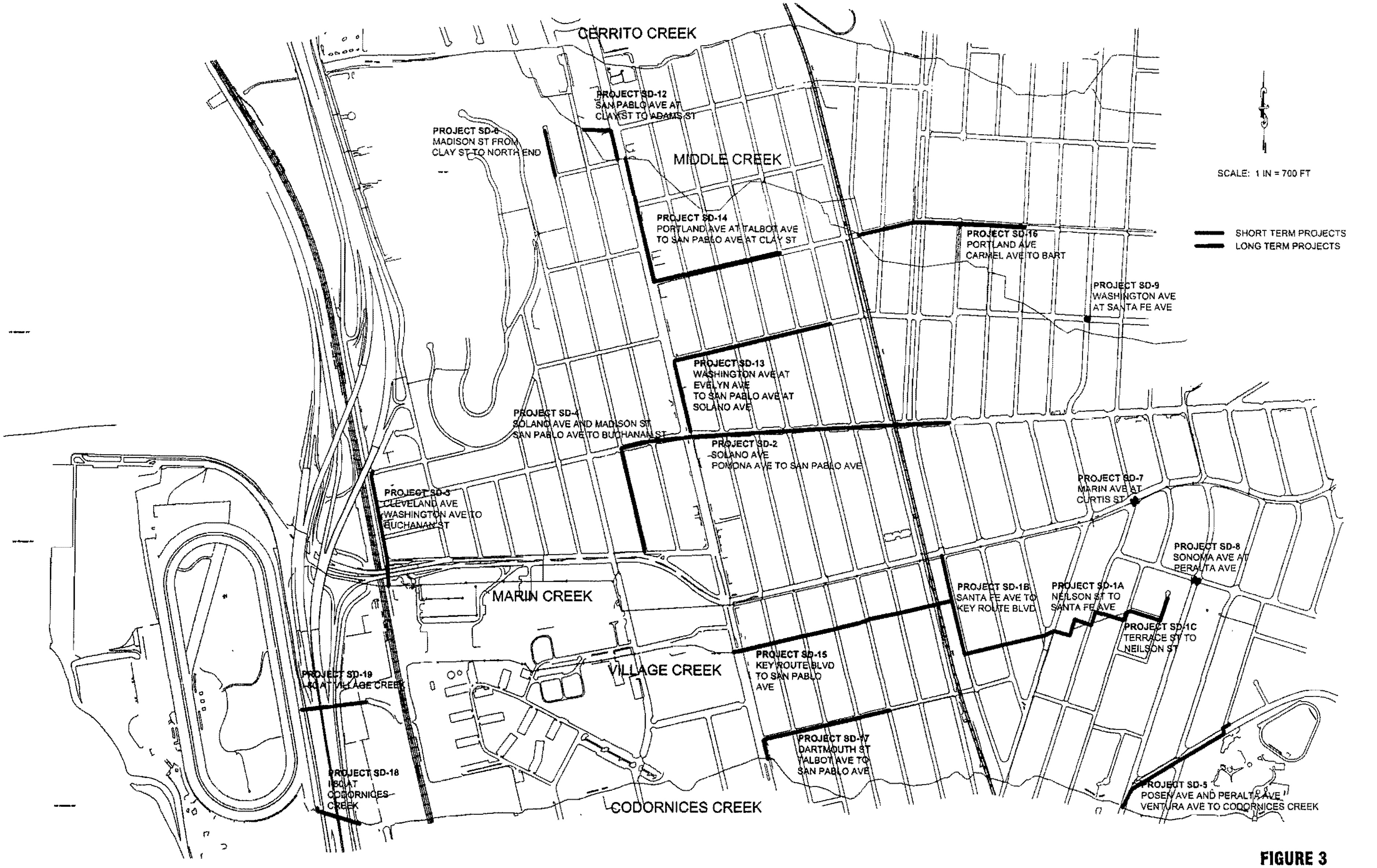



**FIGURE 3**

**STORM DRAIN PROJECTS**

**ALBANY WATERSHED MANAGEMENT PLAN**

MATTERN & ASSOCIATES

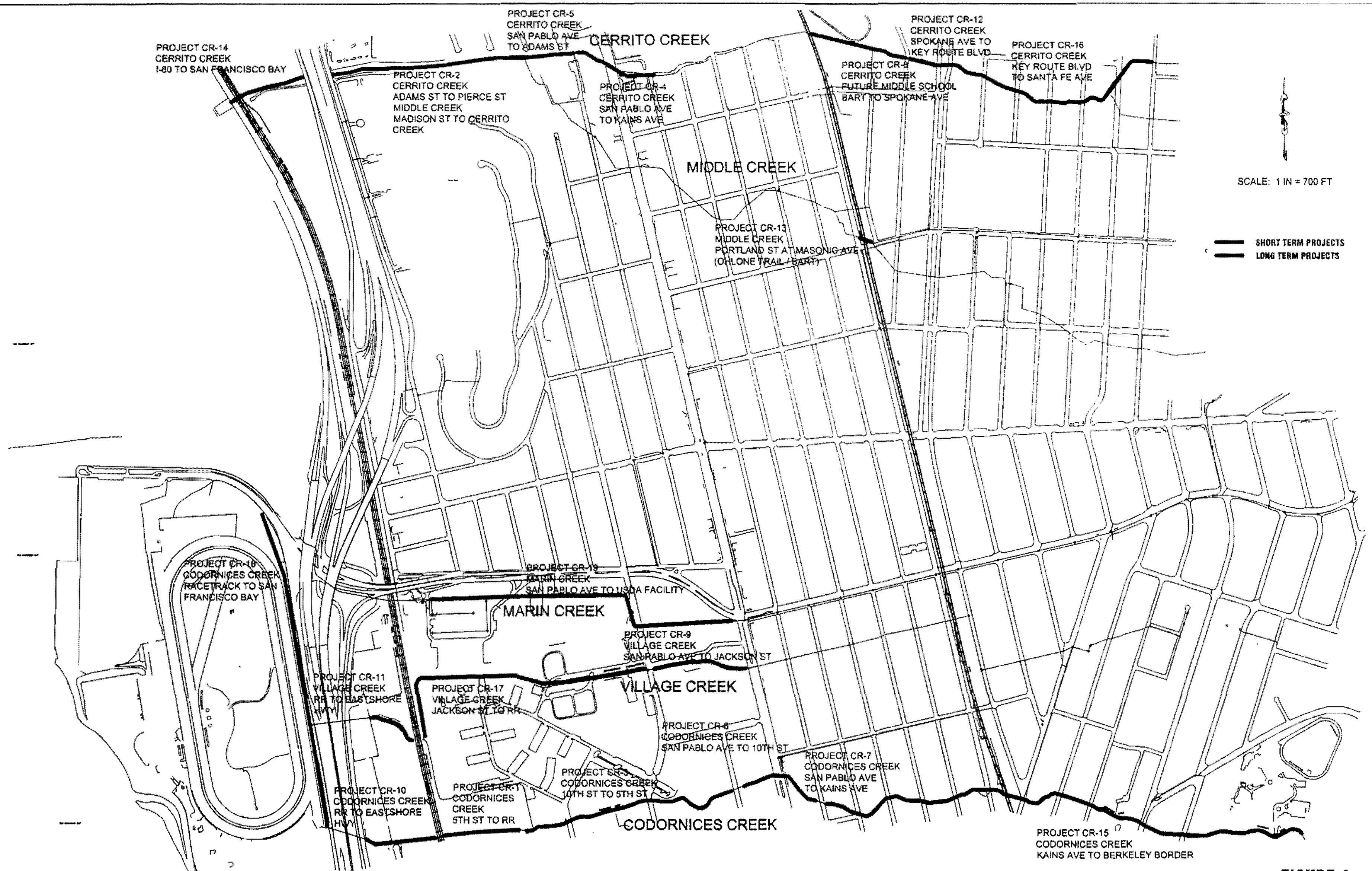



**FIGURE 4**

**ALBANY WATERSHED MANAGEMENT PLAN** — **CREEK RESTORATION PROJECTS**

MATTERN & ASSOCIATES

# INTRODUCTION

## Purpose of the Watershed Management Plan

The purpose of the Watershed Management Plan is to provide a guide for City policy makers, administrators, and residents to the watersheds in Albany. It assesses the existing conditions, including deficiencies and opportunities, in the watershed system. The Plan provides recommendations for improvements and maintenance efforts within each of the watershed areas. Recognizing the limited City resources, the Plan identifies those projects anticipated to provide the most benefits to the residents. It also provides a menu of recommended actions and goals for the near future (five year period), and over a longer period of time (beyond five years). The Plan is a management tool intended to assist in the preservation and restoration of the Albany water resources. As such, it also serves as an educational tool.

## Importance of Watersheds

A watershed consists of all the lands that are drained by a particular creek or river. Activities and decisions that affect local watersheds may affect larger regional watersheds.

Watersheds and their drainage channels were an important part of early civilization. Creeks and rivers provided basic life essentials such as water supply for drinking and agriculture. Flood plains next to rivers provided flat, fertile areas suitable for growing required food supplies. Rivers served as early transportation routes.

With urban development, many of the functions of the watershed changed. Water supply in most cases became centralized and delivered from a remote location, rather than from the local creek. Agricultural use of the land was changed to residential, commercial and industrial use. Creeks may remain only for their utilitarian function of carrying storm water runoff away from the city.

Even the drainage function of watersheds has been altered. Urban development has added roof areas and paving that reduces the ability of the land to absorb water. To minimize the land space required, creeks and swales may have been converted to underground pipes and concrete channels, which greatly speeds the flow of water. Both of these changes have dramatically increased the volume and peak flow rate of runoff that occurs in urban watersheds during storm events. These increases, along with urban encroachment into the natural watercourse areas and floodplains, have increased the potential for flooding damage during major storms.

Many creeks in urban areas have been neglected and ignored, but because of their drainage function, they have not been eliminated. They may remain as some of the few natural open space areas in the city. Many remaining wildlife species use these areas for basic necessities -- water, food, habitat. In some cases, the value of creeks as resources has been recognized and they have been preserved in parks, recreation areas, or wildlife habitats in the community.

**Elements of the Management Plan**

The City of Albany has various programs to address environmental issues and infrastructure needs related to watersheds, storm water, creeks, and water quality within the City. These programs fall under the City's Clean Water Program. The City's Clean Water Program is composed of several elements: the National Pollutant Discharge Elimination System (NPDES) permit, a federally mandated program; urban creeks, an environmental restoration program; and storm drain/flood control, a public health and safety program. Each of these elements is currently planned and managed as if it were unconnected with the others. However, they are connected geographically by the network of water courses and topography that are the Albany watersheds.

The preparation of the Watershed Management Plan evaluated three interlinked elements, both individually and together. These elements are: storm drainage and flooding, creek restoration, and water quality.

Storm Drainage and Flooding

This element considered the evaluation and management of the water runoff that occurs throughout the City during rain storms. This element is part of the City's public health and safety programs, designed to protect residents and businesses in the City from damage caused by flood waters.

For the purpose of this report, the drainage system in Albany's watershed consists of four distinct components: overland (surface) flows, storm drain inlets, storm drain pipes or culverts, and creek channels. Ultimately all water that flows through Albany flows to the San Francisco Bay.

Overland flow is the water that flows over the land (i.e., lawn, streets, and other surfaces). This water flows down hill, overland to a low point where it either forms a puddle or a pond, absorbs into the ground through a porous surface, or enters an underground drainage system.

A storm drain inlet is the entry point of water to either a storm drain pipe, a culvert, or a creek channel. Storm drain inlets can be simply the direct entry of water into a pipe or it can include a catch basin. A catch basin is a box below the surface of the inlet that allows material to settle out of the water before the water enters the pipe.

A storm drain pipe and culverts are usually round, made of plastic, concrete, clay, or metal ranging in size from 8" to 24" in diameter in Albany. Storm drain pipes generally carry water underground from an inlet to either a larger culvert or a creek channel. Box culverts containing greater flow, such as those containing the entirety of a creek, are typically square or rectangular concrete boxes. Although, the Marin Creek system is almost entirely contained within a round culvert.

A creek channel is defined as an open channel with either earth lined or artificial (e.g., concrete) bottom.

The storm drainage and flooding element is primarily an engineering evaluation of the capacity of streets, storm drain inlets, storm drain pipes, and creek channels to carry a 10-year storm event.

Issues considered in this element include:

- Inspection, survey, and inventory of existing storm drain facilities;
- Estimation of flows throughout the city for design storms of various frequencies;
- Estimation of the capacity of existing storm drain facilities;
- Appropriate standards to be used for the planning and design of storm drainage facilities;
- Alternative solutions for storm drainage facilities;
- Priorities for implementation of additional storm drainage facilities; and
- Cost of new or improvements to storm drainage facilities.

This element is sometimes called a storm drain master plan.

Creek Restoration

Creek restoration returns a previously natural creek from an engineered or closed state to a natural state. It is a term that can be used to describe a broad range of creek alteration projects. Water is one of nature's most powerful elements and must be treated with respect. Creeks not only function to transport water, sediment, and woody debris but also provide habitat and food for many varieties of birds and aquatic organisms. Creek restoration employs science, hydrology, and geomorphology to address the functional requirements for moving storm flows efficiently through an urban environment (flood control). Project designs are based on the storm water flow needs of the creek, as well as biology and ecology, to address the aspects of a storm water management system that only creeks can provide. These aspects can include riparian vegetation, wildlife habitat, and community benefits such as recreation/open space and pedestrian greenways.

Restoration can include widening creek channels, stabilizing creek banks, removing fish migration barriers, altering the vegetation of existing creek channels, and removing culverts. Where possible, creek restoration should include creation of pedestrian and bicycle trails to create alternative transportation connections in a community.

Creeks are ecological systems that evolve and change. In most of the creeks in the San Francisco Bay Area, urbanization has encroached into the historic floodplain of the creeks. This poses constraints that require a variety of techniques to achieve a stable channel.

Replacing existing culverts at road crossings with bridges or removing crossings entirely is often desirable because culverts usually restrict the flow of water. The entrance of culverts can also collect debris that can block the opening. Bridges allow a more continuous natural habitat to be established and easier passage for wildlife through the area, with sand and gravel creek bed material instead of concrete.

Criteria for prioritizing the recommended projects are function, location, opportunity and habitat.

Function describes necessary improvements for the channel to carry 10-year storm water flow.

Location/Habitat defines locations where a restoration project would provide benefits to the greatest number of users (human and wildlife). Included in any design analysis is consideration for low-flow conditions. The creation of pools and other year-round habitat are as important in creating a healthy creek as creating a system that transports wet-weather, high-flow conditions.

Opportunity is a situation where other projects are occurring that would make creek restoration possible and/or more cost effective than creek restoration without the other project.

Projects with necessary functional repairs are rated the highest priority.

The creek restoration analysis verified the functional role of the creeks, evaluated the opportunities and feasibility of restoring creeks to a more natural condition, and reviewed policy issues relating to creek enhancements. Examples included improving existing creeks, and re-opening culverted creeks.

Issues considered in this element included:

- Evaluation of existing conditions in creeks
- Identification of existing riparian vegetation and wildlife habitats
- Location of areas of erosion problems and impediments to flow
- Location of sites for potential recreational and greenway enhancements
- Identification of possible community building and education opportunities

- Evaluation of potential creek improvements to provide additional flow capacity
- Identification of opportunities for vegetation and wildlife habitat restoration and enhancement
- Determination of appropriate type of restoration, including widening of channels, removal of exotic and invasive plant material, and revegetating creek areas
- Evaluation of priorities for creek restoration opportunities
- Estimation of construction costs of creek restoration projects

Water Quality

This element assessed the City's existing practices and the opportunities to enhance water quality in Albany's creeks. Analysis included evaluating the City's Clean Water Program efforts for compliance with regulatory requirements, reviewing literature and procedures for effectiveness and completeness, and identifying opportunities to cost-effectively incorporate treatment Best Management Practices (BMP) into flood control, storm drain improvement, and channel restoration projects.

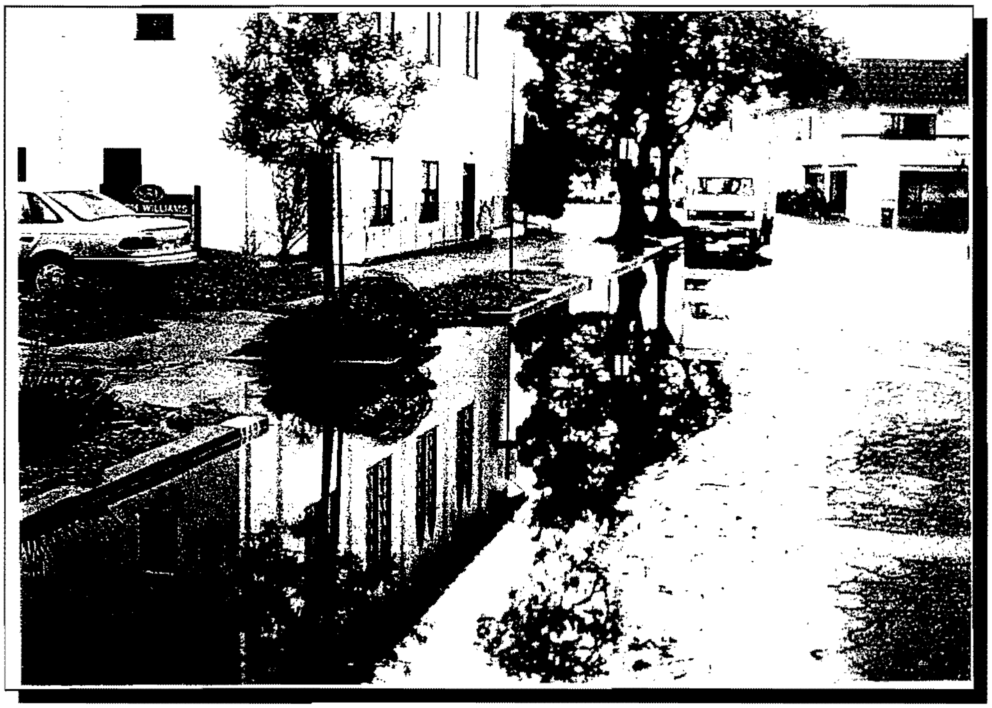
Issues considered in this element included:

- Current City of Albany practices and evaluation of the City's efforts to comply with Alameda County Clean Water Program Best Management Practices
- Existing clean water laws and regulations, including federal, state, and local
- Available data on water quality in Albany's creeks
- Opportunities and methods to improve water quality

Project Cost Estimates

Costs have been estimated for each storm drain and creek project. The cost varies with the difficulty of each project. Project estimates include planning and engineering design.

# Localized Flooding



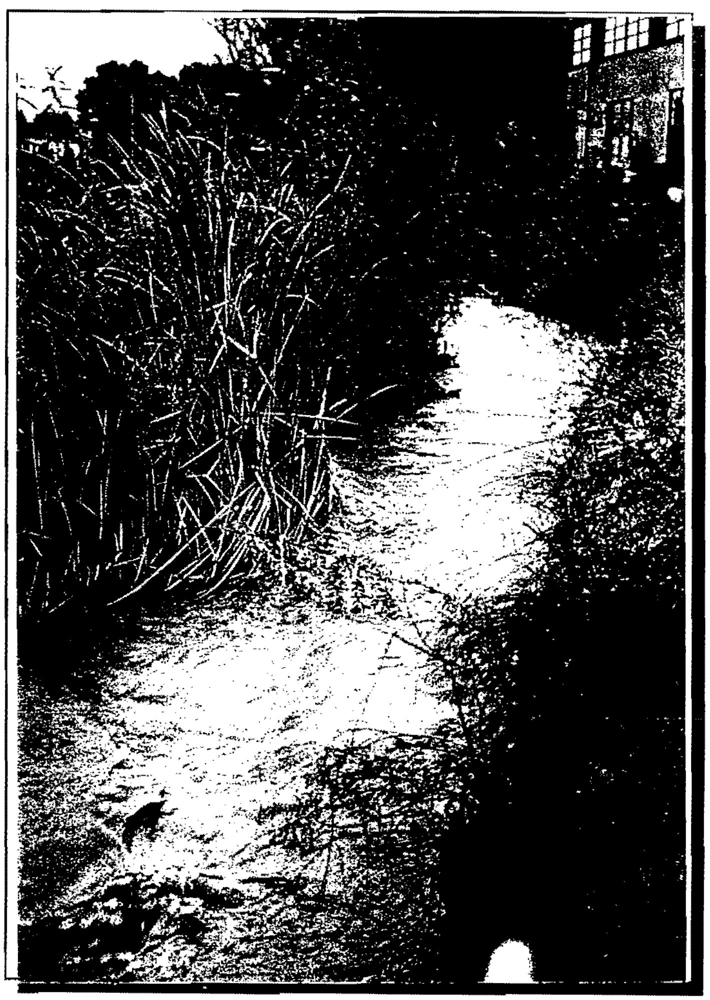
PONDING ON POMONA AVENUE NORTH OF SOLANO AVENUE
JANUARY 1998

CLEVELAND AVENUE AT SOLANO AVENUE

JANUARY 1998

# Codornices Creek Watershed

CODORNICES CREEK AT BYPASS TO VILLAGE CREEK
AND 1997 CHANNEL RESTORATION PROJECT



VEGETATION IN CHANNEL OF CODORNICES
CREEK UPSTREAM OF 8TH STREET JANUARY 1998

## CODORNICES CREEK WATERSHED

Codornices Creek forms the southern boundary of Albany. It extends from just west of Monterey Avenue in Berkeley approximately 1.4 miles to Interstate 80. The creek runs another one-half mile northward between Interstate 80 and the Golden Gate Fields racetrack to San Francisco Bay.

Codornices Creek drains about 700 acres, and the watershed extends to the ridge of the Berkeley Hills. Most of the watershed is located in Berkeley, and only about 30 acres (4% of the drainage area) originates in Albany.

Many of the existing culverts in Codornices Creek are a standard design consisting of a poured in place concrete culvert six feet wide and six feet high, with a circular arch top section. This is true of all the culverts from Ordway Street to Kains Avenue, and the culvert under Interstate 80. The exception is the culvert under the BART right-of-way (Ohlone Greenway), which is eight feet wide. Other creek crossings include a bridge at the entrance to St. Mary's College High School, box culverts at San Pablo Avenue and street crossings within University Village, a trestle at the Union Pacific Railroad tracks, and a bridge at Second Street.

Upstream of San Pablo Avenue, the culverts are generally adequate to carry 75% to 85% of the estimated 10-year flow in the area. At Interstate 80, the culvert is estimated to have a capacity of about 50% of the estimated 10-year flow the lowest estimated capacity of the culverts on Codornices Creek. These calculations consider the effects of the high-flow by-pass channel that connects Codornices Creek to Village Creek in the University Village property. The joint flow of the by-pass and Village Creek discharges through the Union Pacific Railroad right-of-way, across private property, and into a culvert beneath Eastshore Highway and Interstate 80.

### Existing Conditions

The following description of the watershed begins at the upstream, or easternmost limits of the creek. Field observations of the creek were made in June 1997.

Beginning in Berkeley, Codornices Creek flows through a combination of closed conduits and open channel reaches. Two major branches of the creek join in Berkeley at Codornices Park, then flow through the Berkeley Rose Garden.

In Albany, between Monterey Avenue and San Pablo Avenue, the creek consists of a narrow channel corridor through residential neighborhoods with alternating open and culverted sections. Some of the culverts extend beyond the street right-of-way onto adjacent private property. The entire reach between Peralta Avenue and Ordway Street is contained in a culvert. Except for street crossings, creek sections are located on private property controlled by adjacent owners. Open channel sections have generally been modified from their natural form, with concrete walls in some locations, and broken concrete rubble in many locations.

East of San Pablo Avenue, the existing vegetation consists of ornamental trees and shrubs, ruderal herbs, native trees and aquatic plants that have persisted or re-colonized the banks and channel bottom. Native habitat present in the upper portion of Codornices Creek is restricted to scattered remnants of Central Coast riparian scrub, coast live oak woodland and coastal freshwater marsh.

Downstream of the St. Mary's College High School bridge, an extensive piece of filter fabric used under riprap for bank repair on the Berkeley side of the creek is not securely attached to the bank. Should this fabric tear loose, it could block culverts further downstream and cause flooding and property damage.

There are several storm drain pipes that flow directly into Codornices Creek. These include a 12-inch clay drain from Peralta Avenue and Posen Avenue, a 24-inch box culvert in Santa Fe Avenue (which carries flow from as far north as Marin Avenue), a 12-inch clay pipe that enters the creek at San Pablo Avenue from Dartmouth Avenue, and an 18-inch concrete pipe on Eighth Street in University Village. Other minor areas of street flow also enter the creek at various locations through individual drain inlets.

The hydraulic evaluation showed that the existing 12-inch clay drain on Posen Avenue, Ordway Street, and Peralta Avenue that connects to Codornices Creek, can carry about 40% of the required 10-year flow. There have been reports of periodic flooding at the southeast corner of the intersection of Posen Avenue and Ordway Street. The houses at this corner are located well above street level, but interference with traffic may occur.

Between Curtis Street and Santa Fe Avenue, one very wide section exists where the south bank is eroding. On the east side of Santa Fe Avenue, several concrete buttresses cross the creek to support a retaining wall on the southern (Berkeley) side of the creek. Between Santa Fe Avenue and Masonic Avenue, a concrete wall on the south bank is leaning into the channel, and one section is collapsing.

On Dartmouth Street from Talbot Avenue to San Pablo Avenue, the hydraulic analysis showed that the existing 18-inch CMP drain that flows west on Dartmouth Street lacks adequate capacity from Talbot Avenue west to San Pablo Avenue. In addition, the short 12-inch clay drain in San Pablo Avenue from Dartmouth Street to Codornices Creek is also inadequate to carry the 10-year flow. It was not possible to confirm the slope or condition of this drain along Dartmouth Street, since the only direct access point is a manhole at San Pablo Avenue and Dartmouth Street. The slope used for the hydraulic evaluation was based on the catchbasin inlet elevations along Dartmouth Street.

Interestingly, even though the model indicates flooding should occur, there has not been any report of flooding problems in this area. Overflows likely follow the street gutters to San Pablo Avenue. It is possible that storm water is collected in the sanitary sewer system through cross connections, which cause the sewer system to fail, but relieve the storm drain system. This is considered a possibility, as the sewer manhole cover in San Pablo Avenue at Dartmouth Street does dislodge in large storms. The City continues to maintain an aggressive program identifying and eliminating cross connections between sewer and storm drain systems.

Between Cornell Avenue and Stannage Avenue, there is one small area of erosion and collapse in the creek bank. In this same area, many branches hang down into the creek, and trees are growing down in the low flow channel on the north bank, which may catch debris and obstruct flow. These trees are located on private property and should be maintained by the individual property owners.

Downstream (west) of San Pablo Avenue the creek channel is open, except for short culverts beneath streets. Downstream of Interstate-80, Codornices Creek is confined to a man-made earthen channel. In this reach, the creek is subject to tidal influence.

Bed material throughout the creek is a mixture of natural sediment (sand and gravel) and concrete debris that has fallen or been placed into the creek. A few sections of the creek bed consist of poured concrete.

Bank material varies widely, from natural earth to poured concrete. The residential areas upstream of San Pablo Avenue generally consist of hard material bank protection, such as concrete debris or poured concrete walls. However, the banks between Peralta Avenue and Santa Fe Avenue consist in large part of natural soil. Downstream of San Pablo Avenue the creek banks consist more of fill which may contain considerable debris. In general, the most downstream sections of the creek (where tidal influence occurs) have mostly natural earth banks.

Due to the flatter channel slope, the section of Codornices Creek west of San Pablo Avenue is more subject to sedimentation than upstream reaches. This sediment tends to lower channel capacity by reducing the channel cross sectional area.

Codornices Creek tends to be narrower and deeper in the upstream residential sections as compared to downstream areas. It is narrowest between Talbot Avenue and San Pablo Avenue. The section near St. Mary's College High School is very deep.

The creek has a number of locations where buildings are less than twenty feet from the top of the creek bank. Some of these structures are homes, some are industrial or commercial, and many were garden sheds. In some cases, home foundations form the creek bank.

A portion of the flow from Codornices Creek is diverted into the Village Creek watershed, in a culvert located in the University Village area just east of the Union

Pacific Railroad tracks. Low flows remain in the Codornices Creek channel at this location, and higher flows are split between the diversion to Village Creek and the original creek channel.

Some localized flooding occurred during the January 1997 storm in the areas east of San Pablo Avenue, based on conversations with residents and observed high water marks. The areas where flooding occurred were generally at residences that are adjacent to and/or encroaching on the overbank and floodplain area of the creek and have a portion of the structure below street elevation. Apparently no overflows to the streets occurred in these areas.

Flooding problems have occurred a number of times in the lower Codornices Creek area west of San Pablo Avenue. During the January 1997 storm, overflows occurred at Sixth Street, in the area east of the Union Pacific Railroad tracks, and in the area between Interstate 80 and the Union Pacific Railroad tracks. Water overflowing to the north flooded businesses on the Eastshore Highway, and hampered access to the City of Albany maintenance center. Water also flowed to the south along the east side of the Union Pacific Railroad tracks, and was reported to be ten inches deep at the homeless shelter on Harrison Street in Berkeley.

Some flooding occurred in the University Village area in 1982, with flooding in Dowling Park east of the Union Pacific Railroad tracks and near Fifth Street and Sixth Street. There are also reports that flooding occurred in 1986.

Between San Pablo Avenue and Interstate-80, vegetation is mostly ruderal (on ground that has been disturbed), although native vegetation consisting of scattered mature willows and coastal freshwater marsh is also present.

Downstream of Interstate-80, both banks have been highly modified; the top of the west bank has been planted with ornamental trees and the east bank has been planted recently with native shrubs and trees as part of a CalTrans project for Interstate-80. The lower banks support coastal brackish marsh and salt marsh herbaceous species. A well-developed stand of northern coastal salt marsh is present at the downstream end of the creek.

Despite the highly urbanized nature of Codornices Creek, numerous native, presumably indigenous tree species are still present. Creek sections supporting noteworthy native species include the following:

1. Monterey Avenue to Ordway Street, at Saint Mary's School: densely wooded slopes with an abundance of native trees including coast live oak, California bay laurel, California buckeye, Mexican elderberry and box elder;
2. Peralta Avenue to Neilson Street: dense stands of arroyo willow and a few box elder;

3. Neilson Street to Curtis Street: two large arroyo willows;

4. Curtis Street to Santa Fe Avenue: several dense stands of arroyo willows, three box elder, one California buckeye, and a pond supporting a fish, possibly steelhead trout;

5. BART tracks to Masonic Avenue: numerous large Fremont's cottonwood and one box elder;

6. Masonic Avenue to Evelyn Avenue: several large Fremont's cottonwood, two box elder and one large big-leaf maple;

7. Evelyn Avenue to Talbot Avenue: one large California buckeye and one small arroyo willow;

8. Talbot Avenue to Cornell Avenue: a dense stand of arroyo willows and one box elder;

9. Stannage Avenue to Kains Avenue: two white alder and one big-leaf maple;

10. San Pablo Avenue to 10th Street: several large arroyo willows, one large box elder and one Mexican elderberry;

11. 10th Street to 8th Street: one California buckeye, two white alders and a clump of arroyo willows;

12. 8th Street to 6th Street: two medium arroyo willows and one box elder;

13. 6th Street to 5th Street: two arroyo willows and one Mexican elderberry;

14. 5th Street to the railroad tracks: one large clump of arroyo willows. A mature western pond turtle was also sighted on two separate occasions;

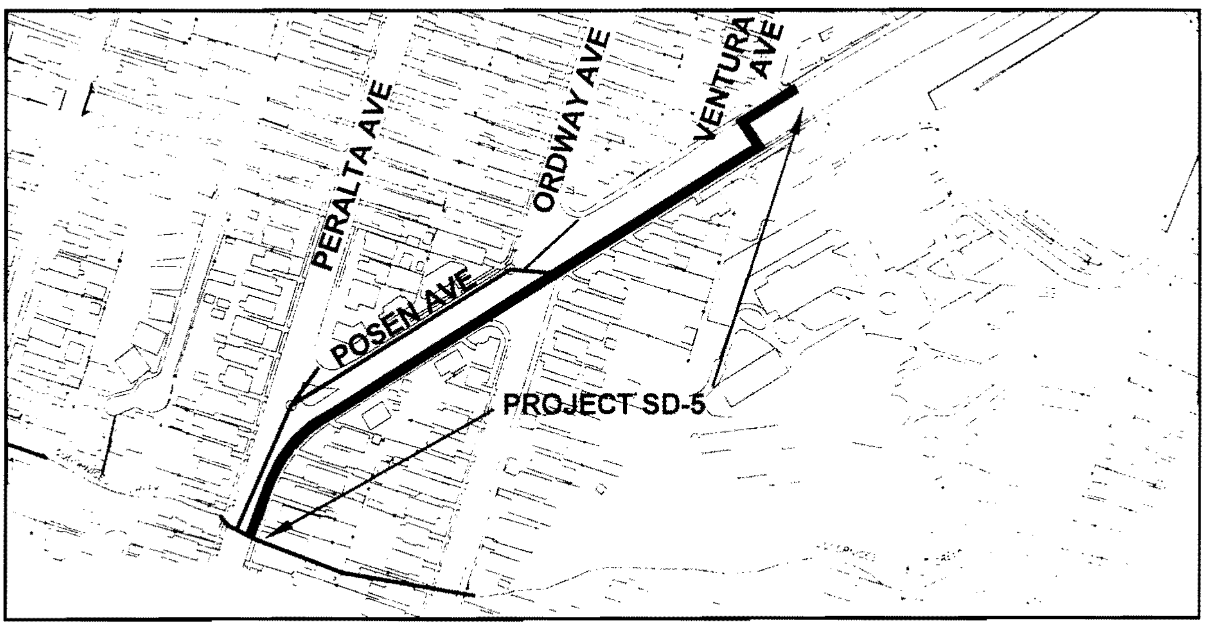
15. Union Pacific Railroad tracks to Eastshore Highway: one small red willow.

**Recommended Projects**

**Project SD-5**: Replace the existing 12-inch storm drain pipe in Peralta Avenue Posen Avenue and Ordway Street (approximately 1,400 lf).

**Estimated Cost:** $220,000

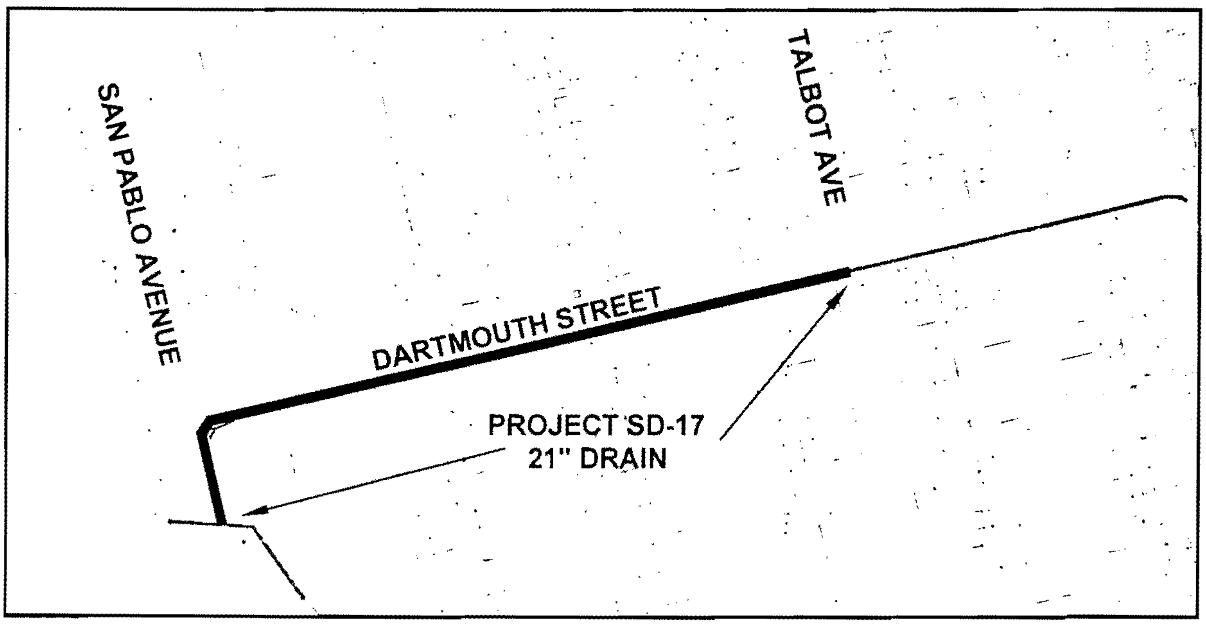
**Description:** The project will replace the existing system with a new 21-inch pipe and a series of catch basins. This project is currently in design by the City using mitigation funds from the expansion of the St. Mary's College High School gymnasium facility. Construction funds have not been allocated.



**Project SD-17**: Replace existing 12-inch storm drain pipe in San Pablo Avenue, and 18-inch pipe in Dartmouth between San Pablo Avenue and Talbot Avenue (approximately 1,150 lf).

**Estimated Cost:** $360,000

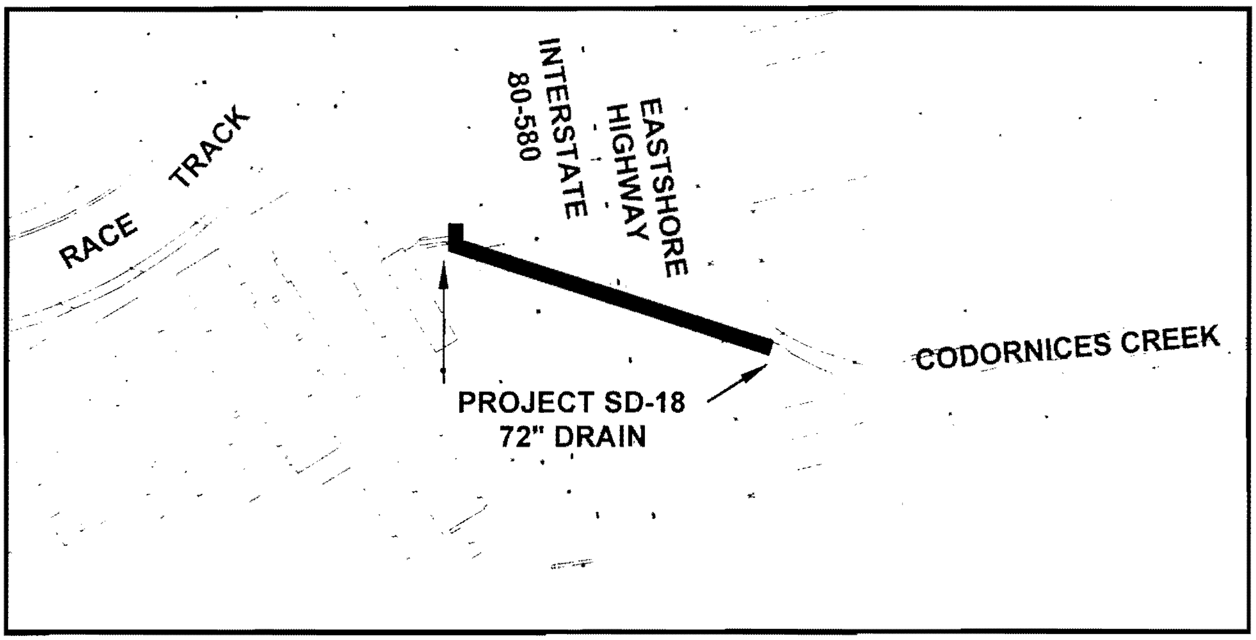
**Description:** The existing storm drain is a deficient metal pipe. Replacing this pipe would provide the capacity needed to carry a 10-year storm event. A new 21-inch pipe is recommended to replace the existing 18- and 12-inch pipes.



**Project SD-18**: I-80 at Codornices Creek.

**Estimated Cost:** $720,000

**Description:** Install a new 72-inch storm drain pipe parallel to the existing six-foot by five-foot concrete arch drain crossing I-80 at Codornices Creek. This would provide additional flow capacity and help eliminate flooding problems between I-80 and the railroad tracks. In order to cross I-80, pipe jacking construction methods would probably be required.

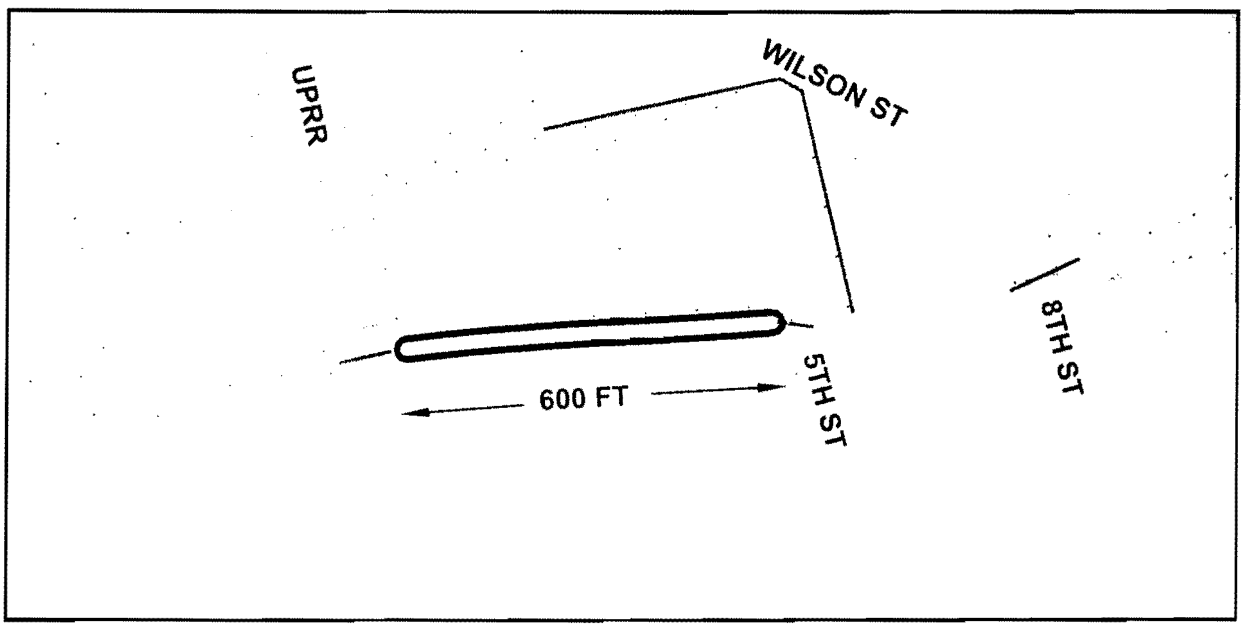


**Project CR-1**: Codornices Creek: Fifth Street to the Union Pacific Railroad tracks (approximately 600 lf)

**Estimated Cost**: $120,000

**Description:** The goal of this project is to increase the creek's capacity for storm flows and to restore the creek channel and creek corridor to a more natural form. This restoration can provide The area on both sides of the creek is currently owned by the University of California. Berkeley. The City has grant funds to design and construct a bicycle/pedestrian trail along the creek to connect San Pablo Avenue with the Bay Trail. Recommended elements include:

- A pedestrian link between future Eastshore Highway commercial development, new play fields on Dowling Park, future San Pablo commercial development, and Albany's residential community.
- Excavation of the creek sections between 5th Street and the railroad tracks to widen the existing channel to form a multi-stage channel with gentle meanders.
- Removal of vegetation and debris to increase flow capacity. Only vegetation or portions of vegetation directly in the creek should be removed; vegetation that is rooted halfway up the bank or higher should be left intact to stabilize the banks and provide shade canopy.
- Pruning of branches of trees or shrubs that hang down into the channel to prevent flooding but leave intact branches which provide shade to the creek.

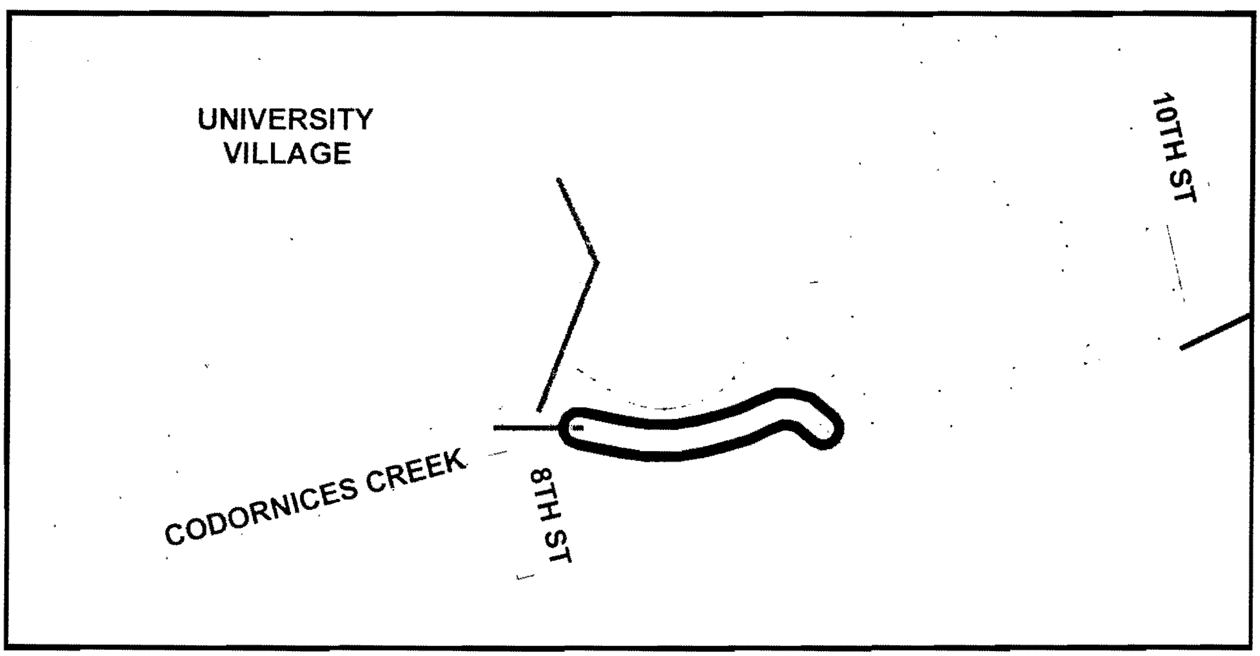


**Project CR-3:** Codornices Creek between 5th Street and 10th Street, approximately 1,500 lf.

**Estimated Cost:** $420,000

**Description:** The creek forms the boundary between University Village housing and the City of Berkeley. Nine hundred feet of creek is open (300 lineal feet east of 9th Street and 600 lineal feet east of 6th Street). The property between 6th Street and 8th Street south of the creek is owned by the University of California. The goal of this project is to increase the creek's flow capacity, to restore the creek channel and creek corridor to a more natural form, and connect to other planned and recently restored creek sections. Recommend project elements include:

- Removing debris and exotic plants and re-vegetating with native species
- Widening channels and introducing meanders where right-of-way is available
- Incorporating trail and bike paths, overlooks, creek identification and educational signs
- Replacement of existing street box culverts with new bridge structures



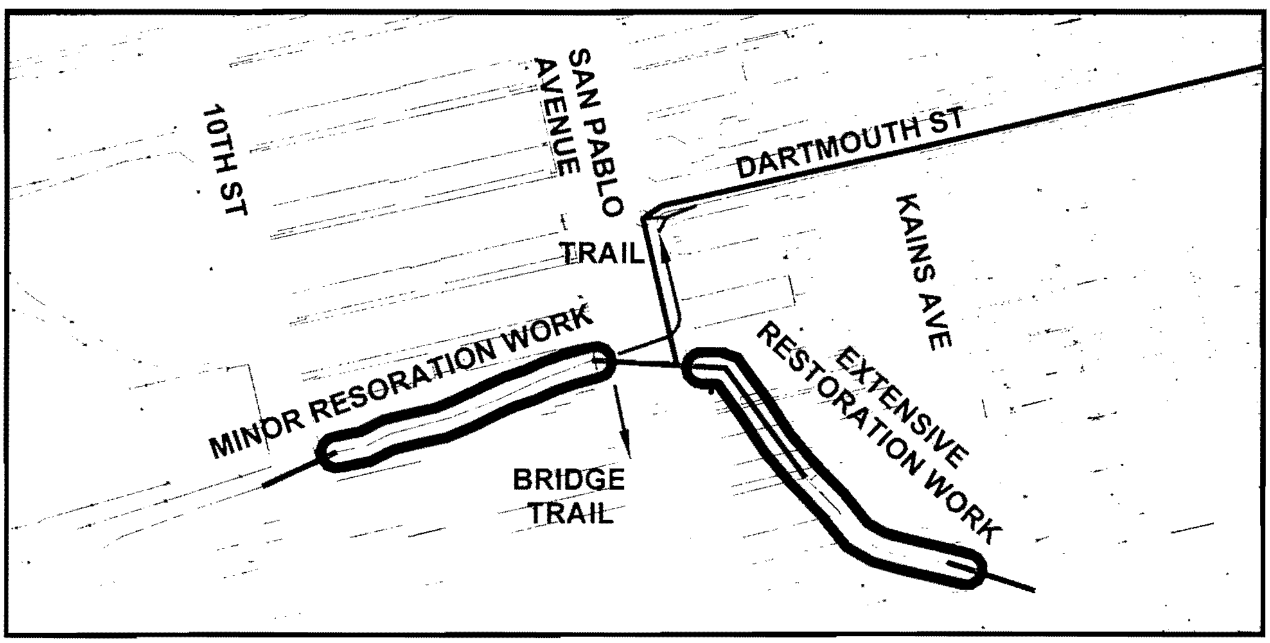
**Project CR-6:** Between San Pablo Avenue and Tenth Street (approximately 300 lf).

**Estimated Cost:** $160,000

**Description:** Codornices Creek is open on the west side of San Pablo Avenue. The project will enhance this site as a "gateway" to Albany. Acknowledging the creek with such elements as bridge rails, special paving and pedestrian scale lights along the creek would bring a greater awareness to those who live near or pass by the creek. Recommended project elements include:

- Removing debris and exotic plant material and re-vegetating with native species
- Constructing a trail and bike path and overlooks
- Installing creek identification and educational signs
- Design and construct gateway elements on San Pablo Avenue, such as bridge railings and special paving

The map below shows this project and project CR-7. CR-6 is the left hand project.



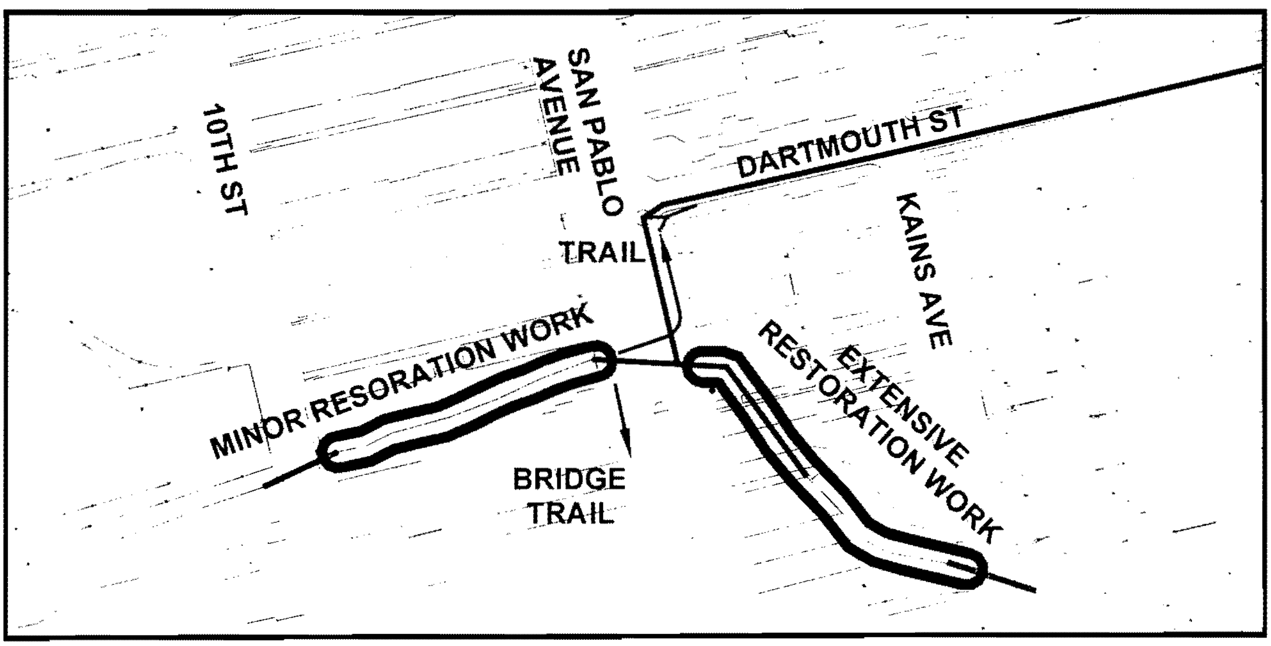
**Project CR-7:** Between San Pablo Avenue and Kains Avenue (approximately 300 lf)

**Estimated Cost:** $95,000

**Description:** The location of the creek at the City border with Berkeley provides an opportunity to enhance the area as a "gateway" to Albany. Acknowledging the creek with such elements as bridge rails, special paving on Kains Avenue, and pedestrian scale lights along the creek would bring a greater awareness to those who live near or pass by the creek. Improvements to this creek section should be coordinated as a part of the re-use and development of the former Villa Motel site. Recommended enhancement elements include:

- Removing debris and the concrete channel
- Recreating a new stream channel geometry by widening and constructing meanders
- Re-vegetating with native species
- Designing and installing Creek identification and educational signs

The map below shows both projects CR-6 and CR-7. CR-7 is the right hand project.

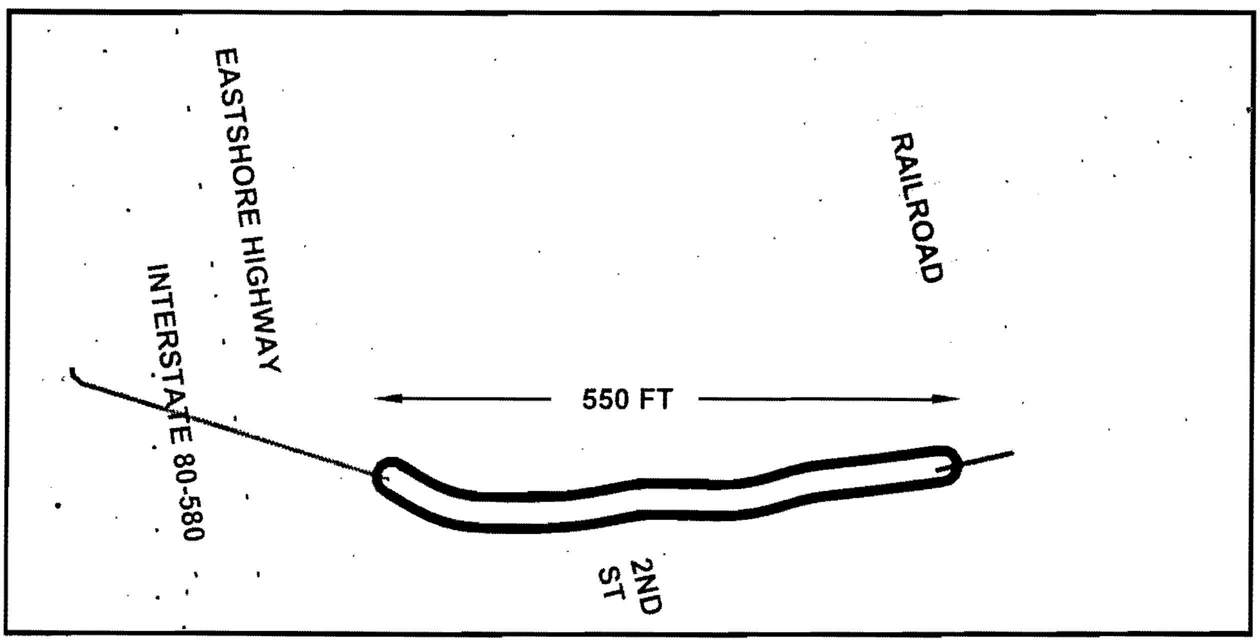


**Project CR-10:** Between the Union Pacific Railroad tracks and Eastshore Highway (approximately 550 lf)

**Estimated Cost:** $195,000

**Description:** This reach of Codornices Creek is continuously open between the Union Pacific Railroad Tracks and Eastshore Highway, except for the bridge at 2nd Street. The purpose of this restoration is to improve the flow capacity of the creek, enhance wildlife habitat, and provide a trail along Codornices Creek to the Eastshore Highway and the San Francisco Bay Trail. Recommended project elements include:

- Removing exotic plants and re-vegetating with native species
- Widening the channel and constructing meanders
- Constructing a trail and bike path and overlooks
- Constructing creek identification and educational signs

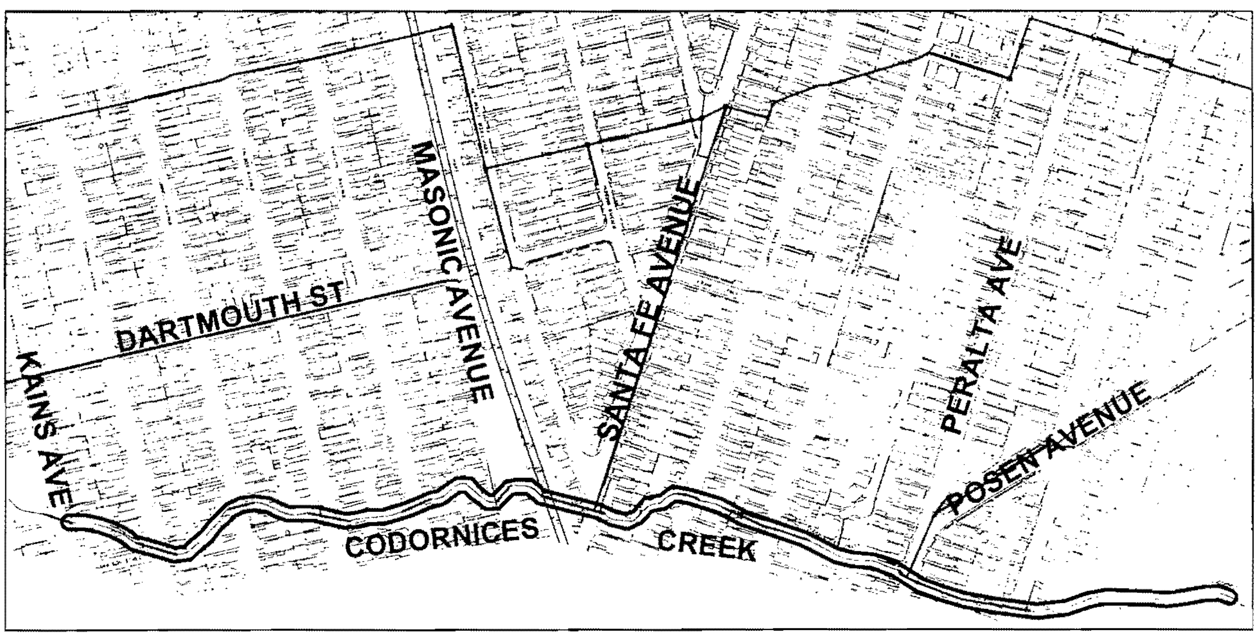


**Project CR-15:** Between Kains Avenue and the eastern Albany city limits (approximately 3,600 LF)

**Estimated Cost:** $105,000

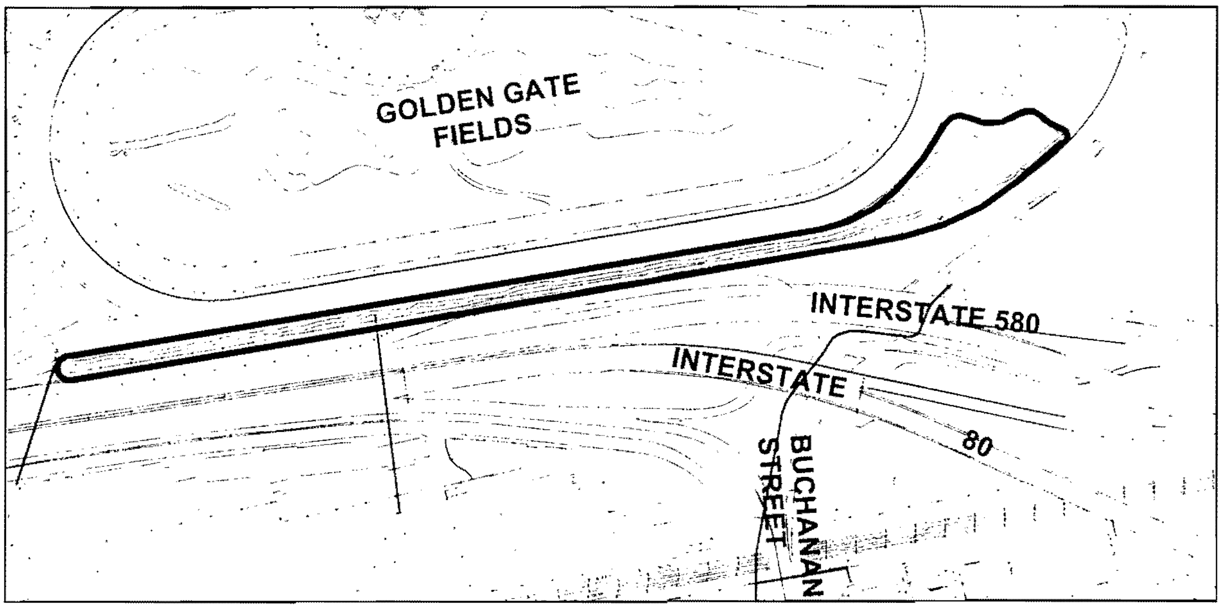
**Description:** Kains Avenue to the Berkeley border near Monterey Avenue is a residential neighborhood. The creek is open within each block with the exception of Ordway Street to Posen Avenue and several partially culverted sections. This project will provide education to the homeowners to encourage better understanding of the relationship between water quality, creek maintenance, and restoration. Education could begin as a short term project with mailings and lead to longer term projects such as workshops and demonstration projects. A secondary, much longer term project, would open the culverts under the roads with bridges for better hydraulic flow conditions. Recommended project elements include:

- Providing educational mailings and workshops on how to:
  - Remove debris and exotic plants
  - Widen channels and introduce meanders where right of ways allow this to happen
  - Stabilize eroding slopes with biotechnical methods
  - Revegetate with native species
  - Provide vegetation management and maintenance
- Construct bridges at street crossings for improved flow capacity (longer term)



**Project CR-18:** Golden Gate Fields to the Albany Mudflats (approximately 2,000 lf)
**Estimated Cost:** $30,000
**Description:** Codornices Creek now flows in an improved channel between Golden Gate Fields and Interstate 80. Recent freeway work included revegetation on most of the east bank of the channel. The area is not readily accessible to the public due to its location. Recommended project elements include:

- Removing Exotic Plants
- Re-vegetating the west bank (Golden Gate Fields side) with native species



# Village Creek Watershed

VILLAGE CREEK UPSTREAM OF RAILROAD JANUARY 1998

VILLAGE CREEK CULVERT UPSTREAM OF EASTSHORE HWY

## VILLAGE CREEK WATERSHED

Village Creek drains an area of about 157 acres, and is almost entirely located within Albany in an area south of Marin Avenue. About three acres (2% of the drainage area) drains into the watershed from Berkeley. Village Creek is not shown on any of the maps of historic creeks in Albany. Its name comes from its function as the major drainage way in University Village. Marin Creek may have drained through portions of the existing Village Creek channel at one time.

Based on the degree of deficiency and the potential for continued flooding of residences in this area, the Village Creek system immediately east and west of Santa Fe Avenue rate as high priorities for storm drain improvements.

The problems presented in this system are some of the most difficult to solve. The existing culverts between streets are located on private property, with very limited access under houses and foundation walls. The lowest point of the streets is located in the middle of the block (which defines the centerline of the drainage basin). It would be difficult or impractical to reroute the storm drain pipes entirely such that they remain solely in public streets. Construction along or near the existing storm drain pipes would require tunneling or other expensive construction techniques.

### Existing Conditions

The drainage of the Village Creek watershed east of San Pablo Avenue is entirely contained within underground pipes and culverts. Many sections of the existing system are on private property, located between or under existing houses and foundations.

The existing storm drain pipes and creek culvert in this area consist of 14-inch to 18-inch clay pipes east of Key Route Boulevard, with a 10-inch plastic insert in the pipe between Curtis Street and Neilson Street. At Santa Fe Avenue, there is a 15-inch pipe that carries some water during high flows into the 24-inch box culvert flowing south into Codornices Creek. From Masonic Avenue west to San Pablo Avenue, drainage is carried in a box culvert, which varies slightly in size from 24-inches by 24-inches to 24-inches by 26-inches.

Nearly all the existing storm drain pipes and inlets in the Village Creek watershed east of San Pablo Avenue are in need of repair or replacement. Those needing replacement have capacity deficiencies. The culverts east of Peralta Avenue are adequately sized, but have collapsed and are in need of repair. Since this Watershed Management Plan study began, the City has replaced two portions of this drainage system. These improvements are located between Ventura Avenue and Ordway Street and between Ordway Street and Peralta Avenue, the two most easterly portions of this drainage system.

Existing conditions within the Village Creek Watershed are discussed below. The discussion that follows evaluates the system beginning from the most upstream portion near the intersection of Ventura Avenue and Beverly Place, continuing to its eventual outfall in the San Francisco Bay.

The most serious capacity problem is the 14-inch pipe that runs from Santa Fe Avenue and Ramona Avenue west to Pomona Avenue. This section has only 11% of the required capacity to carry the 10-year flow. This problem is somewhat ameliorated by the upstream overflow capacity in the 15-inch pipe in Santa Fe, which connects to the Codornices Creek watershed system.

Periodic flooding occurs on the east side of Santa Fe Avenue near the Ramona Avenue intersection. Water apparently crosses over the street on occasion and floods a garage below street level on the west side of Santa Fe. A resident reported that overflows occurred at the storm drain manhole on the east side during the January 1997 storm. After a small storm in June 1997, there was a large amount of debris in the manhole on the west side of Santa Fe. There may be a defect in the downstream culvert west of Santa Fe that causes frequent plugging of the line. A more detailed inspection of this line should be undertaken to determine if there is a serious problem requiring immediate action, rather than waiting to implement a long term solution.

The 10-inch plastic storm drain pipe between Neilson Street and Curtis Street has only 16% of the minimum required capacity. During recent storms, water has regularly backed up at this location, and overflowed through properties on the west side of Neilson Street.

The drainage system east of Santa Fe has capacities of 20% to 25% of the 10-year flow, and the box culverts west of Key Route Boulevard have capacities of 40% to 60% of the 10-year flow. All of these systems are recommended for replacement and increased capacity to accommodate the 10-year storm criterion.

Localized drainage problems exist at the corner of Sonoma Avenue and Peralta Avenue. A videotape recording of the drains at this intersection in February 1998, showed that the drainage on the west side of the intersection is carried from the northwest corner to the southwest corner in a shallow 12-inch CMP drain that is in very poor condition. Portions of the pipe bottom are completely separated from the sides. There is no indication of an impending structural failure of the pipe, it is probably encased in concrete; however the sharp points of the corroded pipe probably cause debris to collect inside the pipe and restrict flow. The storm drain pipe on the east side of the intersection from the northeast corner to the southeast corner is a shallow, rectangular drain, and does not appear to have any serious problems.

For the area east of Santa Fe Avenue (i.e., between Peralta Avenue and Santa Fe Avenue), the best approach appears to be construction of larger storm drain pipes along or near the existing culvert. The City Engineer has already developed preliminary routing that appears to be feasible. This preliminary concept directs the culvert between residences rather than under them.

For the storm drain system extending from Santa Fe west across San Pablo Avenue, there may be alternatives available. An existing 24-inch by 24-inch box culvert carries some overflows from the Village Creek culvert south into Codornices Creek along Santa Fe Avenue. Although Santa Fe Avenue in this area slopes slightly to the north, the drain actually slopes back towards the south and Codornices Creek. If water levels are very high in Codornices Creek, the effective hydraulic capacity of this overflow drain may be reduced. Increasing the size of the 15-inch overflow drain may provide benefits in this area, as well.

Village Creek between San Pablo Avenue and Jackson Street supports numerous non-native trees such as Eucalyptus. This creek section is considered to have high enhancement potential. However, it would require the removal of a substantial number of mature non-native trees. Wildlife values would not necessarily be improved as a result of replacement of non-native trees with native riparian habitat because this site does not connect directly with other natural areas. The existing ornamental trees provide abundant nesting and perching opportunities for resident and migratory birds, including raptors.

Village Creek west of San Pablo Avenue to the Union Pacific Railroad tracks flows through land owned by the University of California. This reach has several restoration opportunities that could be included in the redevelopment of the University Village Housing, which is scheduled to begin in 1998. The open section of Village Creek between San Pablo Avenue and Jackson Street passes through a densely wooded lot consisting primarily of tall, mature horticultural trees to Jackson Street. Other than two small patches of willows, no naturally occurring native vegetation is present along this section.

West of Jackson Street, there is a culvert section of 30- to 42-inch CMP about 1,500 feet long within University Village. Based on the hydraulic analysis by Philip Williams Associates (which is included in this Plan by reference), this culvert does not have enough capacity to carry a 10-year flow.

Along the western boundary of the University Village Housing property, the pipe containing Village Creek is diverted south until it meets the Codornices Creek diversion channel. The overflow channel that diverts high-flow water from Codornices Creek joins Village Creek at a trestle beneath the railroad tracks, approximately 500 feet south of the United States Department of Agriculture (USDA) research facility. This section is delineated by a windbreak of large eucalyptus trees, lacking understory vegetation. The downstream part of this section, near the confluence with the Codornices Creek overflow by-pass, supports coastal freshwater marsh that has become established in open areas. This habitat consists of a dense stand of cattail and scattered bulrush, California oenanthe, and numerous non-native aquatic plants. This area is historically susceptible to cattails and other impediments to the free-flow of the creek and storm water. These were recently cut back, but continued private maintenance will be needed at this location to maintain flow capacity.

The trestle under the railroad has inadequate capacity for the 10-year storm. The 60-inch culvert under Eastshore Highway and Interstate 80 also has inadequate capacity, which contributes to flooding problems in the area between the Union Pacific tracks and Eastshore Highway. Most of these problems are probably related to the overflows from Codornices Creek rather than flows from the Village Creek watershed itself.

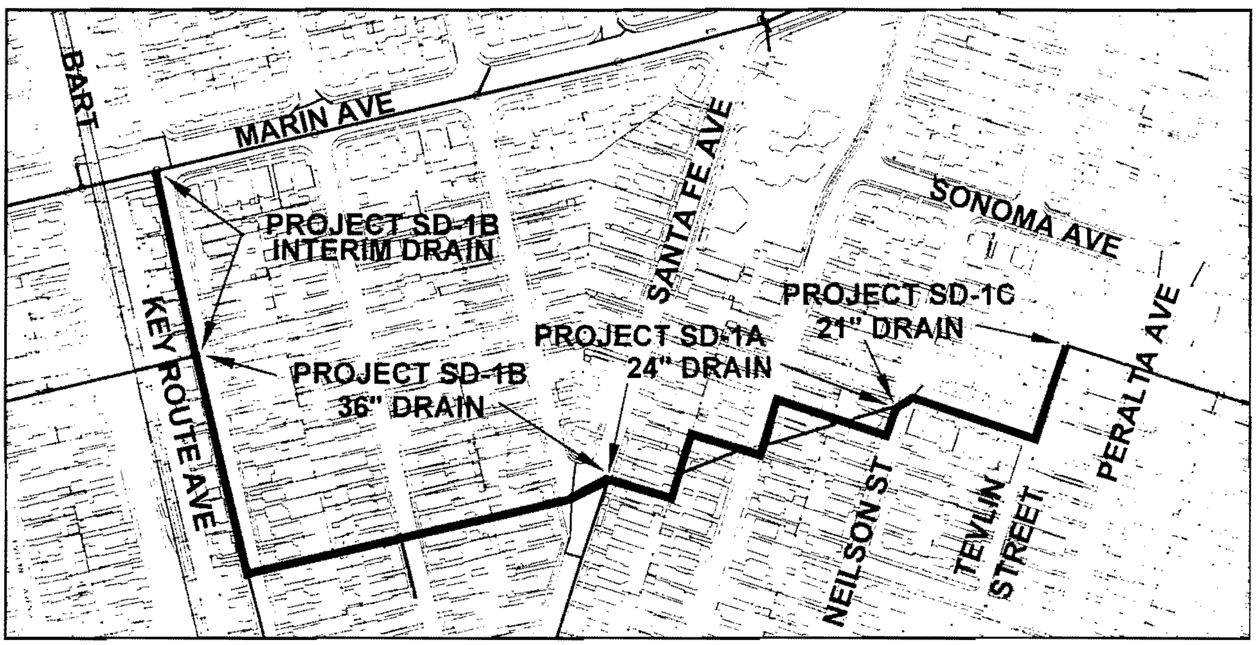
At the time of the field inspection, the culvert located on Union Pacific property had about two feet of sediment and gravel blocking the lower part of the entrance to the pipe, leaving about three feet of clear opening. Union Pacific, subsequent to the 1997 field surveys, effectuated a major clean up of the creek within their property. Included in this clean up was the removal of debris and non-native vegetation.

After passing through the 60-inch culvert under the building at 1057 Eastshore Highway, the frontage road itself, and Interstate 80, the creek empties into the Codornices Creek channel west of Interstate-80, alongside Golden Gate Fields. This artificial channel directs the creek flows of both Codornices and Village Creeks into the mudflats of San Francisco Bay.

**Recommended Projects**

**Project SD-1A, 1B, 1C:** Between Ventura Avenue and Key Route Boulevard

**Description:** This project is the number one priority because of the existing flooding problems that occur on Neilson Street and Santa Fe Avenue. The project is divided into three separate sections, 1A, 1B, and 1C, which could be constructed separately. Project 1A is considered the highest priority because the existing storm system runs beneath private residences and other structures. Ideally the project identified as SD-15 would be constructed prior to any upstream projects. However, the cost of this project, and the absence of immediately identified problems, places this (SD-15) as a lower priority. Nonetheless, to accommodate the improved flow from project SD-1A, project SD-1B is required to eliminate overflows and ponding on Santa Fe Avenue at Ramona Avenue. Localized ponding on Santa Fe Avenue and Ramona Avenue serves as a detention basin to regulate the rate of flow into both Village Creek and Codornices Creek.

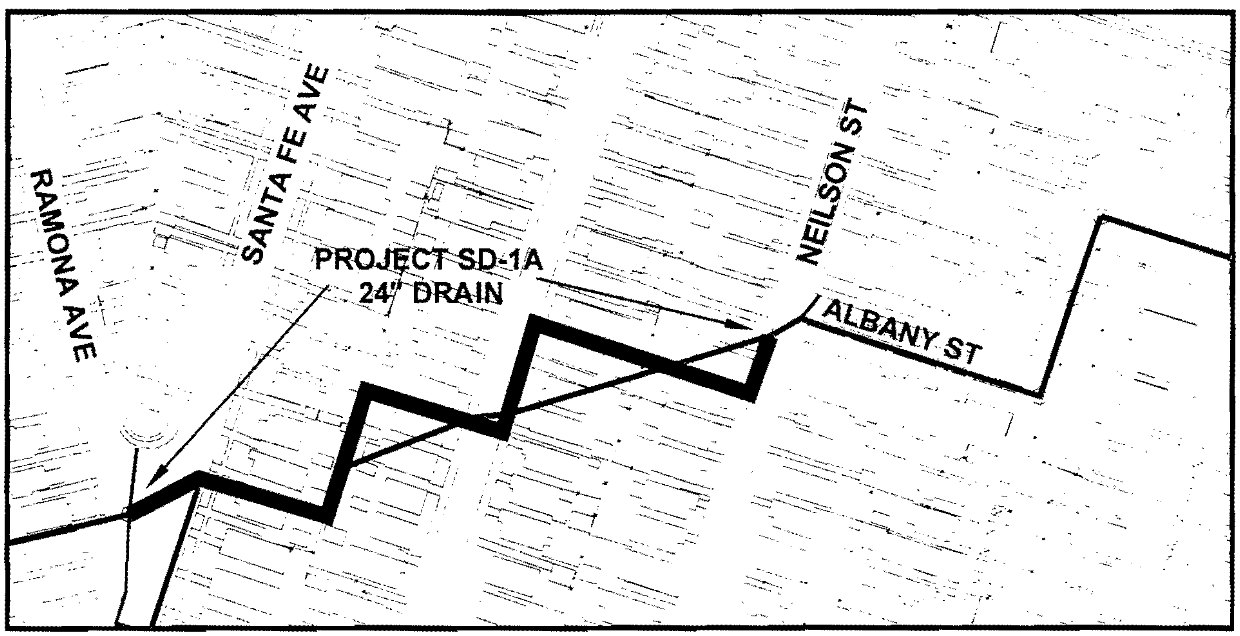


**Project SD-1A:** Install a 24-inch pipe between Neilson Street and Santa Fe, to replace the existing 10-inch PVC pipe and 14-inch VC pipe in this location.

**Estimated Cost:** $315,000

**Description:** The existing pipes are located under residences. A conceptual route for the 24" pipe has been evaluated by the City. Preliminarily it appears feasible to pass the new system between houses rather than under them. Easements would be required from property owners along the new route. Because of limited access, construction is expected to be difficult and expensive. Alternative and innovative construction techniques may be required.

*If this project were constructed by itself as an interim project, it is recommended that the City increase the size of the existing 15-inch overflow connection to the existing 24-inch box culvert flowing south on Santa Fe. This would provide additional capacity during normal storm events, although during major floods when water levels in Codornices Creek are high, this connection may not provide much additional flow capacity.*

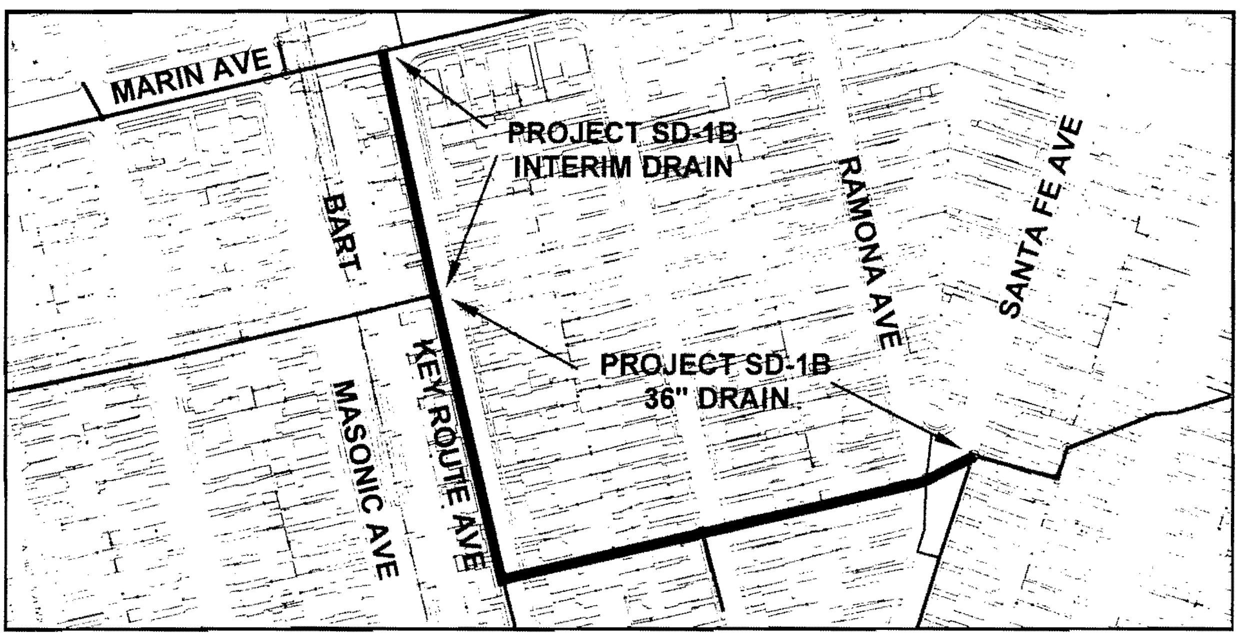


**Project SD-1B:** Replace the existing 14-inch and 18-inch pipes with a new 36-inch pipe between Santa Fe Avenue and Key Route Boulevard.

**Estimated Cost:** $504,000

**Description:** This storm drain pipe would be connected to the existing 24-inch drain which carries flows to the west across the BART right-of-way.

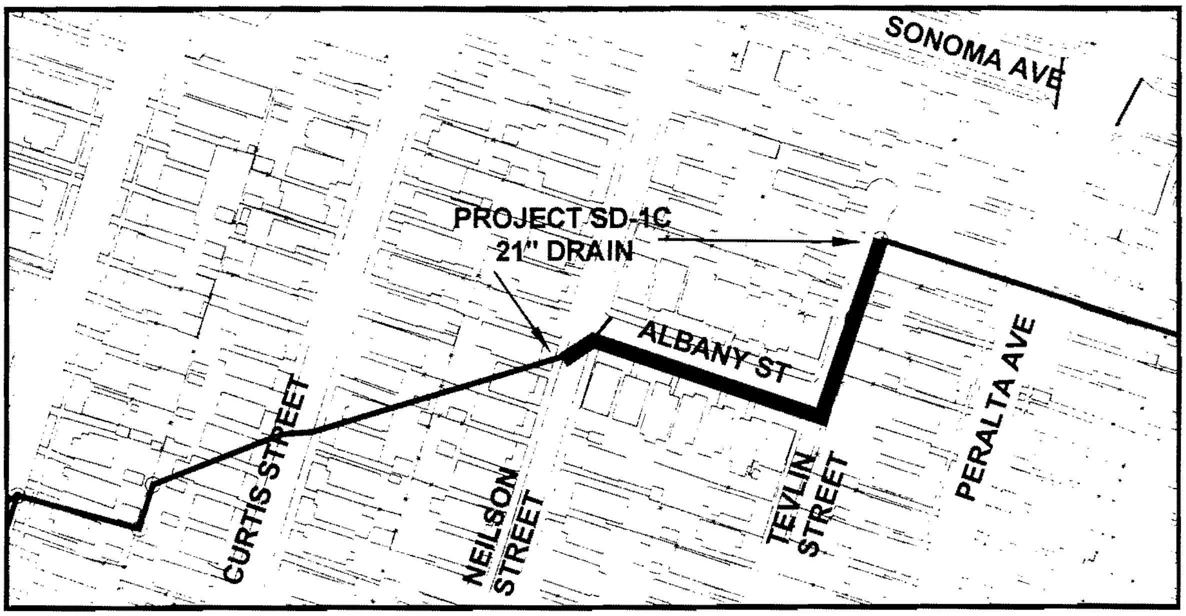
*As an interim project, without downstream improvements, a connection to the existing storm drain in Marin Avenue is recommended be provided to carry excess flows. The Marin Avenue drain does not have excess flow capacity for the 10-year flow, so this would probably not provide a long term solution. However, the Marin Avenue drain currently has upstream constraints (east of Ventura Avenue), so for most storms, this connection would provide drainage benefits. The street level at the existing 24-inch drain in Key Route Boulevard is slightly lower than the street at Marin Avenue, so the possibility of backflows from Marin Avenue during large storms would also have to be considered.*



**Project SD-1C:** Replace the existing 14-inch pipes with a new 21-inch pipe along Albany Terrace and Tevlin Street to Neilson Street.

**Estimated Cost:** $151,000

**Description:** Because the storm drain pipes upstream, between Ventura Avenue and Neilson Street, were replaced with larger pipes as a part of recent City of Albany sewer repairs, it is necessary and appropriate to continue the improvements downstream to accommodate the improved storm flow.

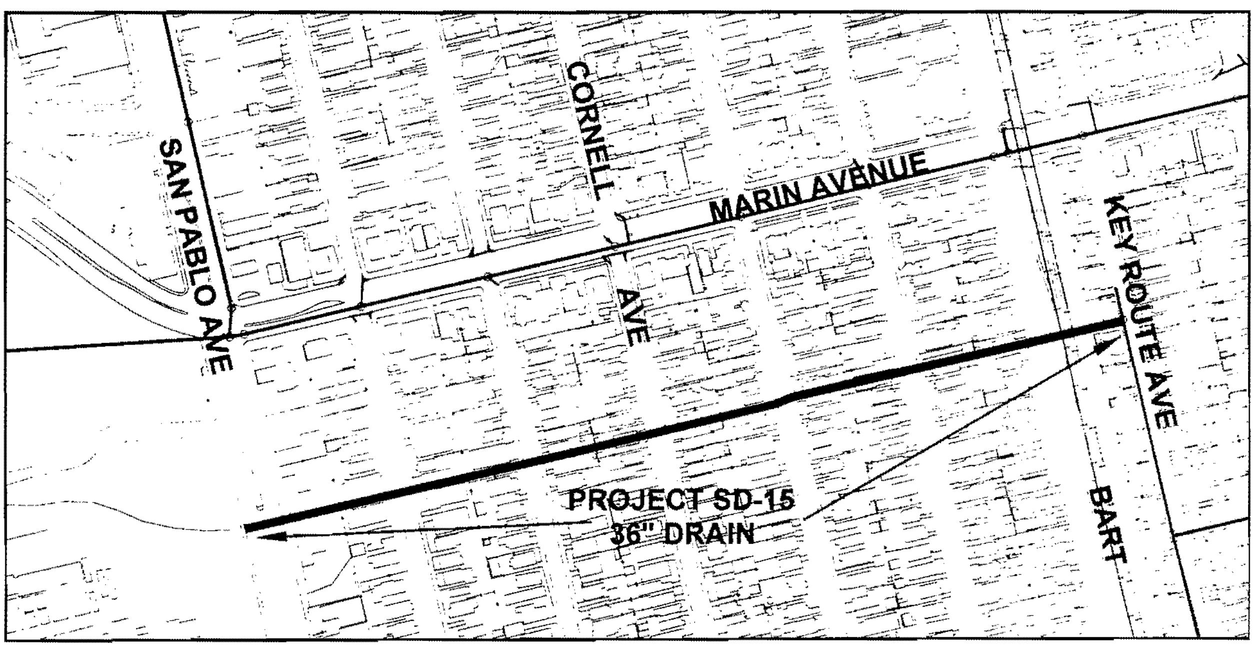


**Project SD-15:** Replace the existing 24-inch x24-inch and 24-inch x 26-inch box culverts that pass between and under houses with a 36-inch pipe from Key Route Boulevard across San Pablo Avenue.

**Estimated Cost:** $780,000

**Description:** Construction along the existing alignment will be difficult and expensive. Additional easement space is necessary to construct and maintain both the existing system and any new system installed in the current alignment. The construction estimate does not include the cost of acquiring easements for either construction or permanent maintenance. A minimum 10-foot easement is recommended for maintenance access.

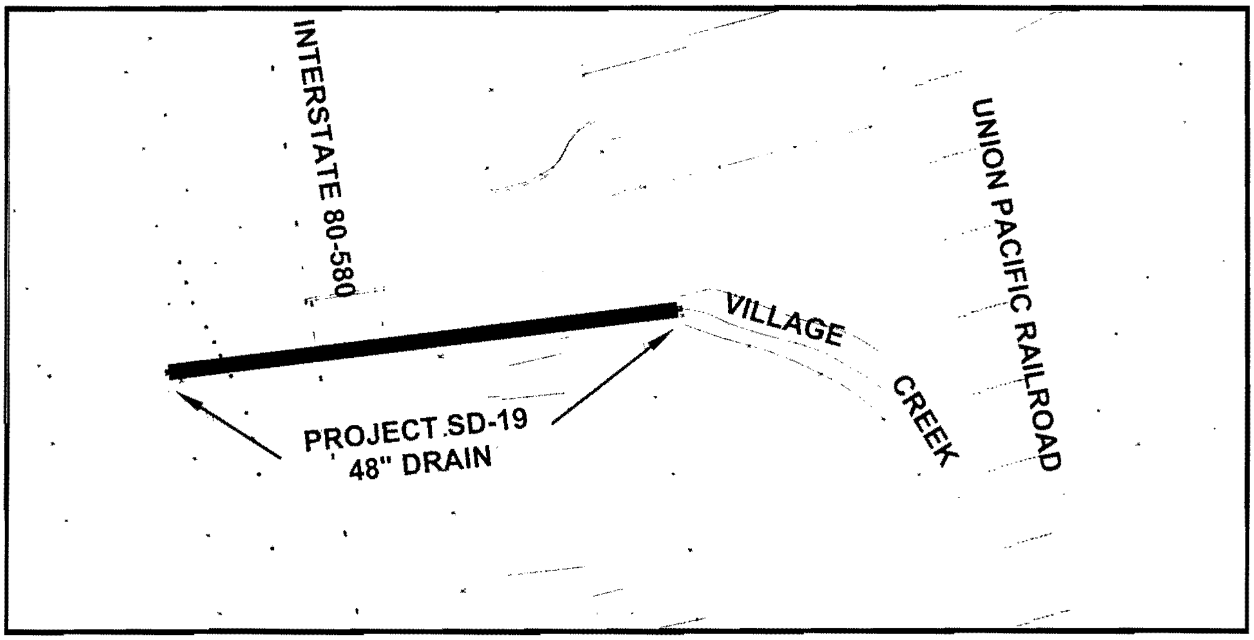
An alternative route to be considered would be expansion of the drainage system along Marin Avenue. The Marin Avenue drainage system is in the Marin Creek Watershed, therefore water would be transferred from one watershed to another. This is not the standard solution to drainage problems. Under this alternative the 36-inch pipe could be placed in Marin Avenue from Key Route Boulevard to San Pablo Avenue. In San Pablo Avenue, the system should turn south and reconnect to the Village Creek watershed.



**Project SD-19:** Install a new storm drain parallel to the existing drain crossing Interstate-80 at Village Creek.

**Estimated Cost:** $450,000

**Description:** This would provide additional flow capacity and help eliminate flooding problems between Interstate-80 and the railroad tracks. In order to cross Interstate-80, pipe jacking construction methods would probably be required.



**Project CR-9:** Village Creek between San Pablo Avenue and Jackson Street, approximately 700 lf.

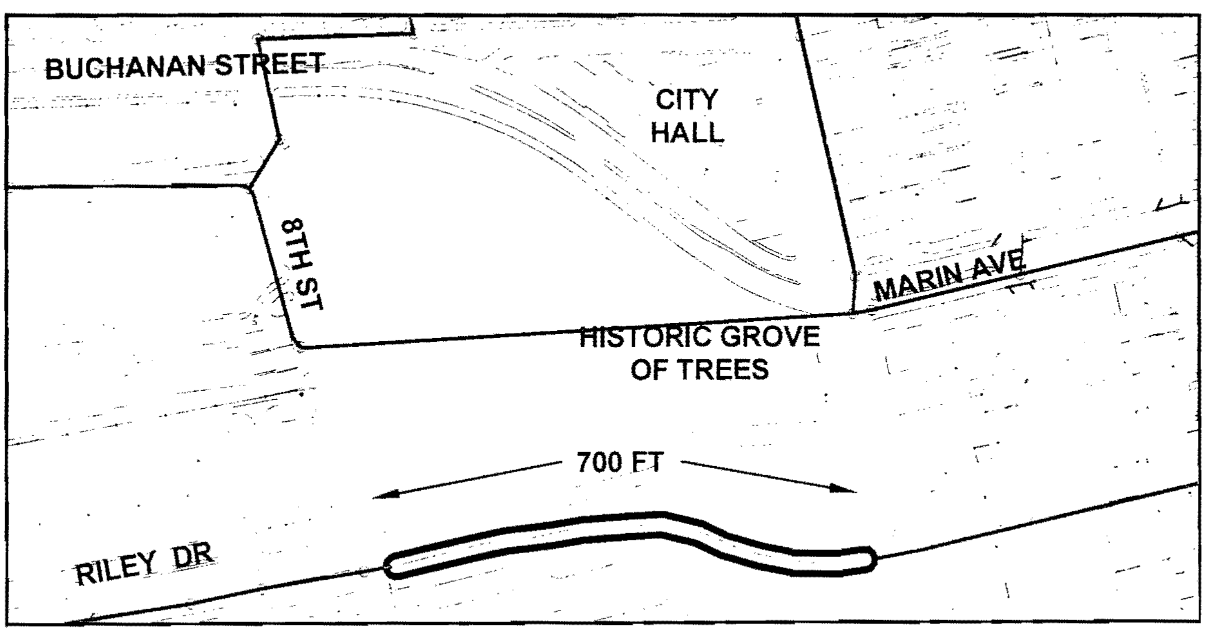
**Estimated Cost:** $380,000

**Description:** Restoration enhancements recommended for this reach of Village Creek include: removal of exotic flora, re-vegetation with native species, vegetation management, trails and overlooks, and education. Restoration projects are most likely to become feasible in the long term, that is beyond the year 2003 (five years from the development of this Watershed Management Plan). In general, this is because of funding and the realistic need to complete the initial phases of the University Village Housing redevelopment.

The following elements are recommended for this project:

- Remove exotic plants and re-vegetate with native species
- Incorporate a trail/bike path and creek overlooks, creek identification and educational signs
- Provide vegetation management / maintenance strategies
- Replace culvert under access roads to University Village with a bridge

An alternative to removing the non-native trees would be to only restore the shrub and groundcover vegetation.



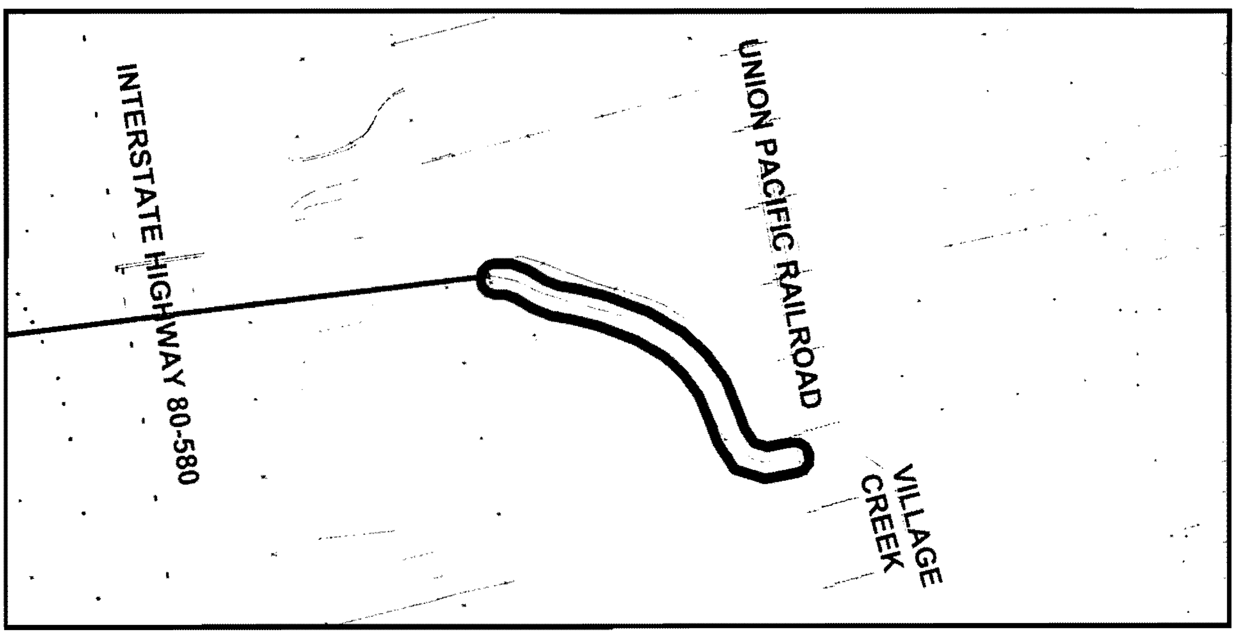
**Project CR-11:** Village Creek between the Union Pacific Railroad right-of-way and Eastshore Highway, approximately 350 lf.

**Estimated Cost:** $90,000

**Description:** The following elements are recommended for the restoration and enhancement of the reach of, recognizing that the land through which the Creek runs is owned by the Union Pacific Railroad Company.

- Remove debris and exotic plants and any concrete bed material
- Widen channel and introduce meanders
- Re-vegetate with native species
- Provide vegetation management and maintenance strategies

As an alternative, the Cleveland Avenue/Eastshore Highway Redevelopment Plan considers re-routing this section of creek, either to Codornices Creek or Marin Creek. Such an project is dependent upon development projects in the area.



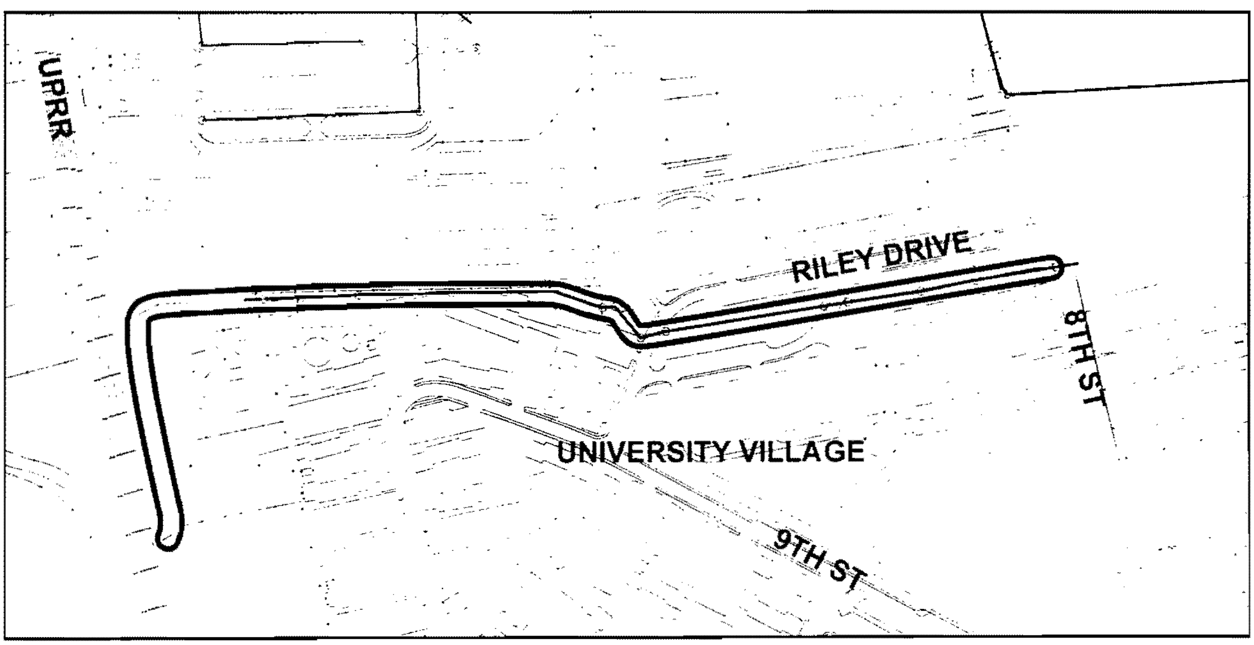
**Project CR-17:** Between Jackson Street and the western boundary of the University Village property (approximately 1,500 lf) and along the western boundary of the University Village approximately 600 lf

**Estimated Cost:** $875,000

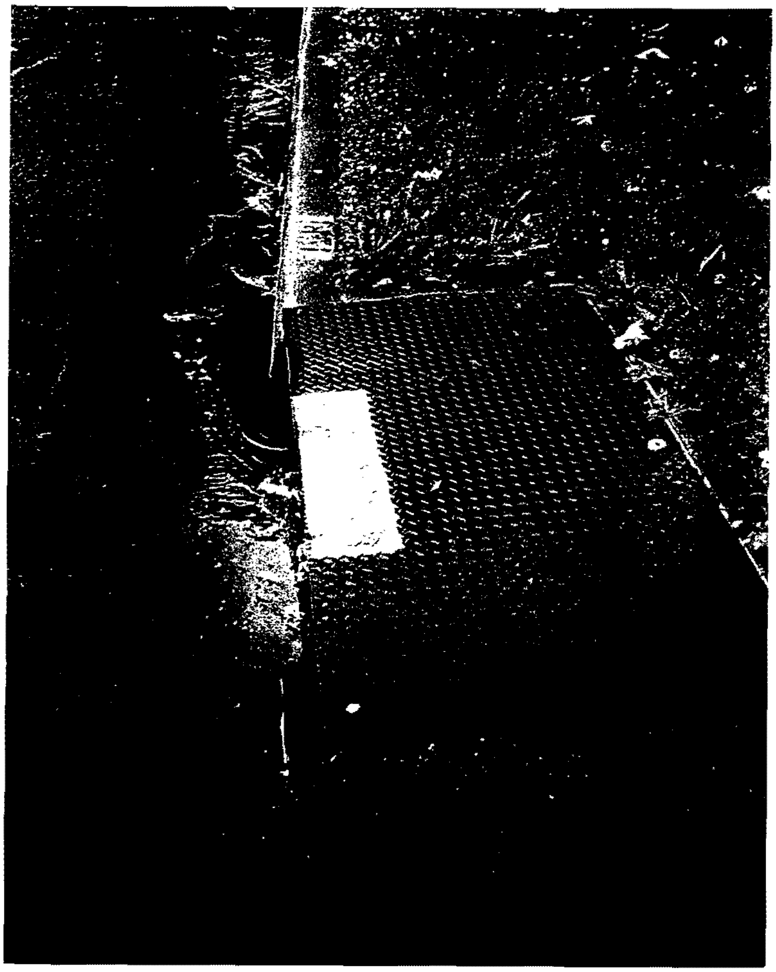
**Description:** Recommended enhancements include the removal of a row of Monterey pine trees and replacement with appropriate upland trees and shrubs as well as riparian species. Reconstruction efforts should be incorporated into redevelopment plans for the University Village Housing project undertaken by the University of California.

The following elements are recommended for the restoration and enhancement of the reach of Village Creek between Jackson Street and the Union Pacific Railroad right-of-way, recognizing that the land through which the Creek runs is owned by the University of California.

- Remove debris and exotic plants and re-vegetate with native species
- Provide vegetation management
- Open the existing culvert by removing existing pipes



# Marin Creek Watershed



AN INLET LEADING INTO
THE MARIN CREEK CULVERT
AT CURTIS STREET
MAY 1998

MARIN CREEK OUTFALL AT THE SAN FRANCISCO BAY
MAY 1998

## MARIN CREEK WATERSHED

Marin Creek drains an area of about 958 acres, 27% of which is located within Albany, the remainder lies within Berkeley. The eastern portion of this watershed in Albany extends from the Berkeley border to the Ohlone Greenway between Solano Avenue and Marin Avenue. West of BART the watershed extends to the San Francisco Bay between Washington Avenue and Solano Avenue.

The Marin Creek Watershed drainage system consists of a culvert, miscellaneous storm drain pipes, and overland (surface) flows. Marin Creek is contained within a round culvert for its entire length and generally follows the location of the historic creek. The culvert flows west under Marin Avenue from the Berkeley/Albany border, continues beneath San Pablo Avenue, crosses the Gill Tract just south of Buchanan Street, flows under the Albany Middle School fields and the United States Department of Agriculture (USDA) research center grounds, moves under Interstates 80 and 580, and flows out to the San Francisco Bay in the Albany mudflats.

The existing drainage area is significantly larger than the historic watershed. The existing storm drain pipe on Los Angeles Avenue in Berkeley directs water to the Marin Creek culvert from areas that formerly drained into Codornices Creek. A storm drain pipe on Spruce Street in Berkeley directs water to the Marin Creek culvert that formerly drained into Middle Creek. In addition, a storm drain pipe in Capistrano Street in Berkeley directs water to the Marin Creek culvert that formerly drained into Capistrano Creek and Blackberry Creeks. This storm drain was constructed under the Solano Avenue ridge and connects with the Marin Creek culvert at Marin Avenue and Peralta Avenue.

### Existing Conditions

The Marin Creek culvert ranges in size throughout its length from a 42-inch round to 84-inch round concrete culvert along Marin Avenue from the Berkeley border to the Union Pacific Railroad tracks. There are three storm drain pipes in the Marin Creek watershed, on Peralta Avenue, San Pablo Avenue and on Madison Street. The largest storm drain pipe in the Marin Creek watershed carries water south along Peralta Avenue in Berkeley, just north of Solano Avenue, to the Marin Creek culvert. It is quite large and ranges in size from a 57-inch pipe at the northern end to a 42-inch pipe where it connects to the culvert. The storm drain pipe was found to be in good condition.

The San Pablo Avenue storm drain pipe ranges in size from 12-inches to 27-inches. It flows west from the corner of Kains Avenue and Washington Avenue to San Pablo Avenue and south along San Pablo Avenue to the Marin Creek culvert.

A 12-inch clay pipe carries water along Solano Avenue between Adams Street and Madison Street. The 18-inch Madison Street storm drain pipe flows west from the corner of Adams Street and Solano Avenue to Madison Street and south along Madison Street to Buchanan Street. In Buchanan Street water flows south to Jackson Street in a 27-inch pipe. At Jackson Street the pipe changes again to a 30-inch diameter and crosses south until it connects with the 84-inch Marin Creek culvert near the entrance to the Albany Middle School site.

The entire storm drain system is contained within public rights-of-way, primarily within streets east of San Pablo Avenue, and a 25-foot wide utility easement (which also contains a sanitary sewer) for sections west of San Pablo Avenue.

There is a capacity problem with the section of the culvert under I-80. This problem is probably responsible for the reported flooding at the U.S.D.A. research center in January of 1995. The culvert at this location reduces from an 84-inch pipe to a 78-inch pipe for most of this section to the San Francisco Bay. (There are some parts that are larger box culverts in this reach). The culvert under the U.S.D.A. research center is the section most affected by this problem. The hydraulic analysis indicates that some flooding may occur as well on Cleveland Avenue and/or Buchanan Street near Polk Street during major storms because of the constriction under I-80. Most of the area that is undersized is located near Interstate-80, and upgrading this storm drain would require coordination with Caltrans. Although replacing only a portion of this culvert would not solve all the flooding problems, it would provide additional capacity and reduce the occurrence of problems.

The 18-inch clay pipe on San Pablo Avenue between Washington Avenue and Solano Avenue carries only 60% of the required flow for a ten-year storm. The 12-inch CMP drain on Washington Avenue between Kains Avenue and San Pablo Avenue is substantially undersized, as it carries only 29% of the required flow for a ten-year storm.

The 18-inch drain on Madison Street between Solano Avenue and Buchanan Street is undersized. As it carries 77% of the required flow for a ten year storm.

Frequent ponding also occurs at the intersection of Adams Street and Solano Avenue, at the northeast and northwest corners. This may be due to problems with the local drain pipes from the catchbasins, which were observed to be in poor structural condition, as the inlets are obstructed with broken concrete curb and gutter.

Solano Avenue has a number of drainage problems due to the absence of underground storm drain pipes to carry storm flows. Surface water flows along the curb and gutter system into storm drain inlets at corners. These inlets connect to CMP arches that carry the flow through the pedestrian bulbs to discharge on the west side of intersections and flow down the gutter to the next inlet. These inlets are undersized and do not allow enough water into the underground pipes under the roadways. In addition, many of the inlets are deteriorating. Flooding problems occur regularly at Kains Avenue, Key Route Boulevard, and Pomona Avenue, all on the north side of the street. As part of the 1998 sewer replacement project in Solano Avenue from San Pablo Avenue to Pomona Avenue, an underground storm drainage system is being constructed between Masonic Avenue and San Pablo Avenue.

Storm flows on Cleveland Avenue at Washington Avenue and Solano Avenues discharge to the east side of the railroad tracks. At Washington Avenue, the six-inch storm drain pipe crosses under Cleveland Avenue and discharges into an unlined ditch next to an abutment of Interstate-80. In 1997 the six-inch storm drain pipe from Solano Avenue that crossed Cleveland Avenue was removed at the request of Union Pacific Railroad Company, because the discharge affected track improvements. In the absence of a new discharge system, runoff ponds at the northeast corner of Solano Avenue and Cleveland Avenue.

Problems have been observed at the southeast corner of Marin Avenue and Curtis Street. Inspection showed that there is standing water in the catchbasin. Water entering the catchbasin is not flowing to the main sixty-inch culvert in Marin Avenue. Video observation was not effective in determining the cause of the blockage, but the sunken curb and possible small sinkhole near the storm drain pipe indicate that the pipe may have collapsed.

There are no existing open creek areas within the Marin Creek Watershed in Albany, so there is no existing vegetation or habitat. As there are no existing creek habitats in this watershed, any enhancement would be an improvement. If a section of the creek were restored, the habitats that could be created would be similar to those in nearby areas of other watersheds.

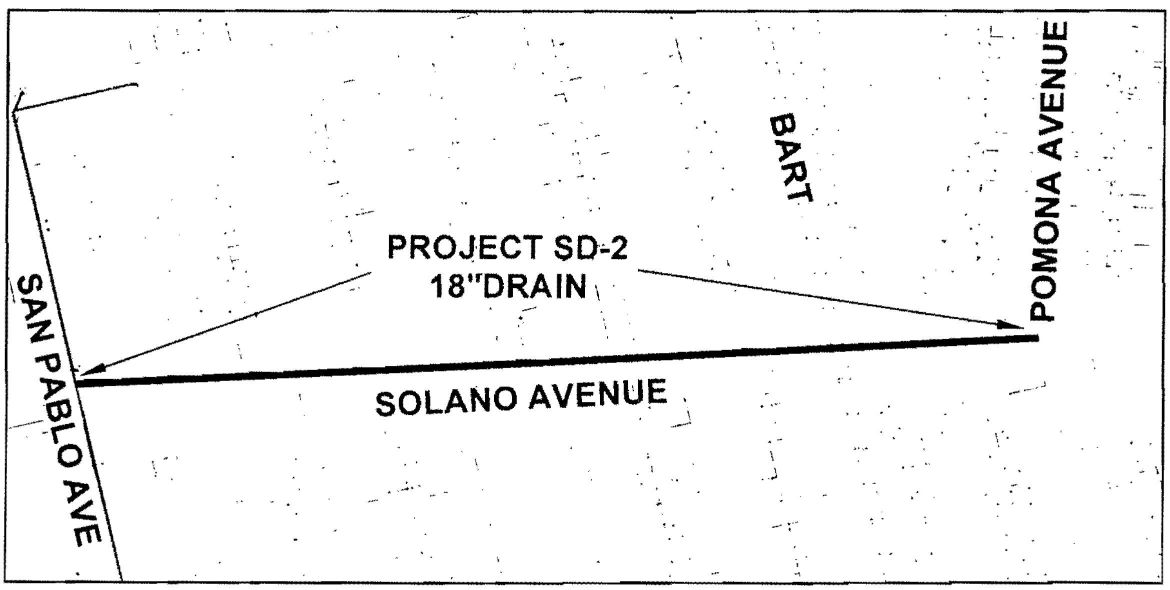
Opportunities for creek restoration in Marin Creek include removing the existing culvert in locations where it is possible. The primary location for these opportunities are west of San Pablo Avenue, in publicly owned areas such as the Gill Tract, Albany Middle School lawn areas, and the Middle School Park lawn areas. In these areas the existing culvert is not constrained by above ground structures or roadways.

**Recommended Projects**

**Project SD-2:** Solano Avenue from Pomona Avenue to San Pablo Avenue.

**Estimated Cost:** $500,000

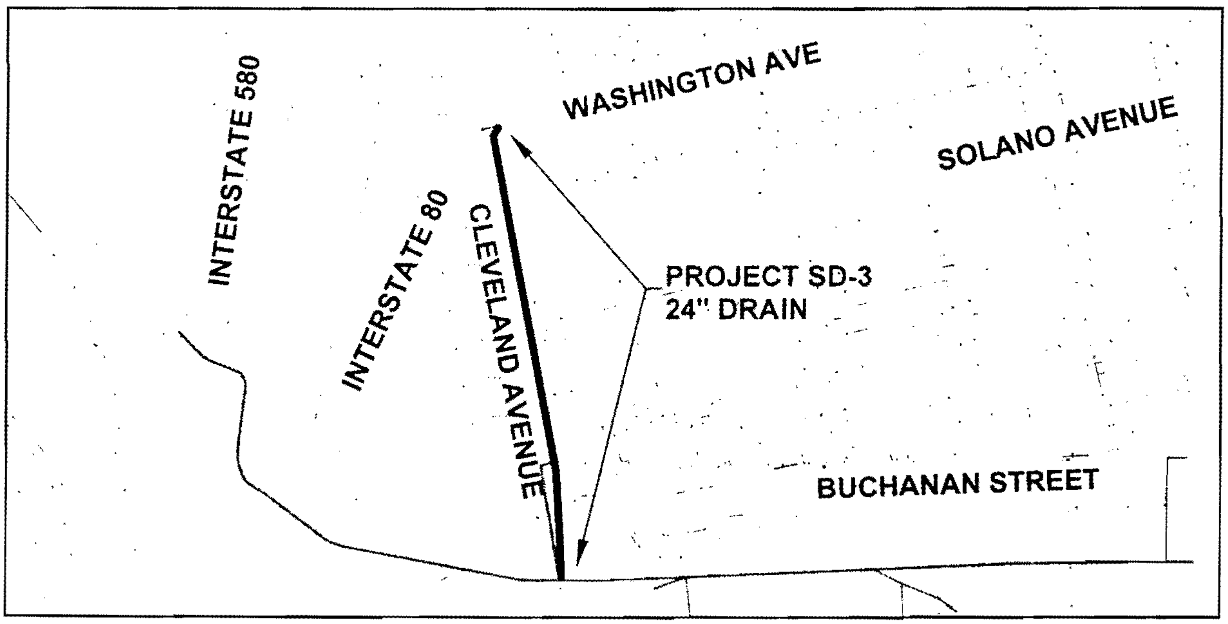
**Description:** This project is to be constructed as a part of the Solano Avenue Project during the summer and fall of 1998. The project includes a 19-inch by 30-inch elliptical pipe between the Caltrans drain pipe in San Pablo Avenue and Kains Avenue, a 24-inch pipe between Kains Avenue and Stannage Avenue, and an 18-inch pipe between Stannage Avenue and Masonic Avenue. New catch basins and connecting drains are also constructed at each of the intersections between Masonic Avenue and San Pablo Avenue. Additional storm drain pipe should be installed above Masonic, at least to Pomona Avenue to eliminate additional areas of ponding. This extension of the drain system is estimated to cost approximately $200,000 for construction, based on the Solano Avenue Project costs.



**Project SD-3**: Install a new a new 24-inch storm drain pipe along Cleveland Avenue from Washington Avenue to Buchanan Street.

**Estimated Cost:** $238,000

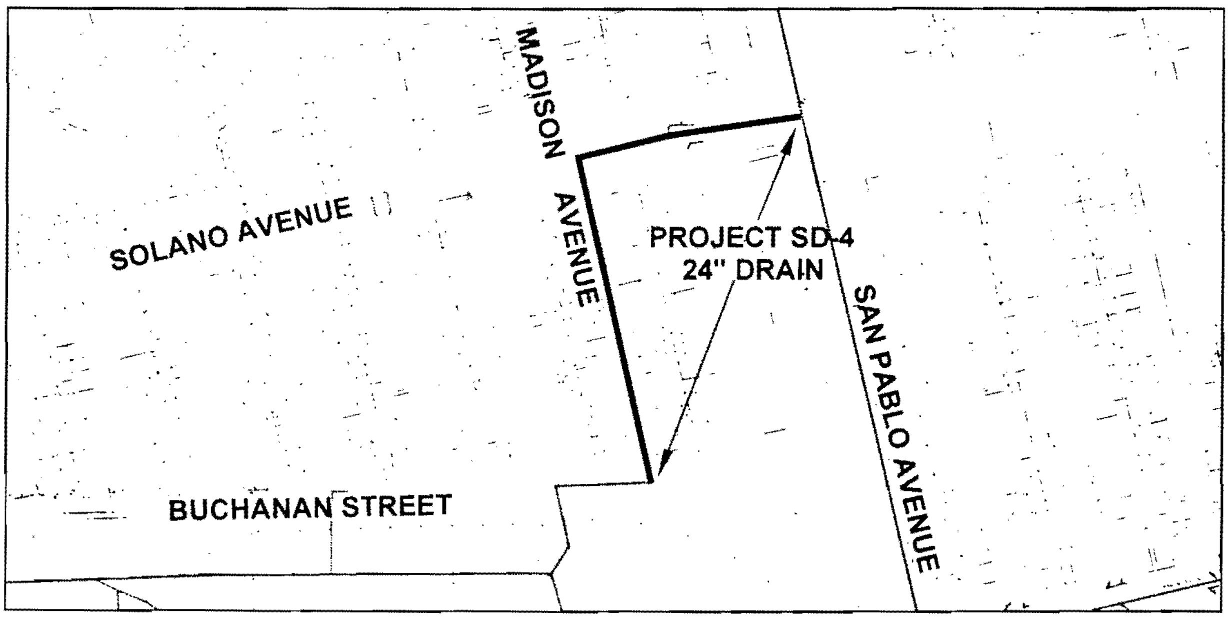
**Description:** There is presently no storm drain in this location, and drainage problems are currently being experienced on Cleveland Avenue at Washington Avenue and Solano Avenue. This storm drain would connect into the existing Marin Creek drain on the north side of the USDA research center.



**Project SD-4**: Solano Avenue from San Pablo Avenue to Madison Avenue and Madison Avenue to Buchanan Street.

**Estimated Cost:** $411,000

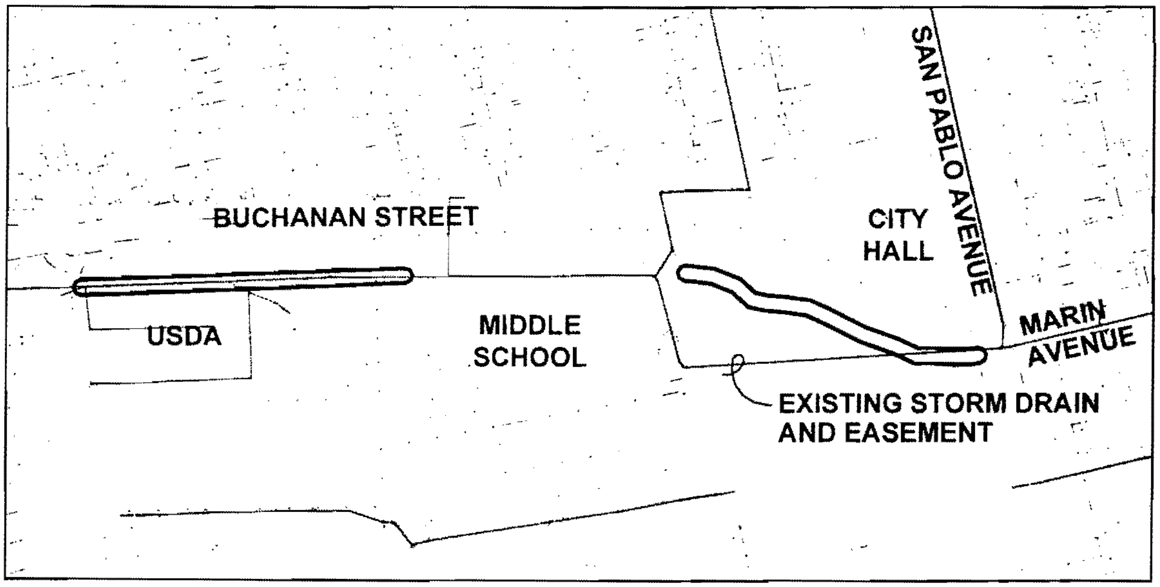
**Description:** The proposed project would replace the existing 12-inch and 18-inch pipes with a 24-inch pipe within the street rights-of-way. New drain inlets and catch basins would also be included in the construction. The project would correct existing drainage problems at Adams Street and Solano Avenue, as well as provide adequate drainage capacity on Madison Street.



**Project CR-19:** San Pablo Avenue west to the eastern border of the USDA research center (approximately 2,200 lf)

**Estimated Cost:** $600,000

**Description:** Remove 2,200 feet of the culvert, restore the creek to a natural condition by regrading and revegetating the banks, provide open space, pedestrian access to a riparian corridor, and improve water quality by enabling the natural cleaning properties of creeks.



# Middle Creek Watershed

MIDDLE CREEK "WATER FALL" AT THE CONFLUENCE WITH CERRITO CREEK, MAY 1998

MIDDLE CREEK WEST OF THE CALIFORNIA ORIENTATION CENTER FOR THE BLIND, MAY 1998

## MIDDLE CREEK WATERSHED

The Middle Creek watershed includes most of the area in Albany north of Solano Avenue, and has a drainage area of about 302 acres. Of this, about 90% of the drainage area is from Albany, and about 10% is from Berkeley. Middle Creek formerly drained a much larger area, but a portion was diverted by the City of Berkeley through storm drain pipes into the Marin Creek watershed.

Middle Creek starts north of Solano Avenue at the Berkeley border, and flows in a northwesterly direction until it converges with Cerrito Creek, west of Adams Street near Creekside Park in El Cerrito.

Middle Creek is a tributary of Cerrito Creek. Its run through Albany is approximately 6,000 feet. The majority, approximately 5,000 feet, is contained in a series of culverts. There are three sections of creek, totaling approximately 1,000 feet, in open channels. A small section west of Masonic Avenue is contained in an open channel in backyard areas. The section west of Adams Street flows in an open channel except for a culvert through the California Orientation Center for the Blind. West of the Orientation Center it is also an open creek channel.

### Existing Conditions

The drainage system in the Middle Creek Watershed consists of a creek culvert, several storm drain pipes, overland flows, and short sections of open creek channel. The mostly underground creek flows in a culvert that varies slightly in size throughout its length but is predominantly a four-foot by five-foot rectangular concrete culvert. This culvert originates on Peralta Avenue just south of Washington Avenue in Berkeley. This drain follows what was probably the original location of Middle Creek, and passes through private residential and commercial property and under City streets for most of its length. Easements have not been granted to the City for most sections of this drain.

The primary storm drain pipe in this watershed runs along Portland Avenue from Neilson Street in Berkeley in a 16-inch PVC pipe west to Curtis Street, where it increases in size to 18-inches. At San Carlos Avenue the pipe increases again to 24-inches. The pipe diameter increases again at Spokane Avenue to 27-inches in diameter. Near San Gabriel Avenue the storm drain pipes enter a four-foot by five-foot concrete box culvert in the apparent alignment of the historic Middle Creek.

Other storm drain pipes include a number of relatively short pipes on north-south streets that convey storm water from overland flows into the Middle Creek culvert. On Pomona Avenue an 18-inch pipe does not connect to the 24-inch pipe in Portland Avenue with the box culvert to the south. Also within Pomona Avenue a 14-inch pipe connects storm drain inlets from Portland Avenue to the box culvert to the south. The concrete box culvert crossing Pomona Avenue is four-foot ten-inches by five feet.

On Key Route Boulevard a 14-inch pipe connects drain inlets at the southeast corner of Portland Avenue and Key Route Boulevard with a four-foot by five-foot concrete box culvert, located to the south. North of Portland Avenue, in Key Route, the City recently constructed an 18-inch pipe from a mid-block inlet to the 24-inch pipe in Portland Avenue.

There is also a storm drain pipe system at the west end of the Middle Creek watershed that drains overland flows from the Jackson Street and Madison Street area. A 10-inch concrete pipe runs east, down Albany Hill, under private residential property to Jackson Street. On Jackson Street the system collects overland flow from Jackson Street into a 12-inch clay pipe and continues under Jackson Street and on down the hill, under private residential property, to Madison Street. On Madison Street, the system turns north in a 15-inch clay pipe, which at some point transitions into an arched 10-inch by 17-inch CMP. The CMP discharges at the end of the paved section of Madison Street onto bare ground, which is eroded and forms a gulley conveying the water to the largest open portion of Middle Creek.

During field investigations water flow and dye tests were used to determine how the storm drains pipes were connected throughout the watershed. Based on this testing, it was discovered that there are two storm drain pipes running south along Pomona Avenue from Portland Avenue to the Middle Creek culvert. The water that drains from the Albany High School and Memorial Park area at the north side of Portland Avenue at Pomona Avenue does not enter the 24-inch storm drain in Portland Avenue, but flows approximately 350 feet south on Pomona Avenue in an 18-inch storm drain pipe, and empties into the Middle Creek culvert. Surface water flowing west from beyond Pomona Avenue enters the storm drain inlet on the southeast corner of Portland Avenue and Pomona Avenue. Water then flows south through a 14-inch pipe along Pomona Avenue to the Middle Creek culvert . These two pipes along Pomona Avenue were apparently installed to carry water to the culvert, because 24-inch drain in Portland Avenue did not have enough capacity.

Key Route Boulevard surface water that enters a storm drain inlet on the west side of Key Route Boulevard is carried in an 18-inch storm drain pipe approximately 300 feet to the 24-inch storm drain pipe on Portland Avenue.

Based on the hydraulic analysis, the Middle Creek culvert has sufficient capacity to carry the 10-year flow for the current watershed area. This culvert appears to have been designed to carry flows from Capistrano Creek and Blackberry Creek (which are technically within the Middle Creek Watershed) before these areas were diverted to the Marin Creek Watershed.

Because of the age and location of the culverts an issue for additional study in the Middle Creek culvert is not flow capacity, but structural adequacy. There are no known areas of structural problems with this storm drain, but only limited sections were inspected due to lack of access points. Structural failure of the culvert could result in settlement of structures where the drain passes near or under existing buildings or roadways.

The 42-, 45-, and 48-inch storm drain pipes west of San Pablo Avenue, just north of Clay Street, have inadequate ten-year storm capacity. They are also located under the Albany Bowl building. There is a constriction at the junction between the culvert under San Pablo Avenue and these pipes, which causes water to pond and sediment to accumulate. This, plus the fact that the culvert is wide and shallow (3-foot x 7-foot), has caused about one foot of rock and sediment to accumulate in the box culvert at San Pablo Avenue. Just to the west, there are two sections of CMP arch pipe that lack ten-year storm capacity. One is located east of Adams Street in the Albany Bowl parking area, and the other is located west of Adams Street.

Problems also have been observed at the intersection of Portland Avenue and Santa Fe Avenue on the northeast and southeast corners. Although there is a storm drain pipe in Portland Avenue, the runoff at this corner apparently does not flow directly into that drain, but is carried in shallow pipes under Santa Fe Avenue. A video inspection in February 1998 showed that these drains are 15-inch clay pipes, and that there is a considerable amount of gravel and debris collected in the drain line from the southeast corner to the southwest corner under the intersection. The drain from the northeast corner to the northwest corner has some fractures, but was clear and open at the time of the inspection.

At Portland Avenue and San Carlos Avenue on the northeast and southeast corners drainage problems also have been reported. These storm drain inlets (which have catchbasins) direct the flow to the storm drain pipe in Portland Avenue. A video inspection in February 1998 showed that there are some fractures in these pipes, but the pipes were not obstructed. The defects in the pipes may cause debris to collect at this location, creating backups of water during some storms.

The hydraulic analysis for the Middle Creek Watershed indicates the following drainage capacity deficiencies:

- The storm drain pipe in Portland Avenue, but the amount of the deficiency is probably not enough to cause frequent overflows. There also has been some overflows of the Berkeley sewer main which is located in Portland Avenue, and reports of flooding in this area may have actually been sanitary sewer overflows rather than storm water.

- The gutter on the east side of San Pablo Avenue between Portland Avenue and Clay Street. There have not been any reports of flooding problems occurring at this location. The flow probably continues along San Pablo Avenue north to Cerrito Creek, without causing major problems.

- There are reports of drainage problems at Washington Avenue and Santa Fe Avenue. Drainage here is carried 100 feet south in a 12-inch clay pipe to the Middle Creek culvert just south of Washington Avenue. A video inspection of this drain in February 1998 showed that the pipe was half full of rocks and debris toward the southern side of this intersection.
- The 10-inch storm drain pipe carrying flows from Portland Avenue to the culvert on Masonic Avenue is undersized for the ten-year storm. However, the current storm drain construction on Solano Avenue will decrease flow to this area.

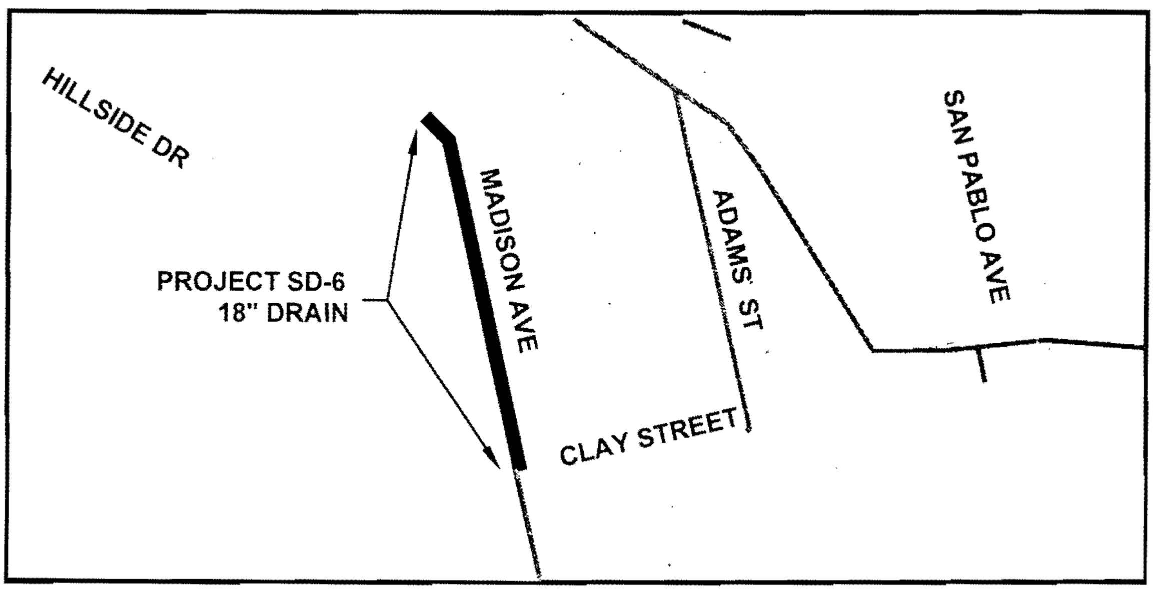
The vegetation along the open sections of Middle Creek consists of dense Central Coast riparian scrub mixed with exotic trees, shrubs and vines. The section of Middle Creek near Cerrito Creek has high enhancement opportunities because of the abundant native tree species (arroyo willow and coast live oak) and because it is contiguous with extensive native habitats on Albany Hill.

**Recommended Projects**

**Project SD-6:** Along Madison Street from Clay Street north to the end of the paved section of Madison Street.

**Estimated Cost:** $75,000

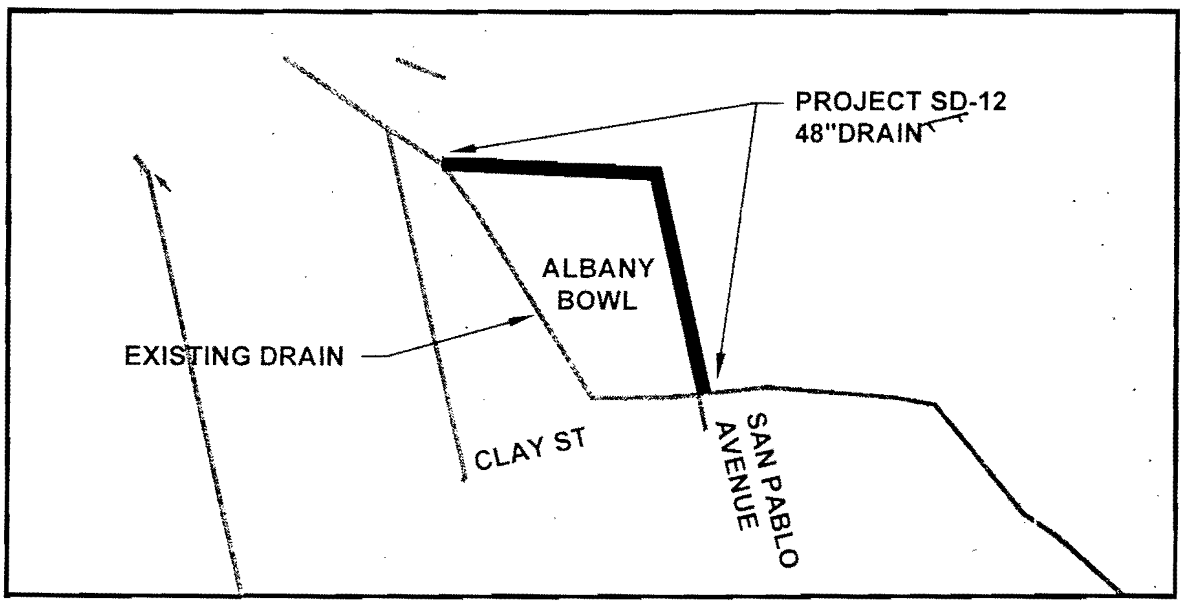
**Description:** The CMP at the north end of Madison is deteriorating. This project will replace the existing arch pipe with an 18-inch pipe to increase flow capacity. The flow from the existing pipe contributes to erosion within the unpaved section of the Madison Street right-of-way, which accesses Creekside Park. A recommended alternative solution to the outfall of the new pipe is to construct a rip-rap energy dissipator to slow the flow of storm water and spread it over a wider area so as to lessen its erosive powers.



**Project SD-12:** Replace the two box culverts currently located beneath the Albany Bowl building.

**Estimated Cost:** $160,000

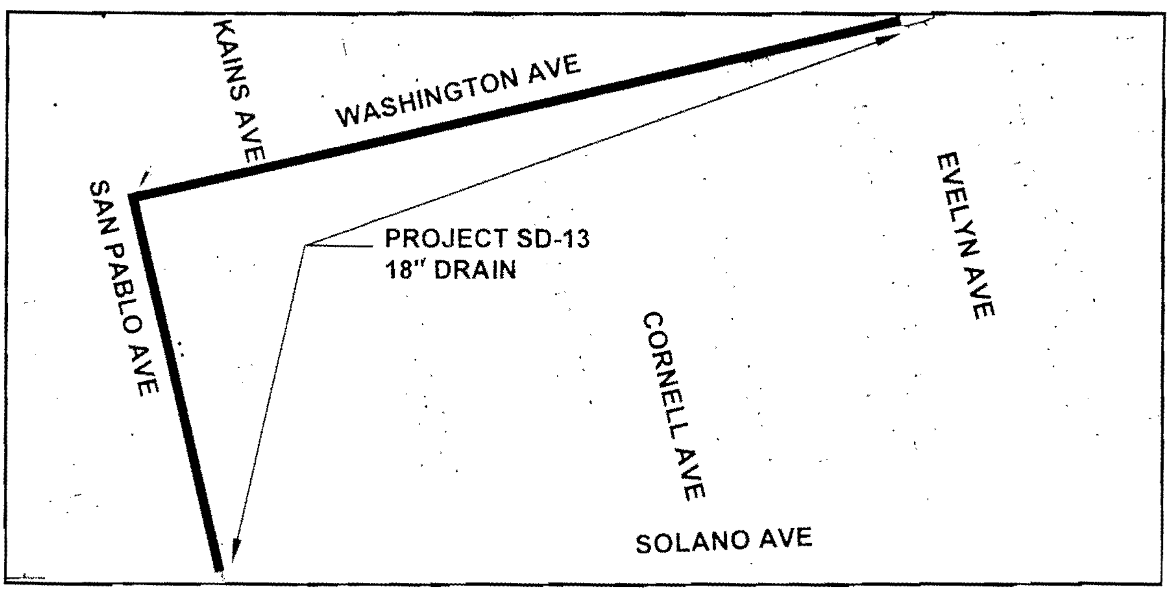
**Description:** The culverts run from San Pablo Avenue at Clay Street to Adams Street. This project would solve the existing capacity deficiency in this location, and eliminate the storm drain located under the Albany Bowl building. The recommended alignment for the replacement system is north on San Pablo Avenue from Clay Street, then west across the existing Albany Bowl parking area. An alternative alignment entirely on existing public rights-of-way would be west on Clay Street and north on Adams Street. However this alternative may be more costly because of the required deeper excavation depths on Clay Street.



**Project SD-13:** Install a new 18-inch storm drain pipe from Washington Avenue at Evelyn Avenue to San Pablo Avenue at Solano Avenue.

**Estimated Cost:** $445,000

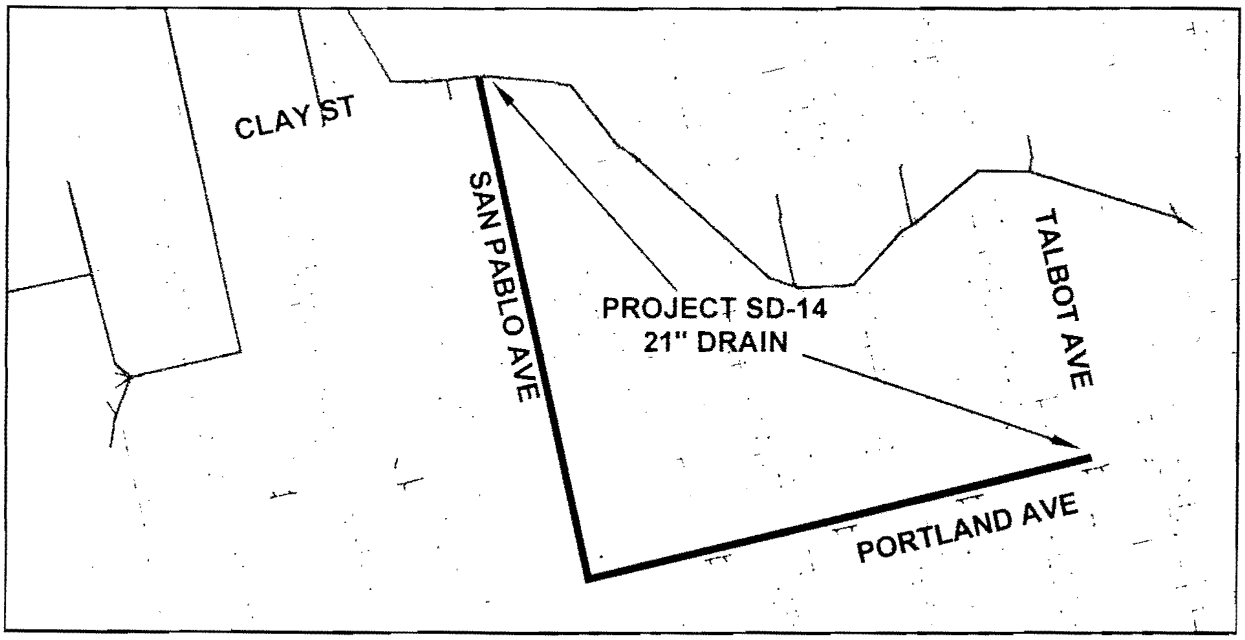
**Description:** This would eliminate the capacity deficiency in the existing 12-inch CMP storm drains on Washington Avenue from Kains Avenue to San Pablo Avenue, and in the existing 18-inch drain on San Pablo Avenue from Washington Avenue to Solano Avenue. It would also extend the storm drain on Washington Avenue to carry flow in an underground pipe instead of the street gutter and shallow cross street drains which are presently utilized. The existing system contributes to the ponding of water at the intersection of San Pablo Avenue and Washington Avenue. Additionally, as a part of the 1998 San Pablo Avenue Sewer Project, the storm drain from Washington Avenue was disconnected from the sanitary sewer. Consequently, more storm water will now flow in the San Pablo Avenue storm drain. The increased pipe size is necessary to accommodate this increased, but naturally occurring, flow.



**Project SD-14:** Install a new 21-inch storm drain pipe in Portland Avenue from Talbot Avenue to San Pablo Avenue, then along San Pablo Avenue to Clay Street.

**Estimated Cost:** $550,000

**Description:** This is an area where there are no existing storm drains, and where high flows are expected in the existing gutter and cross street drainage system during the 10-year flow.

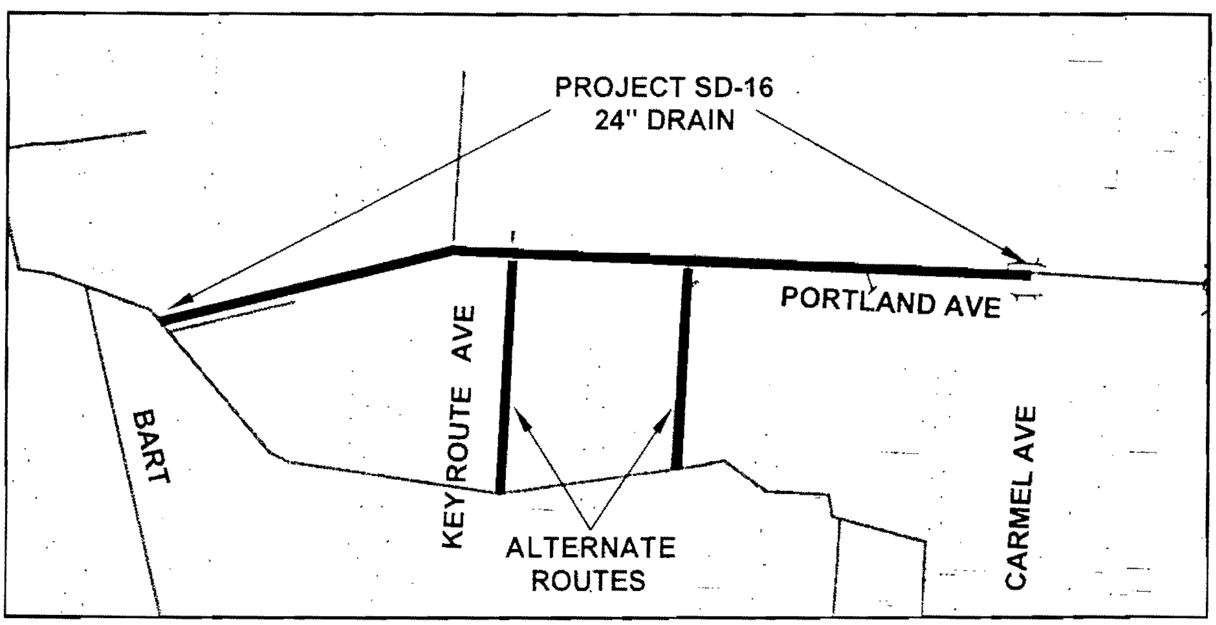


**Project SD-16:** Install an additional 24-inch storm drain pipe parallel to the existing 24-inch storm drain pipe in Portland Avenue from Carmel Avenue to the BART right-of-way (Ohlone Greenway).

**Estimated Cost:** $390,000

**Description:** To relieve the recurring ponding at the intersections between Carmel Avenue and Masonic Avenue, additional drainage capacity is recommended. The most direct route is to construct a new, parallel 24-inch pipe line between Carmel Avenue and Masonic Avenue. However, it is also possible to reduce the impact of Portland Avenue drainage on Masonic Avenue and the connection with the creek culvert by diverting some of the flow from Portland Avenue down side streets. This has the effect of moving water from Portland Avenue to upstream portions of the Middle Creek culvert, where there may be additional capacity in high volume storms.

Alternative routes to be considered would include diverting some flow south on Pomona Avenue or Key Route Boulevard to the Middle Creek box culvert, which has excess capacity in this area.



# Cerrito Creek Watershed

CERRITO CREEK WEST OF THE MIDDLE CREEK CONFLUENCE
DECEMBER 1995

CERRITO CREEK DETENTION POND IN EL CERRITO
DECEMBER 1995

# CERRITO CREEK WATERSHED

Cerrito Creek flows along the northern boundary of Albany. In Albany it extends from the Berkeley border at Curtis Street approximately 1.4 miles to the San Francisco Bay. The creek separates Albany from the cities of El Cerrito and Richmond. The total drainage area is about 1,330 acres, of which only about 2% is located in Albany. The creek originates in the Berkeley Hills but most of the watershed area is located within the City of El Cerrito. The largest portion of the El Cerrito drainage joins the main creek through storm drains located west of San Pablo Avenue. In Albany, many portions of the creek flow in open channel sections, with culverts at street crossings. The longest covered section is between Spokane Avenue and the Ohlone Greenway.

The Cerrito Creek channel is generally smaller than Codornices Creek, reflecting the smaller watershed area. Cerrito Creek tends to be narrower in the upstream residential areas, and is shallower at the downstream end. The deepest sections of Cerrito Creek are along El Cerrito Plaza, and the widest sections are downstream of Adams Street.

Open creek sections are, for the most part, highly urbanized, having been modified to fit between or under residences.

## Existing Conditions

Except for the drainage structures in Cerrito Creek itself, there are only a few existing storm drain pipes in the Albany portion of the Cerrito Creek watershed. At the northeast corner of Albany, there is a 15-inch clay pipe that originates on Neilson Street, in Berkeley. The drain passes between houses to Curtis Street and Santa Fe Avenue. Just west of Santa Fe Avenue, it empties into Cerrito Creek. The outlet of this drain has been located, but no inlet or access point has been located in Santa Fe Avenue, and the exact route of this drain is uncertain.

Other areas east of San Pablo Avenue drain along streets into the creek. There is a short drain from the north end of Adams Street into the creek.

The channel sections located upstream of Spokane Avenue are entirely on private property. Consequently, they are considered to be poorly suited for enhancement. Although these sections support scattered native tree, shrub and vine species and may represent remnants of the native vegetation, they are isolated from one another by streets and homes and are connected only via buried culverts. The enhancement potential of these sections is severely limited by the narrowness of the creek corridor between residences and the presence of steep banks. Most sections have been highly altered by the planting of ornamental species. At best, enhancement might include the eradication of non-native species and replacement with native species. Existing wildlife values of the vegetation in these sections is expected to be moderate, limited to nesting and perching opportunities for resident and migratory birds. Enhancement of these creek sections by the replacement of non-native species with native plantings is not expected to result in a significant increase in wildlife usage.

The Plan recommends that a public information program be developed to provide property owners with resources for creek protection and an understanding of the responsibilities of living on a creek. The Community Development & Environmental Resources Department produced a brochure "Albany's Creeks – Property Owner Rights, Responsibilities and Opportunities" in May 1998.

The middle stretch of the creek, between Santa Fe Avenue and San Pablo Avenue, consists of alternating open channel sections and underground culverts. Open channel sections have been significantly altered by development and horticultural plantings.

The estimated capacity of the culverts and channels in Cerrito Creek east of San Pablo Avenue is generally adequate for the estimated 10-year flow. Opportunities for enhancing riparian habitat are limited by the narrowness of the creek corridor, the presence of a large number of ornamental trees, shrubs and vines as well as invasive non-native species, and intense use by adjacent property owners.

Across the creek from the northern end of Adams Street three large box culverts carrying drainage from El Cerrito connect to the main Cerrito Creek channel. The drainage area contributing runoff to these culverts is larger than the area providing flow to the areas east of San Pablo. Therefore, there is more flow in the portion of Cerrito Creek west of San Pablo Avenue than there is in the portion of Cerrito Creek east of San Pablo Avenue.

Problems with flooding have been experienced in the area of El Cerrito around Creekside Park, and this area is located in a FEMA 100-year floodplain area. No areas in Albany are believed to be affected by this flooding, however flooding problems in adjacent areas would need to be considered in any planned channel modification of Cerrito Creek in this area. The flooding is believed to be caused by low street elevations in El Cerrito (about elevation 9.5 feet above sea level at the southern end of Belmont Avenue, and about elevation 7 feet farther north on Belmont Avenue in El Cerrito), and the capacity of downstream crossings at Interstate-80, the Union Pacific Railroad lines, and Interstate 580. Some clearing of the Cerrito Creek channel was done by the City of El Cerrito in the area near Creekside Park in the fall of 1997.

A 30-inch drain along Pierce Street, which carries some runoff from I-80, joins the creek at the box culvert at Pierce Street. On Cleveland Avenue, a 12-inch drain empties directly into the creek.

There are no known problems or capacity deficiencies with any of the storm drains in the Cerrito Creek watershed.
Downstream of San Pablo Avenue, while the creek has been channelized and

straightened, it is open all the way to San Francisco Bay, with crossing structures at Interstate-80, the railroad, and Interstate-580.

West of San Pablo Avenue, the vegetation along Cerrito Creek is dense and contiguous. While altered by urbanization and landscaping, the tree canopy is strongly influenced by native riparian trees characteristic of Central Coast riparian scrub. The channel bottom in the upper end of this creek section is dominated by native aquatic plant species and supports a well-developed band of coastal freshwater marsh. Within the City of Albany's Creekside Park is an extensive stand of coast live oak woodland. Coastal brackish marsh habitat extends from the Interstate 80 overpass upstream approximately 1,200 feet and downstream to the Interstate 580 overpass. Northern coastal saltmarsh habitat is present at the downstream end of Cerrito Creek on the San Francisco Bay side of Interstate 580 and parallel to the Union Pacific Railroad tracks east of the Interstate.

Despite the highly urbanized nature of Cerrito Creek, numerous native, presumably indigenous tree species are still present. Creek sections supporting noteworthy native species include the following:

1. <u>Santa Fe Avenue to San Carlos Avenue:</u> one large California buckeye, two large coast live oak trees, one Mexican elderberry and one arroyo willow;
2. <u>Carmel Avenue to Ramona Avenue:</u> one big-leaf maple;
3. <u>Pomona Avenue to Key Route Boulevard</u>: one small coast live oak;
4. <u>Key Route Boulevard to Spokane Avenue</u>: one large California buckeye;
5. <u>Talbot Avenue to Cornell Avenue:</u> one large coast live oak and one large arroyo willow;
6. <u>Cornell Avenue to Stannage Avenue:</u> two large arroyo willows, one large Mexican elderberry, one large coast live oak, and a band of low quality freshwater marsh;
7. <u>Stannage Avenue to Kains Avenue:</u> one large big-leaf maple and one large arroyo willow;
8. <u>San Pablo Avenue west to 1,350 feet downstream:</u> moderate to high quality freshwater marsh dominated by Pacific oenanthe, numerous large arroyo willows, one spectacular California sycamore, numerous coast live oak trees, two large Mexican elderberry trees, one alder;
9. <u>Pierce Street east to 700 feet upstream:</u> moderate quality coastal brackish marsh dominated by evergreen thornless blackberry (*Rubus ulmifolius* var. *inermis*) on the banks and cattail, California bulrush and saltmarsh bulrush within the channel itself. Large numbers of the special-status species marsh gumplant are also present along the banks;
10. <u>Interstate 80 west to Interstate 580 and parallel to railroad tracks:</u> disturbed coastal brackish marsh dominated by the special-status species marsh gumplant along banks of channel; side channel supports disturbed northern coastal salt marsh dominated by salt grass, alkali heath, jaumea and pickleweed.

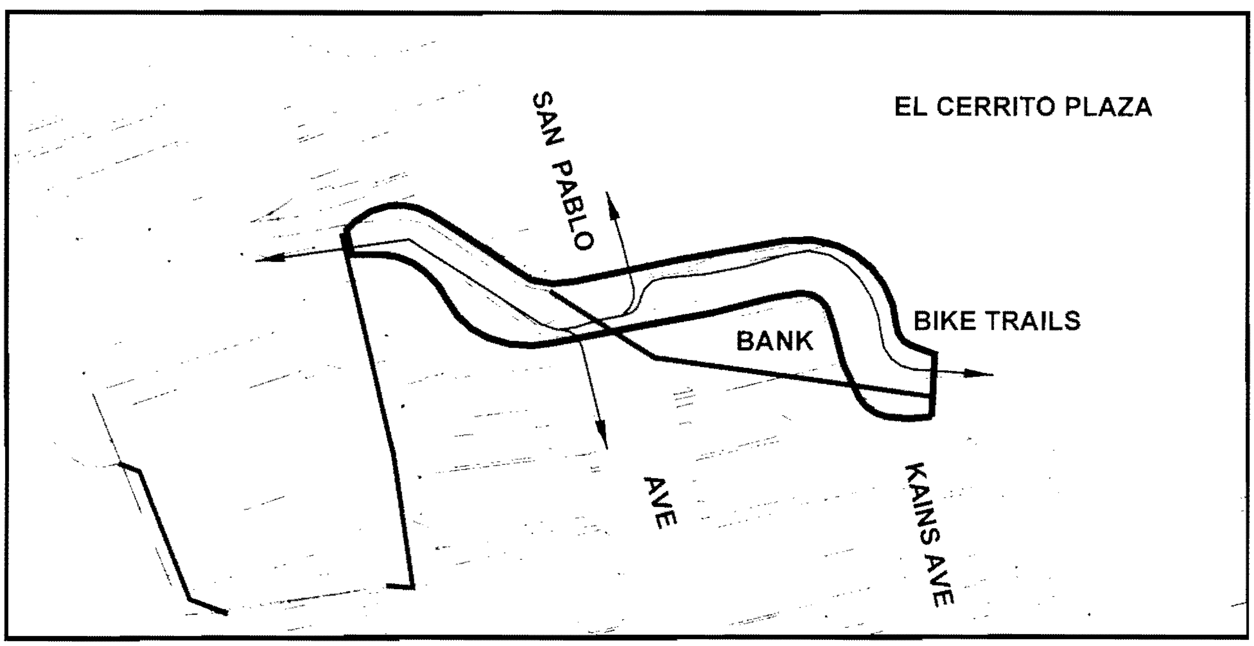
**Project CR-4:** San Pablo Avenue to Kains Avenue, approximately 300 lf.

**Estimated Cost:** $465,000

**Description:** The project plans for the removal of section of the creek from a culvert and the rerouting of the creek north and west around existing commercial development. The creek is contained within a culvert under an existing building east of San Pablo Avenue. Although this section of creek is located within the City of El Cerrito, the project would also serve to create a gateway into the City of Albany. It is anticipated that any construction project would be jointly funded by the cities of Albany and El Cerrito, or by the ultimate developer of the El Cerrito Plaza. Project elements would include:

- Opening of the buried creek as part of the El Cerrito Plaza revitalization
- Relocation of approximately 300 feet of creek north into El Cerrito
- Design elements, such as bridge railings, signs and banners, at San Pablo Avenue to create a gateway to Albany.
- Creek identification and educational signs

The map below shows projects CR-4 and CR-5, which form an integrated project to create the northern gateway of Albany. CR-4 is the right hand project, routing the creek around the bank building.



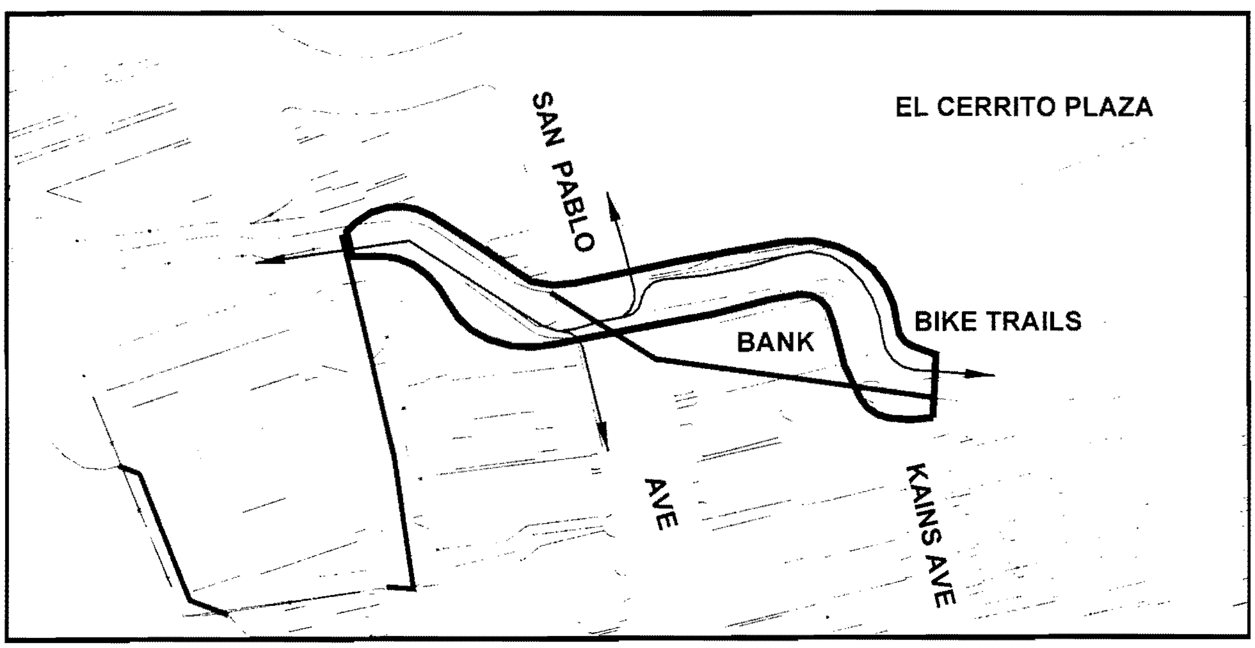
**Project CR-5:** San Pablo Avenue to Adams Street, approximately 200 lf.

**Estimated Cost:** $245,000

**Description:** Continued trails, restoration of native vegetation and creek are included in this project. Elements such as a bridge rails, special paving and pedestrian walk lights would bring a greater awareness to local residents and those who frequent the commercial area.

The map below shows projects CR-4 and CR-5, which form an integrated project to create the northern gateway of Albany. CR-5 is the left hand project extending gateway improvements to the confluence with Middle Creek. Along this reach of the creek there is an existing asphalt trail and lights. Generally, improvements would be to restore native vegetation and provide signs.

- Removing debris and exotic plants and re-vegetating with native species
- Regrading the channel where the right-of-way allows
- Constructing a trail and bike path, overlooks, creek identification and educational signs
- Constructing gateway elements on San Pablo Avenue, such as bridge railings and special paving



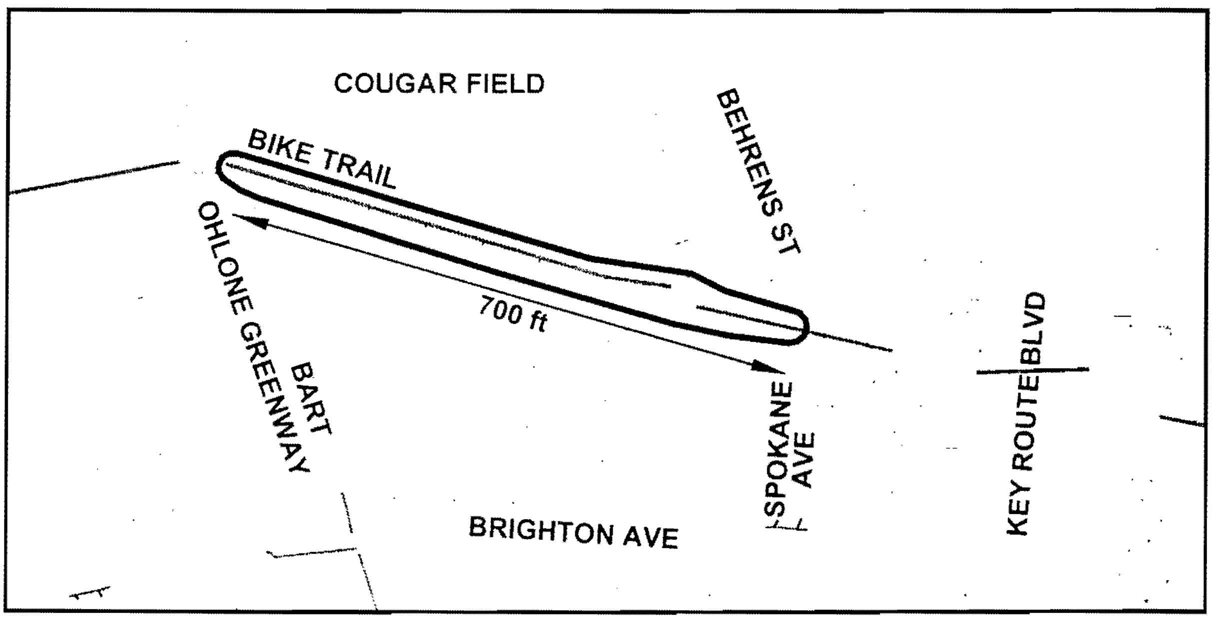
**Project CR-8:** Between Spokane Avenue and the Ohlone Greenway, approximately 700 lf.

**Estimated Cost:** $700,000

**Description:** Remove concrete culvert and regrade banks. Cerrito Creek is contained in a culvert between Spokane Avenue and the BART right-of-way. Development of the proposed new Middle School by the Albany Unified School District would allow for the possibility of opening all or part of this creek segment. Current plans for the Middle School project do not include the restoration of Cerrito Creek.

Restoration elements include:

- Removing the existing culverts to open the creek
- Constructing a trail and bike path along the creek bank to connect Spokane Avenue with the Ohlone Greenway bicycle trail
- Installing creek identification and educational signs

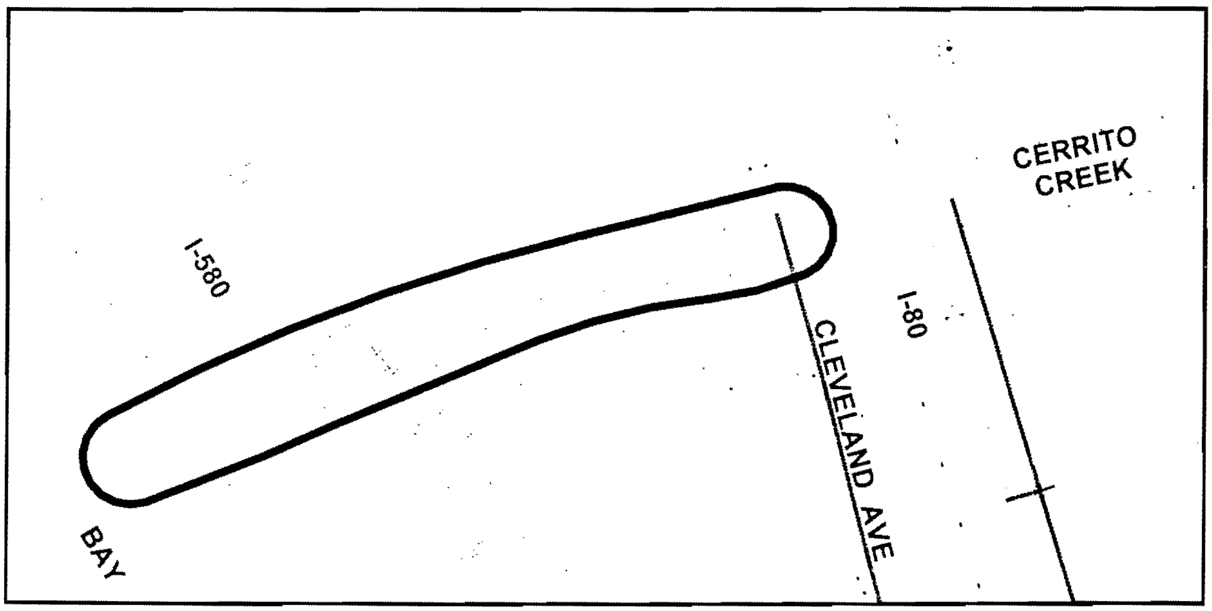


**Project CR-14:** Between Interstate 80 and the San Francisco Bay, approximately 500lf.

**Estimated Cost:** $50,000

**Description:** This is a vegetation restoration and enhancement project. No public access of significant channel improvements are recommended. Project elements include:

- Removing exotic plants
- Re-vegetating with native species
- Installing educational signs along Cleveland Avenue



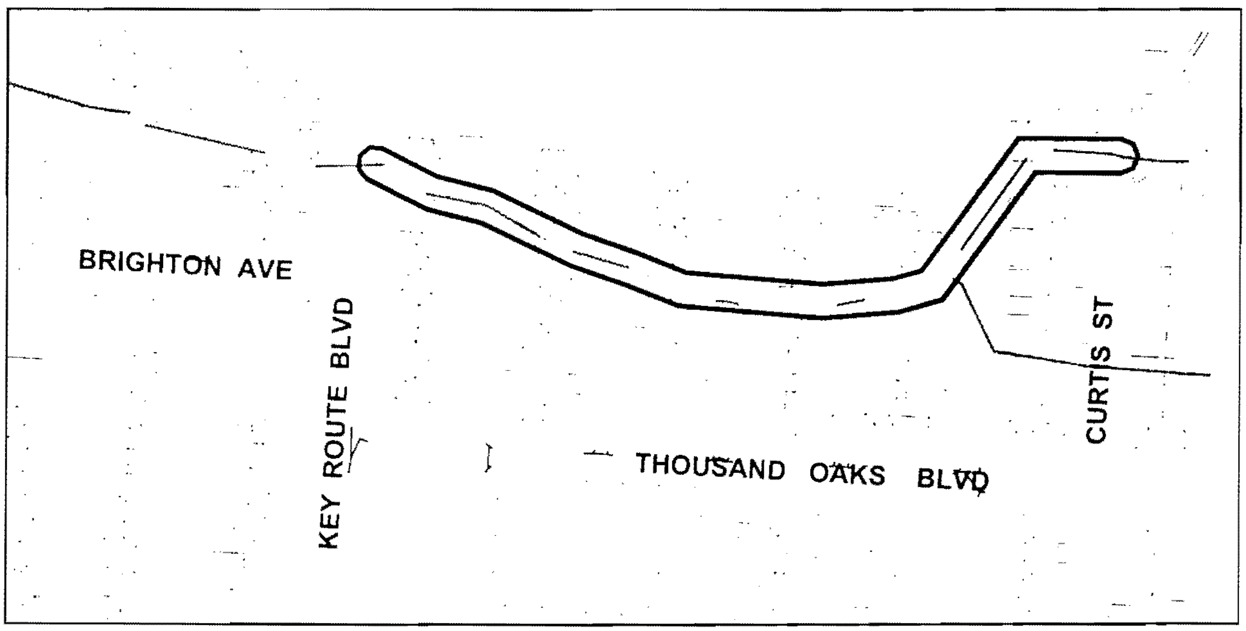
**Project CR-16:** Between Key Route Boulevard and the Berkeley border (approximately 1,400 lf)

**Estimated Cost:** $242,000

**Description:** This project will provide information on appropriate creekside landscaping to homeowners adjacent to the creek. Information could include direct mail, workshops, and demonstration projects. A long term project would include removing the culverts at the road crossings and installing bridges to improve storm flow capacity.

Recommended project elements include:

- Providing informational mailings and workshops on how to:
    - Remove debris and exotic plants
    - Widen channels and introduce meanders where rights-of-way allow
    - Methods to stabilize eroding banks
    - Re-plant with native species
- Designing and installing bridges at street crossings



## WATER QUALITY

The term water quality refers to the various physical and chemical characteristics of water from a particular source, including concentrations of dissolved ions and compounds, and suspended particles. These characteristics provide a measure of the uses and values, such as drinking (potable) water or aquatic habitat, which might be sustained from that source. Water quality is always assessed in relation to a particular end-use. For example, water classified as "excellent" because it meets the California Department of Health Services' most-restrictive standards for potable supply may be less productive for fisheries than "poor" quality water with higher concentrations of nutrients.

In urban streams, such as Cerrito and Codornices Creeks, and in the San Francisco Bay, water quality and the health of the ecosystem depends both on natural conditions, such as rainfall and geology, as well as the type and pattern of land use in the watershed, and management of the surrounding urban environment. High flows of storm runoff can also impact water quality by eroding streambanks and scouring away vegetation, causing an increase in turbidity.

The type and pattern of land use in the surrounding watershed can play a role in influencing water quality. Runoff from undeveloped areas typically exhibits the lowest concentrations of contaminants. Municipalities can improve water quality in urban streams by implementing a variety of control measures, or best management practices (BMPs), to reduce pollution.

BMPs may be divided into two groups: "source-reduction" and "treatment" measures. Source-reduction BMPs, such as collection programs for used motor oil or household hazardous wastes, emphasize prevention, managing potential contaminants before they enter storm drains or the sanitary sewer system. In contrast, treatment BMPs are physical measures selected based on their effectiveness in removing pollutants after they have already been mobilized in stormwater runoff. Oil-water separators, detention ponds and stormwater wetlands are examples of commonly-used treatment BMPs. While BMP choices vary depending on local geography, staff availability and budgets, the likelihood of improving water quality is greatest when BMPs are integrated into a comprehensive municipal program focused on addressing identified water-quality needs and risks.

Because Albany's creeks are largely protected and open in their lower reaches, they already distinguish the city from other East Bay cities where the creeks have been covered, modified in irreversible ways, or degraded by industrial practices. Codornices and Cerrito Creeks and their riparian corridors are an existing resource to the local community, providing habitat for fish and wildlife, opportunities for recreation and education, and increased value for housing and commercial properties.

Efforts to further reduce the amount of pollutants entering the creeks through storm drains and in runoff will enhance present benefits, be consistent with municipal goals and plans, and help improve water quality in the San Francisco Bay. These efforts will likely involve a combination of approaches, including new or expanded programs, installation of treatment BMPs, monitoring and/or enforcement.

**Clean Water Laws and Regulations**

Federal Regulations

The Clean Water Act (CWA), enacted by the federal government in 1972, provides the basis for regulation of water quality throughout the United States. A primary goal of the CWA was to maintain and restore water quality for support of wildlife, fisheries, and recreational uses by reducing contaminants entering ground and surface waters. States were directed to establish water quality standards for "waters of the United States" and to review and update these standards every three years. The CWA authorized the U.S. Environmental Protection Agency (EPA) to regulate discharge of pollutants from "point" sources, such as sewage treatment plants, under the National Pollutant Discharge Elimination System (NPDES) permit system.

The CWA was amended in 1987, expanding the NPDES program to include regulation of "nonpoint" (diffuse) sources, including storm runoff from municipal storm drains, industrial facilities, and construction sites. Municipal aggregations of over 250,000 residents were required to "effectively" prohibit non-storm water discharges into the storm sewer, and to implement controls to reduce the discharge of pollutants from storm sewer systems to waters of the United States to the "maximum extent practicable." Albany is included with other Alameda County urban areas, which collectively exceed the 250,000 population threshold.

State Regulations

California's landmark water quality control legislation, the Porter-Cologne Water Quality Control Act, was enacted in 1969 and became law on January 1, 1970, predating the federal CWA. The Act authorized the State Board to adopt policies for all of the state's waters, and directed the Regional Boards to develop regional Water Quality Control Plans (Basin Plans). The Basin Plans compiled existing policies, water quality objectives and narrative standards for receiving waters into a single comprehensive document based on major surface watersheds and ground water basins.

Through the present, the State and Regional Boards have chosen to implement NPDES permits using a strategy of voluntary compliance, rather than attempt to establish regulations applicable across a range of physical and social settings. Applicants for the permit are required to develop and implement a comprehensive storm water management program (SWMP) consistent with NPDES regulations. The Regional Board then reviews the application and suggests modifications to be made prior to adoption. The permit is reviewed and updated at five-year intervals.

The Alameda Countywide Clean Water Program

Subsequent to the finalization of the EPA regulations, representatives of Albany and the thirteen other cities in Alameda County, the Alameda County Flood Control and Water Conservation District (ACFC&WCD), Zone 7 of the ACFC&WCD, and Alameda County, joined together to develop the urban runoff control program now known as the Alameda Countywide Clean Water Program (ACCWP). Following Regional Board review of the initial joint city-county NPDES storm water permit for municipal discharges, the first SWMP was approved when the permit was granted in October 1991.

The SWMP incorporates a phased and tiered approach that defines the priorities in developing and implementing best management practices for preventing pollution and summarizes the major activities to be accomplished during the five-year permit period. Progress towards specific goals is reported in semiannual reports which are collected and submitted to the Regional Board for review. The ACCWP not only met all of the original requirements for compliance with NPDES regulations during the first term but was also awarded the U.S. EPA's 1994 Second Place National Stormwater Control Program Excellence Award. The second five-year plan (SWMP) developed for the NPDES permit reissued in February 1997 largely maintains the directions established in the initial plan, with several important enhancements: inclusion of a "focused watershed management approach" element; an expanded focus on protection of local streams and wetlands; inclusion in annual reports of work plans for the coming year; increased member participation in developing the new SWMP; and incorporation of performance standards for current and future activities by ACCWP members related to major program components.

The City of Albany Clean Water Program

Municipalities and agencies developed their own Clean Water Programs to coordinate local activities and enforcement within their own jurisdictions. The Albany Clean Water Program (CWP) is administered through the Community Development & Environmental Resources Department. Through this arrangement, Albany effectively integrates management of local creeks with the storm water runoff and flood control program.

The storm water management and discharge control program was established in

December 1992, when the Albany City Council amended Chapters 15 and 16 of the Albany Municipal Code to add a new section (Sec. 15-4) entitled "Storm Water Management and Discharge Control". Section 15-4 states "protect and enhance the water quality in our water courses, water bodies and wetlands, in a manner pursuant to and consistent with the Clean Water Act." This goal is met through elimination of all non-storm water discharges to the municipal storm sewer system; control of accidental spills, disposal or dumping; and reduction of pollutants in storm water discharges to the maximum extent practicable. The Chapter explicitly prohibits illicit discharges and connections, requires implementation of best management practices (BMPs) at facilities known to be a source of pollution (e.g, gas stations), and specifies measures for watercourse protection and maintenance. Section 15-4 also provides City staff with the authority for inspection, monitoring and enforcement action against violators.

**Impacts of Urban Runoff on Water Quality in Albany's Creeks**

Water enters local creeks through a number of pathways: direct rainfall, ground water seepage, discharges from storm drains and surface runoff from streets. Direct rainfall does not usually impair water quality, since concentrations of solutes are typically low, and ground water seepage is only a water-quality problem where percolate has traversed contaminated soil. However, studies have shown that urban storm runoff from streets and other impervious surfaces plays a major role in affecting water quality in streams.

<u>Water Quality in Local Creeks</u>

The environmental consulting firm of Woodward-Clyde Associates collected water quality data for lower Codornices Creek (at Eighth Street) during the period 1986 to 1991, as part of regional urban runoff studies. Results indicate that water quality in Codornices Creek is similar to that of other urban streams draining residential and commercial areas (Appendix E, Table E-1). Total concentrations of copper, zinc, and lead tend to exceed the acute toxicity objective during wet weather. Concentrations of nitrogen species, ammonia, nitrate, and total Kjeldahl (organic) nitrogen, were higher in wet weather than in dry weather, although all values were within the range expected in an urban stream and within the allowable range for drinking water. Total coliform and fecal coliform bacteria levels in both wet- and dry- weather samples were above the acceptable range for water-contact recreation but below the limit for non-contact recreation. Concentrations of both nitrogen and bacteria were highest during wet-season flows, as rains flush debris and litter from lawns, streets and hillsides into storm drains and streams.

Woodward-Clyde also performed limited dry-weather sampling of stream bottom sediments for the regional study. Concentrations of metals and nitrogen species were found to be higher in sediment than observed in either wet- or dry weather stream flows (Appendix E, Table E-2), although well below levels of concern. Elevated sediment-concentrations of these constituents is normal, since both metals and organic nitrogen are typically mobilized as particulates in runoff, rather than as dissolved constituents, and particles would settle-out to the bottom in quiescent waters.

More recent data has been collected by the community group "Friends of Five Creeks." With financial assistance from the City of Albany, and through a $2,000 Community Stewardship Grant, volunteers use test kits to monitor a number of water quality parameters in Codornices and Cerrito Creeks. The monitoring record for Codornices Creek extends from December 1995 to August 1996, then resumes in July 1997 and continues at present. Monitoring of Cerrito Creek at Creekside Park, above the zone of tidal influence yet below the confluence with Middle Creek, has been more regular -- at least biweekly from February 1996 to the present.

Results indicate that both streams are generally healthy, with low turbidity, pH averaging around 8.1, and dissolved oxygen concentrations typically greater than 6.0, reflecting more than 70 percent oxygen saturation. Although limited in number (four), values for ammonia on Codornices Creek are similar to those reported by Woodward Clyde (Appendix E, Table E- 3); no nitrate data are available. The more extensive record for Cerrito Creek shows low (0.04 mg/l nitrate-nitrogen) to zero nitrate levels in most samples but elevated concentrations (to 2.64 mg/l) following rainfall; no ammonia data are available. Total phosphate concentrations averaged 0.40 to 0.45 mg/l in the two creeks, well within the normal range for an urban stream.

Specific conductance in Cerrito Creek was highest near Interstate 80, where streamflows mix with more saline Bay waters, and lowest at El Cerrito's Creekside Park, where storm drains contributed more than half of summer flows. Water quality in Middle Creek, which discharges to Cerrito Creek just upstream of the park, appeared good with no indication of impairment by pollutants, and many apparently healthy tadpoles. Above San Pablo Avenue, the Cerrito Creek channel was dry until flows resumed near Pomona Avenue. In both the lower and upper reaches, water quality in Cerrito Creek appeared acceptable, with healthy vegetation in and alongside the creek and no observations of off-odors, coloration, sheen, or suds, either in the stream or in discharges from drain pipes.

On Codornices Creek, the zone of tidal influence extends upstream from the mouth of the creek into the culvert beneath the Interstate 80. From the Interstate east to Sixth Street, where flows are diverted through a bypass to Village Creek, the channel was either dry or ponded with stagnant water. Above Sixth Street, the Creek flowed freely and water quality appeared to be excellent. The creek surfaces in a concrete-lined channel after passing under San Pablo Avenue, then threads between houses, opening up only on the St. Mary's College High School grounds. Water quality in the upper reaches of Codornices Creek appeared to be unimpaired, with no observations of off-odors, coloration, sheen, or suds.

Village Creek was dry from just west of San Pablo Avenue to the confluence with the Codornices Creek bypass channel, except for ponded water adjacent to the U.S.D.A. parking lot. Abundant cattails in the channel from this point downstream indicate that this reach supports perennial flows.

**Opportunities and alternatives to improve water quality**

The Albany Clean Water Program (CWP) is the local entity with the authority and the responsibility for implementing the Storm Water Management Plan (SWMP) component of the NPDES permit. The following sections evaluate CWP compliance with the requirements of the NPDES permit program, and recommend improvements for implementation.

<u>Compliance of the Albany Clean Water Program with NPDES permit requirements</u>

The Alameda County SWMP is comprised of five elements to focus efforts:

- Public Information/Participation (PI/P)
- Municipal Maintenance Activities
- New Development and Construction Controls
- Illicit Discharge Controls
- Industrial and Commercial Discharge Controls

Each element is divided into three "Tiers" of performance standards. Tier 1 performance standards (Appendix E. Table E-5), represent the baseline level of implementation expected of cities as permit-holders. As of the close of the most recent reporting period (December 1997), Albany is in compliance with almost all Tier 1 standards and had made considerable progress towards meeting the Tier 2 standards (Appendix E, Table E-6). Tier 2 standards, which expand upon or refine the baseline standards, are to be implemented at different times during the five-year term of the current NPDES permit (1997 to 2002). Tier 3 standards (Appendix E, Table E-7) are being studied and evaluated by ACCWP members for possible future implementation. The direction and focus of Albany's Clean Water Program as it relates to implementing the performance standards for each of these elements is further discussed below.

Performance standards may be broadly partitioned into three activity areas: source control/education, facility maintenance/operations, and monitoring/enforcement. (See Elements and their Tiered Performance Standards in Appendix E.) Source control through education has been the major emphasis of the SWMP and Albany's Clean Water Program (CWP). This is because preventing pollutants from entering runoff or creeks is a preventative and is easier to do than to remove contaminants. Similarly, municipalities are responsible for many activities having a high potential for water quality impairment, so educating staff and implementing changes in routine procedures can reduce risks of pollutant discharges.

Source control through education both internally among municipal staff, as well as externally to businesses, schoolchildren and residents is at the center of Element 5.0 (Public Information and Participation, or PI/P). Albany is in compliance with all Tier 1 standards for this element, and far surpasses the Tier 2 standards for the number of education events. In particular, development of a Watershed Management Plan and municipal sponsorship of regular creek walks, creek clean-up days, and creek monitoring have been consistent with the SWMP's recently expanded focus on promoting a watershed perspective to build awareness of the importance of local creeks. The Tier 3 standards provide for expanded outreach to local schools and makes an excellent extension of current PI/P efforts.

Element 6.0 of the SWMP (Municipal maintenance) provides for education of city employees and contractors responsible for different aspects of municipal maintenance. These responsibilities include inspection and maintenance of drainage facilities, and implementation of source controls and spill response systems at sites where potential pollutants are used, maintenance is performed or toxics are stored (e.g, corporation yard). Albany has implemented all relevant Tier 1 performance standards for this element. Tier 2 standards for this element are more extensive than those for the PI/P element, reflecting the numerous areas of municipal activity. BMPs to be adopted in the first year (e.g., cleaning storm drains at least annually) have already been implemented. Other relevant BMPs can be implemented as scheduled during the next four years with relatively little effort, since they mostly expand upon or refine baseline standards, rather than introducing new directions. Similarly, implementation of current Tier 3 standards will not require a significant investment of time or energy.

Element 7.0 (New Development and Construction Site Controls) is less applicable to Albany than to most other cities in Alameda County because Albany is built-out, and the only sizeable sites requiring NPDES Storm Water Pollution Prevention Plans and installation of conventional storm water controls (e.g., detention basins) appear to be those slated for redevelopment. However, Albany has already implemented most of the relevant Tier 1 standards and will be in full compliance when a local grading ordinance, currently in development, has been adopted. While inspection of construction sites is a major focus of this element, most building projects in Albany are for remodels or additions, rather than new homes. To make the best use of limited staff time, Albany has chosen to train its building inspectors in water-quality issues and include inspection for illicit discharges as a regular component of building code enforcement. Increased efficiency and cost savings will also be realized by routing discharge reports to the Community Development office first, rather than the Fire Department.

Two particularly relevant Tier 2 standards concern requirements that water-quality control measures be included in new development projects (7.3), and that a watershed resource inventory be undertaken (7.7). Although Albany is unlikely to process any permits to subdivide undeveloped land in the near future, a number of major redevelopment projects within the city limits and adjacent to Albany's creeks are in the planning stages, when means to minimize storm runoff and impacts on storm water quality can be most effectively included. Municipal staff can also work with neighboring cities to verify that designs for redevelopment projects along Albany's borders include storm water controls protective of riparian functions and values. These standards also recommend establishment of riparian buffer zones and creek restoration as a means to improve water quality, recognizing that these goals are more easily accomplished during redevelopment than as retrofits of existing individual lots.

Comprehensive management of water quality and drainage requires an intimate and integrated knowledge of the relationships between land use, drainage facilities, and waterways. This Watershed Management Plan will provide the city with an inventory of storm drain conditions and creek resources so that sensitive areas can be identified and actions to improve water quality and restore creeks can be prioritized. By commissioning this Plan, Albany has complied with the watershed-planning standard in advance of the suggested schedule and will be better prepared to advance the city's interests as they relate to local creeks when reviewing and commenting upon proposed projects. Preparation of the Plan early in the Tier 2 process allows for clearer coordination with adjoining jurisdictions sharing these watersheds, and sets standards for them to meet or exceed as they develop guidelines of their own.

The majority of performance standards under Element 8.0 (Illicit Discharge Controls) have been designated as baseline (Tier 1) standards. This element specifies development of an Action Plan to guide inspections and focus activities on high-priority areas. It also provides standards for investigation and enforcement activities. Albany has prepared an Action Plan and recently developed an Illicit Discharge Report form for building inspectors. Because Albany has limited resources and no code enforcement staff, it has been important to revise internal reporting procedures to streamline operations and coordinate spill responses. Calls are now initially routed through the Community Development & Environmental Resources Department, so that the Fire Department only responds where appropriate. Once the Watershed Management Plan is completed, and city staff have information on the location and condition of the municipal storm drain system, Albany will be in complete compliance with all Tier 1 standards for this element, and better able to investigate and respond to spills.

By requiring that outflows from local businesses be inventoried, Element 9.0 (Industrial Discharger Identification and Runoff Control) performance standards are consistent with the emphasis on identifying higher-risk sources and prioritizing them for education, monitoring and inspection. Albany has complied with all Tier 1 standards for this element. Staff have prepared an Industrial and Commercial Business Inspection Plan, including a priority list of businesses to be inspected, and are using the Plan to direct inspection efforts. Albany has only 17 small industrial businesses and two commercial areas. Automobile-related businesses have been a priority for outreach and inspections because there are a sizeable number of them in the city and they are a potential source of priority pollutants. However, city staff have also inspected Golden

Gate Fields, where water-quality control has been an ongoing problem, and Caltrans' I-80 project, where 'housekeeping' and BMP maintenance have apparently been low priorities. The only Tier 2 standard for this element requests that the Inspection Plan be re-evaluated and revised annually. Tier 3 standards expand the inspection and outreach components of the CWP inspection program, and also expand outreach between Albany staff and the other entities in the ACCWP sharing the NPDES permit.

Review of BMP flyers, handouts and compliance procedures

Albany makes available a number of BMP flyers developed by the ACCWP for participating cities and a "Creek Care Guide" published by the National Park Service. BMP flyers are well-produced, with eye-catching artwork and readable text that clearly explains the relevant concepts and recommended behaviors. Different flyers address water-quality protection measures for home maintenance, car repairs, urban runoff, and pest control. Each flyer discusses low-risk or least-toxic materials for different tasks, appropriate methods and disposal options. The flyers also provide local phone numbers to contact relevant departments, agencies and programs, and cite references as sources of additional information.

Albany has also developed hand-outs. One is for building maintenance and remodeling which is given out with building permits. The flyer explains contractor responsibilities to minimize storm water pollution, and recommends BMPs for housekeeping, materials storage, and cleanup activities. A new flyer promotes residential safe alternatives to hazardous household cleaning products and provides proper disposal information. In addition, the City has produced a brochure called Albany's Creeks, Rights, Responsibilities and Opportunities to outline the regulations and provide recommendations to property owners. The City distributes clean-up day flyers through the schools and prints articles on the clean water topics in the quarterly City-wide newsletter.

Potential locations to site structural BMPs for further water-quality improvement

For purposes of this discussion, Cerrito and Codornices Creeks may be divided into two sections: (1) the lower portion, a relatively low-gradient reach, that passes from the mouth of the stream through the zone of tidal influence to the base of the hills, with most adjacent uses of a commercial/industrial nature; and (2) steeper upper reaches, where the creek channel is narrowly confined as it passes through residential neighborhoods.

Upstream of Key Route Boulevard on both Cerrito and Codornices Creek no suitable sites for structural BMPs exist. Sites for water-quality treatment centers, such as wet ponds or dual-purpose detention basins, are limited by residences or yards which closely abut the creek. Downstream of Key Route Boulevard, water-quality basins or other BMPs could potentially be incorporated into redevelopment of larger parcels.

For example, on Cerrito Creek, BMPs could be integrated with the proposed Middle School site, whether or not the creek channel is restored through that reach. Another promising location to treat storm runoff is El Cerrito Plaza. While buildings, parking lots, slopes and streets constrain siting basins or terraces on the Albany side of the creek, the north side is currently in the planning stages of redevelopment, and it may be possible to include improved runoff treatment measures in the redesigned commercial space.

On Codornices Creek, BMPs could be employed as part of a coordinated program with the City of Berkeley. Storm runoff BMPs might readily be designed into the proposed renovation of University Village, or adjoining portions of Dowling Park.

No areas appear available for storm-runoff BMPs on Village or Marin Creeks, either upstream of Key Route Boulevard or between Key Route Boulevard and San Pablo Avenue. Introducing BMPs of this type might be accomplished as part of planning for University Village redevelopment. Another opportunity might be presented by post-flood planning after the 1998 storms at the USDA Western Regional Laboratory. Storm runoff BMPs might effectively be integrated with other measures to reduce probable inundation levels, even after culvert capacities are restored (see recommended improvements for the Marin Creek Watershed).

Placement of BMPs along Middle Creek will also be limited to possible redevelopment of larger lots along San Pablo Avenue. Current plans call for the creek to remain in a culvert near the Albany High School campus. The only other open space within Albany in the Middle Creek watershed is in the southeastern corner of Memorial Park, adjoining the newly-constructed community daycare center and the playground facilities. Child-safety and space considerations realistically preclude this use of the site.

**Existing City Policies**

A number of the elements of the watershed management plan are found in current goals, policies, and regulations of the City.

**Albany Municipal Code Section 15-4 - Storm Water Management and Discharge Control**

Purpose

Ensure the future health, safety, and general welfare of City of Albany citizens by eliminating non-storm water discharges to the municipal separate storm sewer, controlling the discharge to storm sewers from spills, dumping or disposal of materials other than storm water, reducing pollutants in storm water discharges to the maximum extent practicable. The intent is to protect and enhance the water quality of our watercourses, water bodies, and wetlands in a manner pursuant to and consistent with the Clean Water Act.

Discharge of Pollutants

The discharge of non-storm water into the City storm sewer system is prohibited. All discharges of material other than storm water must be in compliance with a NPDES permit issued for the discharge. It is prohibited to establish, use, maintain, or continue illicit drainage connections to the City storm sewer system.

Any person engaged in activities which will or may result in pollutants entering the City storm sewer system shall undertake all practicable measures to reduce such pollutants. Examples of such activities include ownership and use of facilities which may be a source of pollutants such as parking lots, gasoline stations, industrial facilities, commercial facilities, stores fronting City streets, etc.

Sidewalks, Gutters and Roadways

Paved sidewalks and parking strips shall be maintained free of dirt,. debris, or litter to the maximum extent practicable. Sweepings shall not be swept into the gutter or roadway, but shall be disposed of in receptacles as required for disposal of garbage.

Parking Lots and Similar Structures

Parking lots, gas station pavement or similar structure shall be cleaned as frequently and thoroughly as practicable in a manner that does not result in discharge of pollutants to the City storm sewer system.

Best Management Practices for New Developments and Redevelopments

Any construction contractor performing work in the City shall endeavor to provide filter materials at the catch basin to retain any debris and dirt flowing into the City storm sewer system.

Best Management Practices

Any activity, operation, or facility which may cause or contribute to storm water pollution or contamination, illicit discharges, and/or discharge of non-storm water to the storm water system, shall comply with best management practices, guidelines or requirements adopted by any Federal, State, regional, and/or City agency.

Watercourse Protection

Obstruction of watercourses is prohibited.

Watercourses on private property shall be maintained reasonably free of trash, debris, excessive vegetation, and other obstacles which would pollute, contaminate, or significantly retard the flow of water through the watercourse. Healthy bank vegetation shall not be removed beyond that actually necessary for watercourse maintenance, or in such a manner as to increase erosion.

Prohibitions

The following are prohibited without written permit from the Community

Development & Environmental Resources Director:

- Discharge into or connect any pipe of channel to a watercourse.
- Modify the natural flow of water in a watercourse
- Locate structures closer than twenty feet from the top of the natural creek bank.
- Deposit in, plant in, or remove any material from a watercourse including its banks, except for necessary maintenance.
- Place any loose material along the side of or within a watercourse as to cause a diversion or that may be carried away by storm waters.

Permit

Any wall, culvert, drain bulkhead or other depression which carries any storm waters require a permit from the Community Development & Environmental Resources Director.

Nuisances

Any wall, bulkhead, culvert or drain erected without permit, and any structure or accumulation of materials, debris or dirt that will obstruct the flow of any natural watercourse may be declared a nuisance. After notice, the Community Development & Environmental Resources Director may abate such nuisance by removal.

Fee

The City may charge a reasonable storm sewer service fee for residential, industrial, and commercial users of the City storm sewer system, based on the amount of storm water generated on the site and adjusted for site specific uses. Revenues shall be used for the enforcement, implementation, and administration of the Urban Runoff Clean Water Program.

# City of Albany

## Watershed Management Plan
## Technical Appendices

May, 1998

# APPENDICES

**Mattern & Associates** **Consulting Civil Engineers**
3967 South Peardale Drive, Lafayette, CA 94549 FAX: (925) 283-6312 Tel: (925) 283-6315

September 9, 1998

Community Development &
Environmental Resources Department
City of Albany
1000 San Pablo Avenue
Albany, CA 94706

**Re: Watershed Management Plan**

The information we provided to the City for our work on the Watershed Management Plan consisted of our Final Draft Report dated April 13, 1998 (text file dated April 21, 1998).

Since our draft report, we have also provided:
- Updated drainage system figure.
- Updated Storm Drain Maps (dated 9/7/98).
- Updated Storm Drain Maps drawing files (dated 9/7/98).
- Updated Storm Drain Information Database listing (dated 9/9/98).
- Hydrology Database listing (dated 9/9/98).

The information we provided for this plan is intended for watershed planning purposes only. A more detailed review of watershed areas would be required for specific site planning, or design and construction of storm drain and creek improvements.

I have appreciated the opportunity to work on this watershed plan, and hope that the information we provided will serve the City for the future management of their watershed areas.

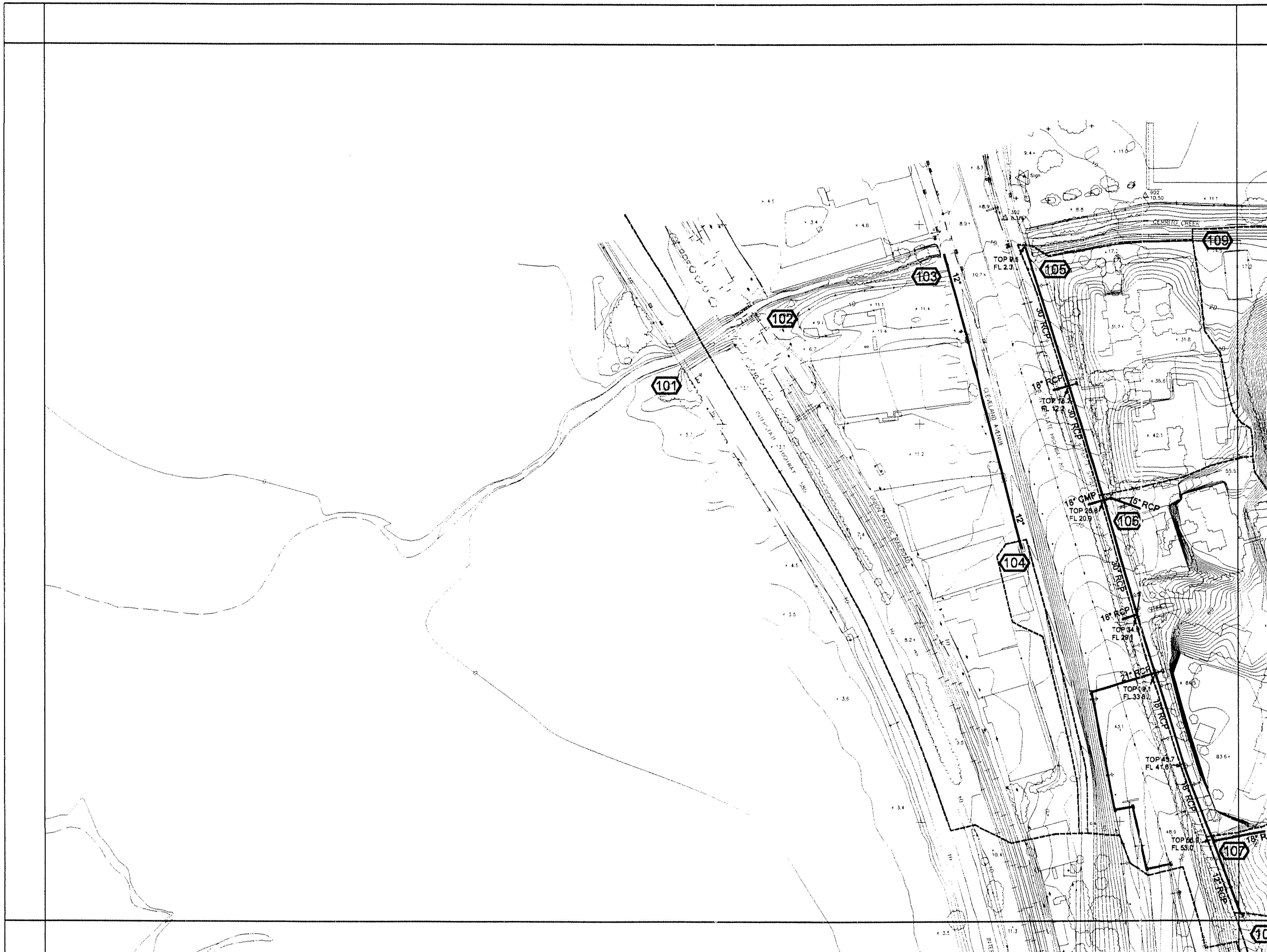
Sincerely,

David E. Mattern, P.E.
Mattern & Associates

REGISTERED PROFESSIONAL ENGINEER
DAVID E. MATTERN
No. C039332
Exp. [illegible]
CIVIL
STATE OF CALIFORNIA

# APPENDIX A

# STORM DRAIN MAPS




City of Albany

# WATERSHED MANAGEMENT PLAN

## STORM DRAIN MAPS

9/7/98

MATTERN & ASSOCIATES

--------- WATERSHED BOUNDARY

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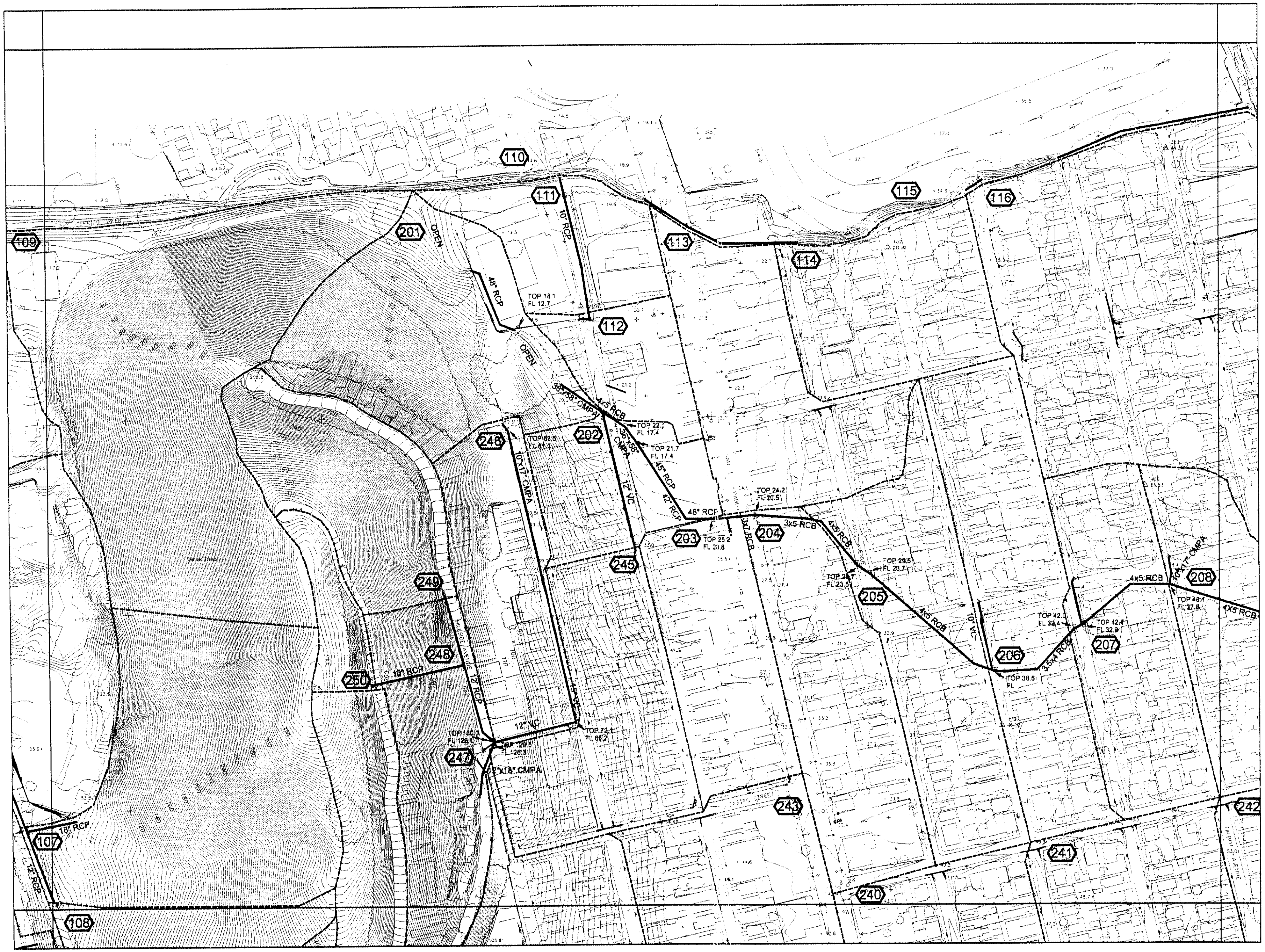


City of Albany

# WATERSHED MANAGEMENT PLAN

## STORM DRAIN MAPS

9/7/98

MATTERN & ASSOCIATES

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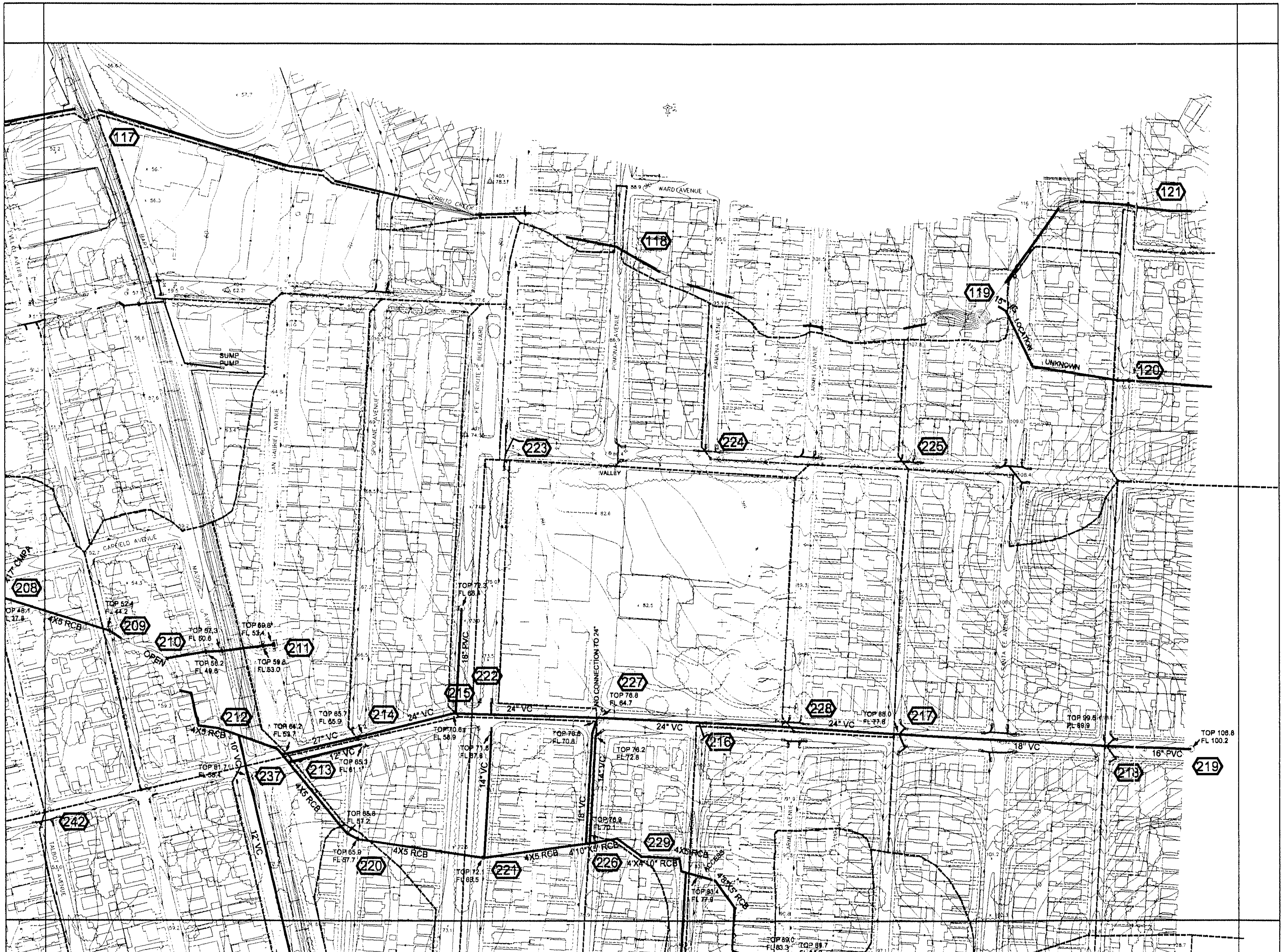


*City of Albany*

**WATERSHED MANAGEMENT PLAN**

**STORM DRAIN MAPS**

9/7/98

MATTERN & ASSOCIATES

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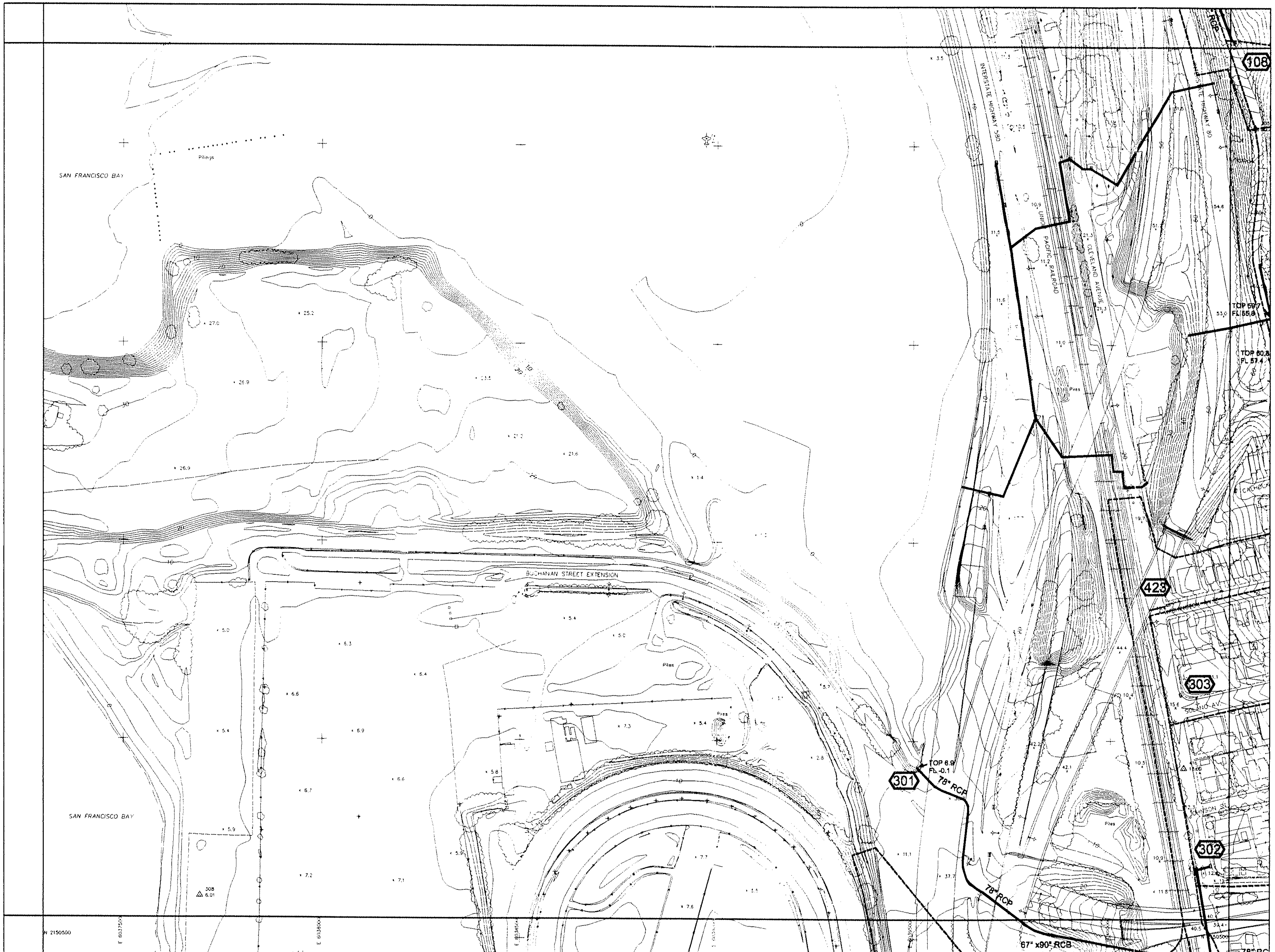


*City of Albany*

# WATERSHED MANAGEMENT PLAN

## STORM DRAIN MAPS

9/7/98

MATTERN & ASSOCIATES

--------- WATERSHED BOUNDARY

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*City of Albany*

**WATERSHED MANAGEMENT PLAN**

**STORM DRAIN MAPS**

9/7/98

MATTERN & ASSOCIATES

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City of Albany

# WATERSHED MANAGEMENT PLAN

# STORM DRAIN MAPS

9/7/98

MATTERN & ASSOCIATES


-------- WATERSHED BOUNDARY

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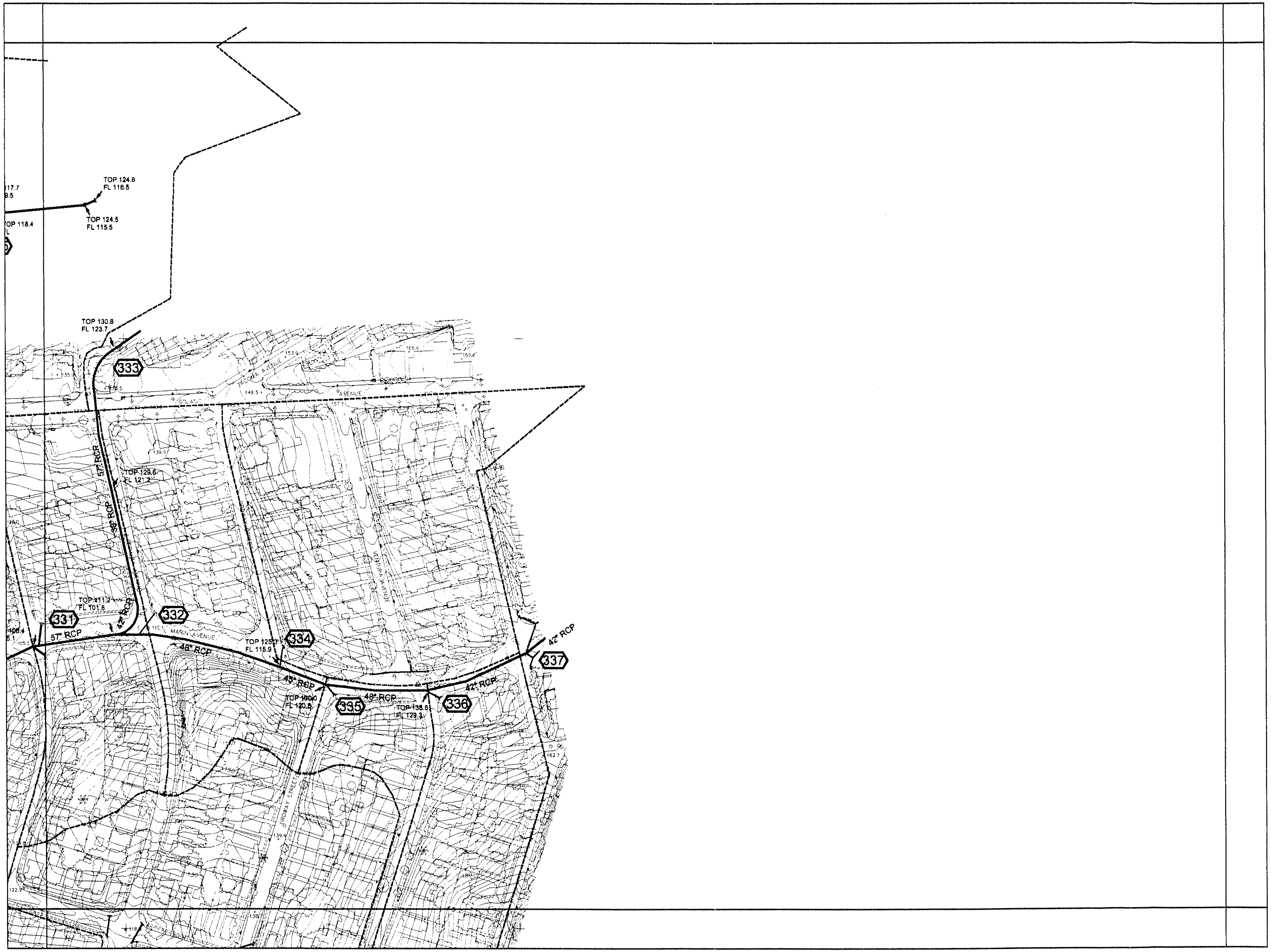


City of Albany

**WATERSHED MANAGEMENT PLAN**

**STORM DRAIN MAPS**

9/7/98

MATTERN & ASSOCIATES

--------- WATERSHED BOUNDARY

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City of Albany

**WATERSHED MANAGEMENT PLAN**

**STORM DRAIN MAPS**

9/7/98

MATTERN & ASSOCIATES

-------- WATERSHED BOUNDARY

(999) STORM DRAIN JUNCTION NUMBER

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City of Albany

**WATERSHED MANAGEMENT PLAN**

**STORM DRAIN MAPS**

9/7/98

MATTERN & ASSOCIATES

------- WATERSHED BOUNDARY

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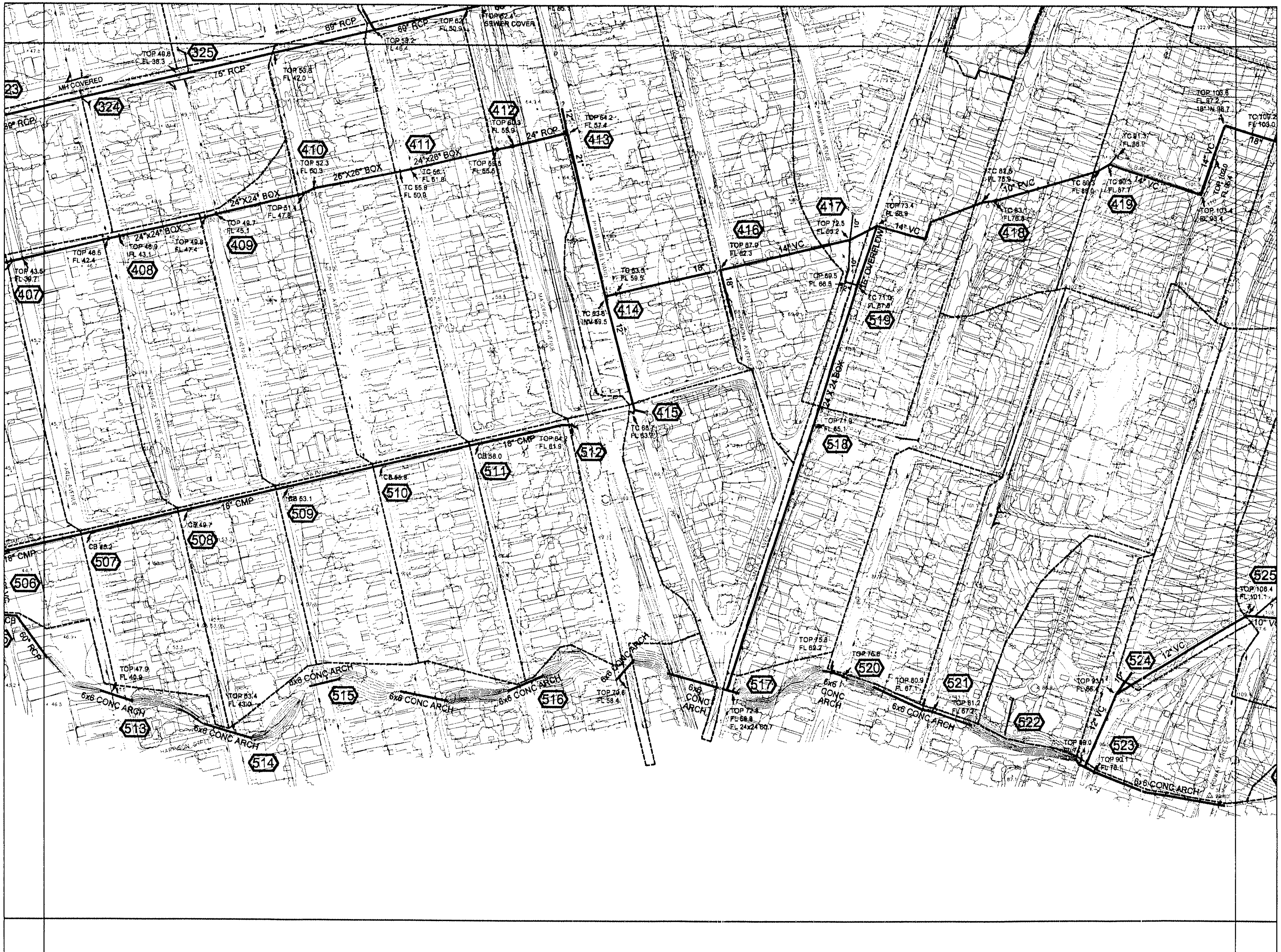


City of Albany

**WATERSHED MANAGEMENT PLAN**

**STORM DRAIN MAPS**

9/7/98

MATTERN & ASSOCIATES

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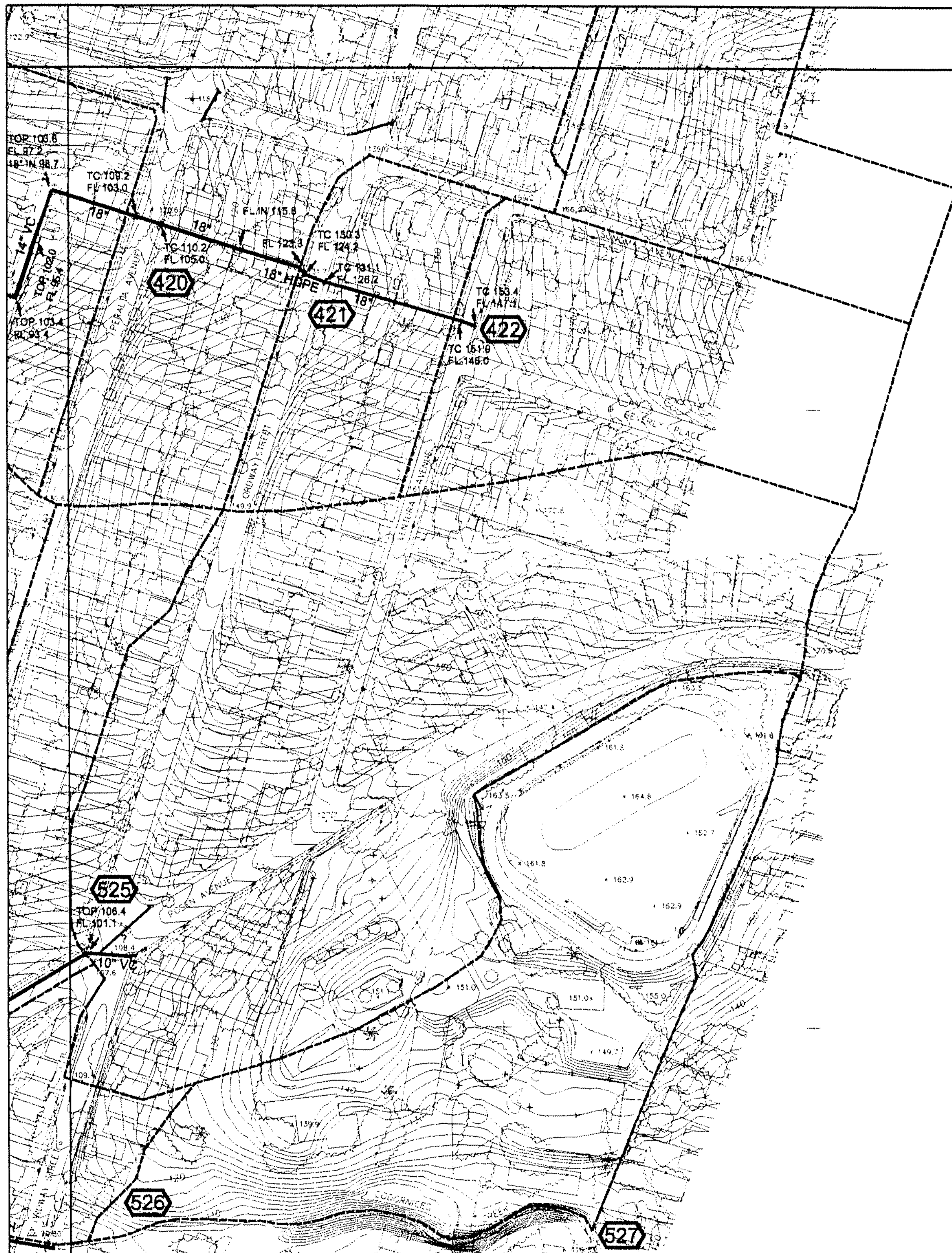
| 8 | 9 | 10 | 11 |

SCALE 1 INCH = 250 FEET

100 0 100 200 300 400

# SHEET 10




City of Albany

**WATERSHED MANAGEMENT PLAN**

**STORM DRAIN MAPS**

9/7/98

MATTERN & ASSOCIATES

--------- WATERSHED BOUNDARY

(999) STORM DRAIN JUNCTION NUMBER

MAP KEY

| | | | |
|---|---|---|---|
| 1 | 2 | 3 | |
| 4 | 5 | 6 | 7 |
| 8 | 9 | 10 | 11 |

SCALE 1 INCH = 250 FEET

100 0 100 200 300 400

# SHEET 11

# APPENDIX B

# HYDRAULIC ANALYSIS

# EVALUATION METHODS

## STUDY APPROACH

The approach used for the preparation of the watershed management plan included the following tasks for each of the three elements:

### Research

Information about the city's watershed features was gathered by researching available reports, maps, and documents. Field surveys were performed to gather first hand information about existing conditions in creek channels and locate specific storm drain and drainage features. Interviews were conducted with City staff and residents concerning known drainage and flooding problems.

### Evaluation of Deficiencies

Before possible improvements to the watersheds of the city could be determined, it was necessary to evaluate what was wrong with the existing watershed components. Deficiencies for each of the elements was determined using evaluation and analysis procedures.

### Evaluation of Priorities

There are limited resources available in Albany for implementation of watershed management measures, and not every beneficial project can be implemented in the near future. To determine the projects which would be most desirable to implement first, methods of ranking potential projects for each of the elements was developed based on criteria reflecting the desires of the city and the professional evaluation of the project staff.

## PREVIOUS STUDIES

The City of Albany has a long history of concerns about their watershed areas. A Creek Restoration Program was written in 1977 by the Albany Landuse Committee and Albany Planning and Zoning Commission. This report recommended that the City encourage controlled access to creeks in public and semipublic areas, improve wildlife habitat and visual qualities in industrial and commercial areas. It was suggested these goals be reached through short term measures of planting suitable vegetation, stream cleanup, cooperation with other agencies and education to improve water quality. Long term measures suggested requiring creek restoration as part of development, and public acquisition of property along the creek. This report was the source of the since adopted watercourse combining zone in the city for significant water related sites.

No information was found about any previous storm drain master plans for Albany. Storm

Drain Master Plans have recently been completed for the cities of Berkeley and El Cerrito, and since these cities share watersheds with Albany, these studies were reviewed and some information from these reports was utilized in the preparation of this Watershed Management Plan.

A number of studies have been prepared for individual sites in the City that are of interest in managing the watershed areas. These sites include Codornices Creek, UC Village area, El Cerrito Plaza, Albany Hill, and other sites.

An evaluation of flooding conditions in Codornices and Village Creeks, including a hydrology analysis and hydraulic study, was prepared in 1993 for the UC Albany Village area by Philip Williams & Associates. This evaluation was supplemented by an additional hydraulic analysis of various flood control alternatives in October 1997 (draft).

## STORM DRAIN AND FLOODING

### Information Obtained

As part of the evaluation of the storm drain system, a comprehensive review was made of the existing drain facilities, see Appendix C. This review included an inspection of almost all known storm drain manholes as well as catch basins and drop inlets where the main storm drain was accessible. At these locations, where the pipe could be viewed, the size and type of pipe was confirmed, the condition of pipe determined, and the depth to invert of pipe measured. Portions of larger storm drains were entered to view drain condition and the size and location of connecting drains. Culvert crossings at the creeks were inspected during the creek field inspections.

Surveys, using satellite global positioning system (GPS) survey methods, were conducted of the storm drain manholes, catch basins and drop inlets where the main storm drain was accessible. This technology allowed the determination of vertical elevations within 2 cm and horizontal coordinates within 1 cm. The survey information was used to determine existing drain inverts and slopes, and allow a better hydraulic analysis of the storm drain system.

Updated storm drain maps were prepared as part of this project. These maps used as a base the topographic maps prepared from aerial photos taken 4/11/97, with two foot topographic contours. The storm drain maps show general location of drains, size of pipe, pipe material, and surveyed elevations. For locations where GPS survey was taken, these coordinates were used in preparation of the storm drain maps. Between surveyed points, the locations of the storm drains shown on these maps was taken from the best available information, and may vary from actual locations. Maps were prepared as AutoCAD drawing files, with a series of 11 maps providing coverage of the entire city. Storm drain maps at a scale of 1" = 250 ft of the existing system are shown in Appendix A.

During the field review, information on street drainage patterns (flow directions at intersections and other key points) was noted to assist with the delineation of watershed subarea boundaries. Streets often alter the natural flow patterns, and topographic maps are often not detailed enough to provide complete information.

## HYDRAULIC CAPACITY ANALYSIS

A hydraulic analysis was performed for the Albany storm in order to estimate storm flows in the drainage system, including the existing underground storm drain pipes, creeks, and major areas served only by street gutters, and the capacity of the existing storm drain pipe system. This analysis was used to determine storm drain pipes which currently have a hydraulic deficiency, defined as a facility which is unable to carry reasonable flows based on a consistent criteria applied to the entire city, such as a 10-year storm.

### Hydrology Analysis

A hydrology analysis was conducted to estimate the storm drain flows throughout the city. In order to estimate peak flows at selected points in the storm drain system, the five creek watershed areas were divided into a number of subareas. These subareas were defined based on locations where significant inflows to the storm drain system occur, such as intersections where one or more catchbasins collect storm water. A total of 118 subareas were used in the evaluation, with an average drainage area of 7 acres for subareas within the city (an area of about 2 standard city blocks). Areas outside the city were generally modeled as one subarea for each inflow point, regardless of the size of the subarea, since it was not necessary to estimate flow values at intermediate points in the drainage system.

In the computer model of the storm drain system, the location where runoff from the subarea was considered to enter the storm drain system was a junction point, which were defined as being at the upstream end of a drain segment as entered in the storm drain information database.

Drainage area boundaries for each of the subareas was determined using the topographic maps, as well as the results of the field investigations described above in which street flow patterns were observed.

Other information estimated for each of the subareas included runoff coefficients, which were based on land use types; and ground slopes and overland flow lengths for the most upstream subareas in each watershed and each storm drain line.

Hydrology methods used for the evaluation were the rational method, using criteria developed by the Alameda County Flood Control District. The rational method is the most widely used and accepted method for analysis of small urban watersheds, and the method is generally accepted as being reasonably accurate for drainage planning purposes in watersheds up to one square mile in drainage area. The watershed areas defined for the analysis of the storm drain system in Albany were small enough that the rational method of estimating peak storm runoff seemed appropriate.

The principle for the rational method is that during uniform rainfall intensity, the maximum discharge at the basin outlet will occur when the entire drainage area above the outlet is contributing runoff. The length of time after the start of rainfall when this occurs is commonly known as the time of concentration, and is defined as the time required for runoff to travel from the most distant point in the basin to the junction point where the peak flow is estimated. The main assumptions inherent in the rational method are that the rainfall intensity is uniform during the analysis period, and the rainfall intensity is the same for all areas of the watershed. Also, it is assumed that the frequency or return period of the computed peak flow is the same as the design rainfall. Thus, a 10-year rainfall intensity is assumed to provide the basis to estimate the 10-year peak runoff.

The time of concentration for each junction point was estimated using the travel time from the upstream end of the watershed. This time included the overland flow time at the uppermost watershed point (flow from the ridge of the watershed ridgeline to the first drainage inlet), and the travel time through the storm drain system itself. Travel times were computed in the hydrology procedure using lengths, slopes, and material (land type or drain type) of overland segments and storm drain segments.

Rainfall intensity information was used from precipitation duration-frequency-depth curves developed by the Alameda County Flood Control District.

Hydrology computations were performed using a dBase computer program that accessed information from the storm drain information database, performed the necessary computations, and stored the results in appropriate data fields of the database.

## Drainage Criteria

It is recognized by engineers and planners that it is generally not feasible to plan city storm drain systems to carry the worst possible flood. This would usually require an enormous expenditure of funds and the construction of very large drainage structures. Therefore, planned drainage facilities usually provide protection for small and moderate sized storms. In doing this, it is recognized that on rare occasions, storms may occur that are larger than the facility was designed for.

The level of protection provided by a drainage system is usually stated as a design storm frequency. This is given as an average period that it is predicted will occur between larger storm events that exceed the drainage system capacity. Unfortunately, it is not possible to accurately predict when large storms will occur, so while the average period between a number of large storms can be predicted, the actual period between large storms will likely be shorter or longer than the stated frequency.

Storms are random events, so the occurrence of storms are commonly stated in terms of probabilities. For instance, the 10-year storm has the probability of occurring once in ten years, or a ten percent chance of occurring in any year. Likewise, the 100-year storm has the probability of occurring once in 100 years, or a one percent chance of occurring in any year. It is also possible, although very unlikely, to have two ten year storms or even two 100 year storms in a single year.

A common level of protection for relatively small drainage systems is the ten year storm. Usually flooding in these small areas will occur for a short period of time, and will involve inconveniences such as street flooding rather than damage to property. It is accepted that this flooding can occur during rarer storms. If there is a known possibility of more serious flooding damage occurring in a localized area, it may be desirable to provide a higher level of protection at this specific location.

Cities and counties near Albany all use the 10-year storm as a criteria for designing drainage systems in small watershed areas, and a 15 or 25 year storm for larger watersheds. Alameda County uses a 10-year storm for secondary facilities with drainage areas less than 50 acres. Contra Costa County uses a 10-year storm for areas less than one square mile, and a 25-year storm for larger areas. The City of Berkeley used a criteria of 10-years for basins less than 1000 acres, and 25-years for larger basins. The City of Oakland uses the 10-year flow for areas up to one square mile (640 acres), and a 15-year flow for larger areas.

For Albany, a storm drain design criteria of a 10-year storm for watersheds less than one square mile, and the 25-year storm for larger watersheds is recommended. Areas affected by the higher storm criteria would include the downstream portions of Codornices Creek, Marin Creek, and Cerrito Creek. A criteria higher than 25-year protection (such as 100-year) may be warranted in some downstream areas where extensive flood damages would occur, and would be determined in individual cases.

**Design Parameters**

For evaluation of storm runoff peak flows, common hydrology procedures utilize methods to evaluate the different runoff characteristics of various landuse types. Many of these methods use runoff coefficients to relate rainfall intensities to rates of storm runoff. Runoff coefficients are usually derived empirically, using calibrations from watershed areas where rainfall and runoff values can be accurately measured for significant storms. Runoff coefficients utilized in this study are shown in Table 1.

Table 1
Runoff Coefficients

| Land Use Type | Runoff Coefficient |
|---|---|
| Residential | 0.50 |
| Commercial | 0.95 |
| Parks and recreation | 0.25 |
| Open space | 0.20 |

Rainfall intensity variations throughout the city were estimated by determining the variation in mean annual precipitation as adopted by the Alameda County Flood Control District. In general, annual precipitation, as well as storm intensity during individual storms, increases from west to east in this region, based on the increasing elevations in the Berkeley Hills. Using the information provided by Alameda County, the rainfall values used for individual subareas are shown in Table 2.

Table 2
Mean Annual Precipitation Used for Subareas

| Location of Subarea | Mean Annual Precipitation (in) |
|---|---|
| West of San Pablo Avenue | 20 |
| East of San Pablo Avenue, subarea outlet lower than elev 100 ft | 22 |
| Subarea outlet higher than elev 100 ft | 23 |
| Watershed areas in Berkeley | 25 |

The annual precipitation values were stored in the hydrology database for each subarea, and the design storm rainfall intensities were calculated from these values using formulas adopted by Alameda County.

**Hydraulic Analysis**

The hydraulic flow capacity of the existing storm drain facilities is defined generally as the flow which the drain can carry without overflowing. The capacity was estimated for all significant stormdrain pipe and culvert segments in the city (pipes 10-inches or greater except for short drains between catchbasins and main storm drain pipes).

The hydraulic capacity computations were performed by the same dBase computer program which performed the hydrology computations, and the computed hydraulic capacity was stored in appropriate data fields of the database.

The formula for calculation of hydraulic capacity in a drain uses the slope of the hydraulic gradeline. The hydraulic gradeline is the elevation to which water in the drain would rise if it were not confined. If the pipe is not flowing full, the hydraulic gradeline elevation is the same as the elevation of the water surface. If a pipe is flowing full, the hydraulic gradeline elevation may rise above the top of the pipe, which is considered a pressure flow or surcharge condition.

The procedure for calculation of hydraulic capacity in the Albany storm drain system was based on full flow conditions without surcharge in the storm drain. This assumption is conservative since due to the hydraulics of pipe flow, a slightly greater flow rate may actually be carried in a drain when it is not quite full. In addition, pressure flow conditions may allow the slope of the hydraulic gradeline to be steeper than the slope of the pipe, which would result in a greater flow capacity.

Short, single drain segments may have actual capacities greater than the estimated full flow capacity, because over short distances, the slope of the hydraulic gradeline can be steeper than the pipe itself. However, the capacity of long drain segments or several consecutive drain segments will probably be close to the full flow capacity, since the average hydraulic gradeline slope cannot vary much from the ground slope over long distances.

The Manning formula was utilized to estimate hydraulic capacities. Manning's "n" values (roughness coefficients) used in this evaluation are shown in Table 3.

Table 3
Pipe Roughness Coefficients

| Type of Pipe | Manning's "n" Value |
|---|---|
| Plastic | .010 |
| Concrete<br>Clay | .013 |
| Corrugated metal (CMP) | .024 |

Although hydraulic capacities were not estimated for open channel areas, since channel dimensions change frequently in creek channel segments, a velocity was estimated for the purpose of estimating the travel time through the reach. Velocities were estimated by assuming a channel sideslope of 1:1 (45 degrees), using a bottom width of one foot for every 50 cfs of flow, and estimating the flow depth necessary to carry the 10-year flow with the channel slope given in the storm drain information database.

Storm drain slopes were obtained by GPS survey of most storm drains at available manholes and drain inlet access points. In some cases, average slope were determined over several drain segments due to lack of access points. Where drain inverts could not be measured, estimated slopes were used based on available ground slope information, or the typical slope of other storm drains in the area.

While estimation of storm drain capacities using assumed slope values are less accurate than those with actual slope information, the hydraulic flow equation is less sensitive to the drain slope than other hydraulic parameters, since flow capacity varies with the square root of the slope. For example, an actual slope that is double the estimated slope (200% greater) would have a flow capacity that is only 41% greater than the capacity using the estimated slope.

For some storm drain segments, a special storm drain hydraulic analysis was performed using actual storm drain and ground elevation data, along with appropriate loss coefficients. This was done for the entire Marin Creek drain system, in order to better evaluate the capacity of the lower section of drain, and to evaluate the impact of the proposed Solano Avenue storm drain. For these drains, the computed hydraulic gradeline elevation is shown in the storm drain information database.

A summary of the storm drain information in the data base and the computed results of the hydraulic analysis is contained in Appendix B.

A summary of the flows in each watershed estimated with the rational method hydraulic analysis and a comparison with flow values from other sources is shown in Table 4. Since the larger watersheds are larger than one square mile in downstream areas, which is generally considered the practical limit for application of the rational method hydrology procedures, other hydrology methods may be more accurate in these locations.

Table 4
Watershed Flow Summary

| | | Estimated Flow | | Philip Williams Assoc | | FEMA |
|---|---|---|---|---|---|---|
| Watershed / Location | Drainage Area (ac) | 10-year (cfs) | 25-year (cfs) | 10-year (cfs) | 25-year (cfs) | 10-year (cfs) |
| Codornices Creek | | | | | | |
| San Pablo Avenue | 741 | 425 | 515 | | | |
| Interstate-80 | 763 | 465 | 565 | 692 | | 660 |
| Village Creek | | | | | | |
| San Pablo Avenue | 95 | 80 | 95 | 134 | | |
| Interstate-80 | 157(1) | 95(1) | 115(1) | 218(1)(2) | 251(1)(2) | 190 |
| Marin Creek | | | | | | |
| San Pablo Avenue | 858 | 540 | 650 | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Interstate-80 | 978 | 560 | 675 | | | |
| Middle Creek | | | | | | |
| Outlet (Cerrito Creek) | 302 | 145 | 175 | | | |
| Cerrito Creek | | | | | | |
| San Pablo Avenue | 380 | 290 | 350 | | | |
| Interstate-580 | 1365 | 680 | 820 | | | |

(1) Village Creek does not include drainage area and flows from Codornices Creek bypass channel.
(2) Village Creek drainage area used was 233 acres (0.36 sq miles).

| JUNCTION NO. | LOCAL AREA (ac) | TOTAL AREA (ac) | COEF AREA (ac) | ROOF TIME (min) | RUNOFF COEF | MEAN RAIN (in) | LENGTH OPEN (ft) | SLOPE OPEN | LENGTH GUTTER (ft) | SLOPE GUTTER | TIME CONC (min) | 10-YR FLOW (cfs) | 25-YR FLOW (cfs) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 101.0 | | 1366.95 | 702.56 | | | | | | | | 53.9 | 669.2 | 808.1 |
| 102.0 | | 1366.95 | 702.56 | | | | | | | | 52.9 | 669.2 | 808.1 |
| 103.0 | | 1366.95 | 702.56 | | | | | | | | 51.7 | 677.1 | 817.6 |
| 104.0 | 0.87 | 0.87 | 0.83 | 5 | 0.95 | 20.0 | | | 700 | 0.0110 | 10.6 | 1.6 | 1.9 |
| 105.0 | 6.13 | 1366.08 | 701.73 | | 0.80 | 20.0 | | | | | 51.0 | 681.3 | 822.7 |
| 106.0 | 7.46 | 19.93 | 9.09 | | 0.80 | 20.0 | | | | | 5.2 | 24.7 | 29.9 |
| 107.0 | 10.22 | 12.47 | 3.12 | | 0.25 | 20.0 | | | | | 4.3 | 9.3 | 11.2 |
| 108.0 | 2.25 | 2.25 | 0.56 | | 0.25 | 20.0 | 650 | 0.2700 | 200 | 0.0650 | 3.7 | 1.8 | 2.1 |
| 109.0 | 14.82 | 1340.02 | 687.74 | | 0.25 | 20.0 | | | | | 49.5 | 679.5 | 820.6 |
| 110.0 | 657.76 | 1049.72 | 555.56 | 23 | 0.53 | 22.0 | | | | | 27.0 | 755.3 | 912.1 |
| 111.0 | 3.31 | 391.96 | 206.94 | | 0.75 | 20.0 | | | | | 26.8 | 296.1 | 357.6 |
| 112.0 | 2.18 | 2.18 | 2.07 | 5 | 0.95 | 20.0 | | | 450 | 0.0110 | 8.6 | 4.4 | 5.4 |
| 113.0 | 6.06 | 386.47 | 202.39 | | 0.80 | 22.0 | | | | | 26.1 | 294.0 | 355.1 |
| 114.0 | 4.82 | 380.41 | 197.54 | | 0.60 | 22.0 | | | | | 25.8 | 289.4 | 349.5 |
| 115.0 | 15.22 | 375.59 | 194.65 | 5 | 0.95 | 22.0 | | | | | 25.3 | 288.3 | 348.1 |
| 116.0 | 19.61 | 360.37 | 180.19 | | 0.50 | 22.0 | | | | | 25.0 | 269.4 | 325.3 |
| 117.0 | 100.67 | 340.76 | 170.39 | 12 | 0.50 | 22.0 | | | | | 24.0 | 261.5 | 315.8 |
| 118.0 | 7.05 | 240.09 | 120.05 | 5 | 0.50 | 22.0 | | | | | 22.2 | 198.3 | 239.4 |
| 119.0 | | 233.04 | 116.53 | | | | | | | | 20.9 | 199.3 | 240.7 |
| 120.0 | 6.71 | 6.71 | 3.36 | 5 | 0.50 | 25.0 | | | 700 | 0.0200 | 9.1 | 8.7 | 10.5 |
| 121.0 | 226.33 | 226.33 | 113.17 | 20 | 0.50 | 25.0 | | | | | 20.0 | 197.9 | 239.0 |
| 201.0 | 7.25 | 1325.20 | 684.04 | | 0.20 | 20.0 | | | | | 47.0 | 694.6 | 838.8 |
| 201.1 | | 268.23 | 127.03 | | | | | | | | 46.0 | 127.1 | 153.5 |
| 202.0 | 3.10 | 247.09 | 121.69 | | 0.50 | 20.0 | | | | | 44.8 | 124.5 | 150.3 |
| 203.0 | 4.45 | 238.27 | 117.28 | | 0.50 | 20.0 | | | | | 44.0 | 121.5 | 146.7 |
| 204.0 | 5.76 | 216.49 | 106.38 | | 0.50 | 22.0 | | | | | 43.8 | 111.5 | 134.6 |
| 205.0 | 6.45 | 189.82 | 93.04 | | 0.50 | 22.0 | | | | | 43.3 | 98.3 | 118.7 |
| 206.0 | 6.70 | 183.37 | 89.82 | | 0.50 | 22.0 | | | | | 42.9 | 95.5 | 115.3 |
| 207.0 | 5.56 | 176.67 | 86.47 | | 0.50 | 22.0 | | | | | 42.5 | 92.4 | 111.5 |
| 208.0 | 4.73 | 171.11 | 83.69 | | 0.50 | 22.0 | | | | | 42.3 | 89.7 | 108.3 |
| 209.0 | 5.00 | 166.38 | 81.32 | | 0.50 | 22.0 | | | | | 42.0 | 87.5 | 105.7 |
| 210.0 | | 161.38 | 78.82 | | | | | | | | 41.6 | 85.3 | 103.0 |
| 211.0 | 7.44 | 7.44 | 3.72 | 5 | 0.50 | 22.0 | | | 1070 | 0.0100 | 13.9 | 6.9 | 8.3 |
| 212.0 | | 153.94 | 75.10 | | | | | | | | 40.9 | 82.1 | 99.2 |
| 213.0 | 3.21 | 139.13 | 67.31 | | 0.50 | 22.0 | | | | | 31.1 | 84.8 | 102.5 |
| 214.0 | 6.24 | 70.66 | 33.07 | | 0.50 | 22.0 | | | | | 26.0 | 46.0 | 55.5 |
| 215.0 | 1.61 | 64.42 | 29.95 | 5 | 0.50 | 22.0 | | | 850 | 0.0088 | 25.5 | 42.2 | 51.0 |
| 216.0 | 5.14 | 45.30 | 20.38 | | 0.50 | 22.0 | | | | | 12.3 | 42.0 | 50.7 |
| 217.0 | 13.10 | 35.80 | 15.63 | | 0.50 | 22.0 | | | | | 11.4 | 33.8 | 40.9 |
| 218.0 | | 22.70 | 9.08 | | 0.50 | | | | | | 10.5 | 21.2 | 25.6 |
| 219.0 | 22.70 | 22.70 | 9.08 | 5 | 0.40 | 24.0 | 150 | 0.2000 | 1100 | 0.0440 | 10.2 | 21.5 | 25.9 |
| 220.0 | 2.46 | 65.26 | 32.64 | | 0.50 | 22.0 | | | | | 30.9 | 41.1 | 49.6 |
| 221.0 | 9.02 | 62.80 | 31.41 | | 0.50 | 22.0 | | | | | 30.5 | 39.8 | 48.1 |
| 222.0 | 1.19 | 62.81 | 29.14 | | 0.50 | 22.0 | | | | | 25.3 | 41.3 | 49.8 |
| 223.0 | 6.31 | 16.32 | 8.16 | | 0.50 | 22.0 | | | | | 18.7 | 13.2 | 16.0 |
| 224.0 | 3.79 | 10.01 | 5.01 | | 0.50 | 22.0 | | | | | 16.0 | 8.9 | 10.7 |
| 225.0 | 6.22 | 6.22 | 3.11 | 5 | 0.50 | 23.0 | 200 | 0.0330 | 800 | 0.0156 | 13.0 | 6.2 | 7.5 |
| 226.0 | 1.70 | 53.78 | 26.90 | | 0.50 | 22.0 | | | | | 30.3 | 34.4 | 41.5 |
| 227.0 | 12.97 | 12.97 | 6.49 | | 0.50 | 22.0 | 650 | 0.0230 | 2500 | 0.0120 | 29.4 | 8.2 | 9.9 |
| 228.0 | 4.36 | 40.16 | 17.81 | 5 | 0.50 | 22.0 | 200 | 0.0330 | 600 | 0.0175 | 12.0 | 37.5 | 45.2 |
| 229.0 | | 39.11 | 19.56 | | | | | | | | 13.8 | 37.7 | 45.5 |
| 230.0 | 6.34 | 33.90 | 16.95 | | 0.50 | 22.0 | | | | | 11.7 | 35.7 | 43.2 |
| 231.0 | 2.36 | 27.56 | 13.78 | | 0.50 | 22.0 | | | | | 11.5 | 29.5 | 35.6 |
| 232.0 | 4.66 | 25.20 | 12.60 | | 0.50 | 22.0 | | | | | 11.4 | 27.2 | 32.9 |
| 233.0 | 5.28 | 20.54 | 10.27 | | 0.50 | 23.0 | | | | | 11.1 | 22.7 | 27.4 |

| JUNCTION NO. | LOCAL AREA (ac) | TOTAL AREA (ac) | COEF AREA (ac) | ROOF TIME (min) | RUNOFF COEF | MEAN RAIN (in) | LENGTH OPEN (ft) | SLOPE OPEN | LENGTH GUTTER (ft) | SLOPE GUTTER | TIME CONC (min) | 10-YR FLOW (cfs) | 25-YR FLOW (cfs) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 234.0 | 5.26 | 15.26 | 7.63 | | 0.50 | 23.0 | | | | | 10.8 | 17.3 | 20.9 |
| 235.0 | 10.00 | 10.00 | 5.00 | 5 | 0.50 | 24.0 | 200 | 0.0500 | 700 | 0.0340 | 10.3 | 11.7 | 14.2 |
| 236.0 | 5.21 | 5.21 | 2.61 | 5 | 0.50 | 22.0 | 200 | 0.0400 | 700 | 0.0120 | 12.8 | 5.0 | 6.1 |
| 237.0 | 2.39 | 14.81 | 7.79 | | 0.50 | 22.0 | | | | | 40.4 | 8.4 | 10.1 |
| 238.0 | 4.71 | 12.42 | 6.60 | | 0.50 | 22.0 | | | | | 37.4 | 7.4 | 8.9 |
| 239.0 | 7.71 | 7.71 | 4.24 | 5 | 0.55 | 22.0 | 200 | 0.0235 | 1900 | 0.0064 | 28.0 | 5.5 | 6.6 |
| 240.0 | 6.86 | 20.91 | 10.46 | | 0.50 | 22.0 | | | | | 23.1 | 15.0 | 18.1 |
| 241.0 | 7.07 | 14.05 | 7.03 | | 0.50 | 22.0 | | | | | 17.9 | 11.5 | 13.8 |
| 242.0 | 6.98 | 6.98 | 3.49 | 5 | 0.50 | 22.0 | 200 | 0.0235 | 750 | 0.0105 | 14.3 | 6.4 | 7.7 |
| 243.0 | 9.16 | 17.33 | 8.67 | | 0.50 | 20.0 | | | | | 16.1 | 13.6 | 16.4 |
| 244.0 | 8.17 | 8.17 | 4.09 | 5 | 0.50 | 20.0 | 100 | 0.2000 | 800 | 0.0500 | 8.5 | 8.8 | 10.6 |
| 245.0 | 5.72 | 5.72 | 2.86 | 5 | 0.50 | 20.0 | | | 1400 | 0.0660 | 9.5 | 5.8 | 7.0 |
| 246.0 | 4.27 | 21.14 | 5.34 | | 0.40 | 20.0 | | | | | 14.8 | 8.7 | 10.5 |
| 247.0 | 5.10 | 16.87 | 3.63 | | 0.25 | 20.0 | | | | | 11.0 | 6.9 | 8.3 |
| 248.0 | | 5.85 | 1.17 | | | | | | | | 9.0 | 2.5 | 3.0 |
| 249.0 | 4.52 | 4.52 | 0.90 | 5 | 0.20 | 20.0 | 300 | 0.3500 | 800 | 0.0700 | 8.8 | 1.9 | 2.3 |
| 250.0 | 1.33 | 1.33 | 0.27 | 5 | 0.20 | 20.0 | 200 | 0.0750 | 550 | 0.0870 | 8.3 | 0.6 | 0.7 |
| 251.0 | 5.92 | 5.92 | 1.18 | 5 | 0.20 | 20.0 | 170 | 0.6500 | 950 | 0.1000 | 8.0 | 2.6 | 3.2 |
| 301.0 | | 949.20 | 405.58 | | | | | | | | 32.5 | 552.7 | 667.5 |
| 301.2 | | 949.20 | 405.58 | | | | | | | | 30.2 | 552.7 | 667.5 |
| 302.0 | 8.72 | | | | 0.50 | 20.0 | | | | | | | |
| 303.0 | 6.36 | 6.36 | 3.18 | 5 | 0.50 | 20.0 | 230 | 0.3300 | 1300 | 0.0790 | 9.8 | 6.4 | 7.7 |
| 304.0 | 8.01 | 942.84 | 402.40 | | 0.40 | 20.0 | | | | | 29.8 | 553.4 | 668.3 |
| 305.0 | | 934.83 | 399.20 | | | | | | | | 29.1 | 556.5 | 672.0 |
| 306.0 | | 934.83 | 399.20 | | | | | | | | 28.4 | 563.1 | 679.9 |
| 307.0 | 14.37 | 27.29 | 13.65 | | 0.50 | 20.0 | | | | | 15.0 | 22.1 | 26.7 |
| 308.0 | 4.27 | 9.18 | 4.59 | | 0.50 | 20.0 | | | | | 11.0 | 8.7 | 10.5 |
| 309.0 | 4.91 | 4.91 | 2.46 | 5 | 0.50 | 20.0 | 220 | 0.2680 | 630 | 0.0413 | 8.6 | 5.3 | 6.3 |
| 310.0 | 3.74 | 3.74 | 1.87 | 5 | 0.50 | 20.0 | | | 1480 | 0.0500 | 10.5 | 3.6 | 4.4 |
| 311.0 | 4.29 | 907.54 | 385.55 | | 0.40 | 20.0 | | | | | 28.2 | 548.7 | 662.5 |
| 312.0 | 12.44 | 903.25 | 383.83 | | 0.25 | 20.0 | | | | | 27.8 | 550.3 | 664.5 |
| 313.0 | 5.81 | 33.26 | 16.63 | | 0.50 | 20.0 | | | | | 17.4 | 25.0 | 30.2 |
| 314.0 | 10.81 | 27.45 | 13.73 | | 0.50 | 20.0 | | | | | 16.9 | 20.9 | 25.3 |
| 315.0 | 10.58 | 16.64 | 8.32 | | 0.50 | 20.0 | | | | | 14.6 | 13.7 | 16.5 |
| 316.0 | 6.06 | 6.06 | 3.03 | 5 | 0.50 | 20.0 | 200 | 0.0300 | 720 | 0.0100 | 13.8 | 5.1 | 6.2 |
| 317.0 | 13.25 | 857.55 | 364.09 | | 0.50 | 22.0 | | | | | 26.7 | 538.3 | 650.0 |
| 318.0 | 3.24 | 25.46 | 15.12 | | 0.75 | 22.0 | | | | | 21.8 | 22.3 | 26.9 |
| 319.0 | 6.01 | 14.32 | 7.16 | | 0.50 | 22.0 | | | | | 18.5 | 11.5 | 13.9 |
| 320.0 | 8.31 | 8.31 | 4.16 | 5 | 0.50 | 22.0 | | | 750 | 0.0072 | 12.4 | 8.2 | 9.9 |
| 321.0 | 4.48 | 7.90 | 5.53 | | 0.67 | 22.0 | | | | | 15.1 | 9.8 | 11.9 |
| 322.0 | 3.42 | 3.42 | 2.53 | 5 | 0.74 | 22.0 | | | 750 | 0.0190 | 9.5 | 5.7 | 6.8 |
| 323.0 | 14.39 | 818.84 | 342.34 | | 0.50 | 22.0 | | | | | 20.6 | 580.2 | 700.6 |
| 324.0 | 3.67 | 804.45 | 335.14 | | 0.50 | 22.0 | | | | | 20.4 | 572.4 | 691.3 |
| 325.0 | 12.83 | 800.78 | 333.31 | | 0.50 | 22.0 | | | | | 20.2 | 572.8 | 691.7 |
| 326.0 | 7.05 | 787.95 | 326.89 | | 0.50 | 22.0 | | | | | 19.8 | 568.6 | 686.6 |
| 327.0 | 3.47 | 780.90 | 323.37 | | 0.50 | 22.0 | | | | | 19.5 | 566.2 | 683.7 |
| 327.5 | 14.74 | 777.43 | 321.63 | 5 | 0.50 | 22.0 | | | 1450 | 0.0204 | 19.4 | 565.5 | 682.8 |
| 328.0 | 11.50 | 762.69 | 314.26 | | 0.50 | 22.0 | | | | | 18.9 | 561.3 | 677.8 |
| 329.0 | 9.07 | 751.19 | 308.51 | | 0.50 | 22.0 | | | | | 18.4 | 559.9 | 676.1 |
| 330.0 | 8.20 | 742.12 | 303.98 | | 0.50 | 22.0 | | | | | 18.0 | 558.3 | 674.2 |
| 331.0 | 7.28 | 733.92 | 299.88 | | 0.50 | 23.0 | | | | | 17.8 | 555.3 | 670.6 |
| 332.0 | 6.91 | 726.64 | 296.24 | | 0.50 | 23.0 | | | | | 17.6 | 551.2 | 665.6 |
| 333.0 | 281.00 | 281.00 | 115.21 | 11 | 0.41 | 25.0 | | | 1900 | 0.0770 | 16.7 | 220.9 | 266.8 |
| 334.0 | 10.79 | 438.73 | 177.57 | | 0.50 | 23.0 | | | | | 16.9 | 337.3 | 407.3 |
| 335.0 | 2.11 | 427.94 | 172.17 | | 0.50 | 23.0 | | | | | 16.8 | 328.8 | 397.1 |
| 336.0 | 7.83 | 425.83 | 171.12 | | 0.50 | 23.0 | | | | | 16.6 | 329.1 | 397.4 |

| JUNCTION NO. | LOCAL AREA (ac) | TOTAL AREA (ac) | COEF AREA (ac) | ROOF TIME (min) | RUNOFF COEF | MEAN RAIN (in) | LENGTH OPEN (ft) | SLOPE OPEN | LENGTH GUTTER (ft) | SLOPE GUTTER | TIME CONC (min) | 10-YR FLOW (cfs) | 25-YR FLOW (cfs) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 337.0 | 418.00 | 418.00 | 167.20 | 13 | 0.40 | 25.0 | | | 700 | 0.0300 | 16.4 | 324.0 | 391.2 |
| 401.0 | | 161.56 | 76.36 | | | | | | | | 27.9 | 100.5 | 121.3 |
| 403.0 | 18.16 | 161.56 | 76.36 | | 0.30 | 20.0 | | | | | 25.8 | 100.5 | 121.3 |
| 404.0 | 35.88 | 138.84 | 68.64 | | 0.50 | 20.0 | | | | | 22.6 | 97.7 | 118.0 |
| 405.0 | 7.85 | 102.96 | 50.70 | | 0.40 | 22.0 | | | | | 20.8 | 77.2 | 93.3 |
| 406.0 | 5.21 | 95.11 | 47.56 | | 0.50 | 22.0 | | | | | 18.3 | 77.4 | 93.5 |
| 407.0 | 4.11 | 89.90 | 44.95 | | 0.50 | 22.0 | | | | | 17.9 | 74.2 | 89.6 |
| 408.0 | 4.16 | 85.79 | 42.90 | | 0.50 | 22.0 | | | | | 17.3 | 71.9 | 86.9 |
| 409.0 | 4.36 | 81.63 | 40.82 | | 0.50 | 22.0 | | | | | 16.7 | 69.8 | 84.3 |
| 410.0 | 6.22 | 77.27 | 38.64 | | 0.50 | 22.0 | | | | | 16.1 | 67.2 | 81.2 |
| 411.0 | 6.22 | 71.05 | 35.53 | | 0.50 | 22.0 | | | | | 15.7 | 62.9 | 75.9 |
| 412.0 | 3.79 | 64.83 | 32.42 | | 0.50 | 22.0 | | | | | 15.2 | 58.3 | 70.4 |
| 413.0 | 8.06 | 61.04 | 30.52 | | 0.50 | 22.0 | | | | | 14.8 | 55.6 | 67.2 |
| 414.0 | | 52.98 | 26.49 | | | | | | | | 13.4 | 51.0 | 61.6 |
| 415.0 | 5.26 | 5.26 | 2.63 | 5 | 0.50 | 22.0 | | | 830 | 0.0086 | 12.5 | 5.2 | 6.2 |
| 416.0 | 7.32 | 47.72 | 23.86 | | 0.50 | 22.0 | | | | | 12.1 | 48.5 | 58.6 |
| 417.0 | 6.77 | 40.40 | 20.20 | | 0.50 | 22.0 | | | | | 10.9 | 43.5 | 52.5 |
| 418.0 | 4.65 | 33.63 | 16.82 | | 0.50 | 22.0 | | | | | 10.0 | 37.9 | 45.8 |
| 419.0 | 6.38 | 28.98 | 14.49 | | 0.50 | 22.0 | | | | | 9.5 | 33.7 | 40.7 |
| 420.0 | 13.25 | 22.60 | 11.30 | | 0.50 | 23.0 | | | | | 8.2 | 28.4 | 34.4 |
| 421.0 | 3.40 | 9.35 | 4.68 | | 0.50 | 23.0 | | | | | 7.9 | 12.0 | 14.5 |
| 422.0 | 5.95 | 5.95 | 2.98 | 5 | 0.50 | 23.0 | | | 860 | 0.0717 | 7.7 | 7.7 | 9.4 |
| 423.0 | 4.56 | 4.56 | 2.28 | 5 | 0.50 | 20.0 | 250 | 0.3200 | 850 | 0.1000 | 8.3 | 5.0 | 6.0 |
| 501.0 | | 769.01 | 315.93 | | | | | | | | 43.6 | 379.2 | 457.9 |
| 502.0 | | 769.01 | 315.93 | | | | | | | | 40.3 | 379.2 | 457.9 |
| 503.0 | 8.91 | 769.01 | 315.93 | | 0.30 | 20.0 | | | | | 38.3 | 389.4 | 470.2 |
| 504.0 | 12.86 | 760.10 | 313.26 | | 0.50 | 20.0 | | | | | 33.1 | 416.7 | 503.2 |
| 505.0 | | 747.24 | 306.83 | | | | | | | | 30.0 | 430.4 | 519.7 |
| 506.0 | 1.40 | 18.25 | 9.13 | | 0.50 | 22.0 | | | | | 19.0 | 14.4 | 17.4 |
| 507.0 | 2.62 | 16.85 | 8.43 | | 0.50 | 22.0 | | | | | 17.7 | 13.8 | 16.7 |
| 508.0 | 2.96 | 14.23 | 7.12 | | 0.50 | 22.0 | | | | | 16.6 | 12.1 | 14.6 |
| 509.0 | 2.82 | 11.27 | 5.64 | | 0.50 | 22.0 | | | | | 15.5 | 9.9 | 11.9 |
| 510.0 | 3.24 | 8.45 | 4.23 | | 0.50 | 22.0 | | | | | 14.3 | 7.7 | 9.3 |
| 511.0 | 3.47 | 5.21 | 2.61 | | 0.50 | 22.0 | | | | | 12.9 | 5.0 | 6.1 |
| 512.0 | 1.74 | 1.74 | 0.87 | 5 | 0.50 | 22.0 | | | 800 | 0.0090 | 12.0 | 1.7 | 2.1 |
| 513.0 | | 728.99 | 297.70 | | | | | | | | 29.3 | 424.2 | 512.2 |
| 514.0 | | 728.99 | 297.70 | | | | | | | | 28.5 | 430.2 | 519.5 |
| 515.0 | | 728.99 | 297.70 | | | | | | | | 28.4 | 431.2 | 520.7 |
| 516.0 | | 728.99 | 297.70 | | | | | | | | 27.0 | 442.2 | 534.0 |
| 517.0 | | 728.99 | 297.70 | | | | | | | | 25.7 | 453.4 | 547.5 |
| 518.0 | 6.36 | 11.69 | 5.85 | | 0.50 | 22.0 | | | | | 12.6 | 11.4 | 13.7 |
| 519.0 | 5.33 | 5.33 | 2.67 | 5 | 0.50 | 22.0 | | | 970 | 0.0154 | 11.5 | 5.4 | 6.6 |
| 520.0 | 3.49 | 717.30 | 291.85 | | 0.50 | 22.0 | | | | | 24.8 | 453.4 | 547.6 |
| 521.0 | 8.17 | 713.81 | 290.11 | | 0.50 | 22.0 | | | | | 24.3 | 456.1 | 550.8 |
| 522.0 | 2.89 | 705.64 | 286.02 | | 0.50 | 22.0 | | | | | 23.9 | 453.5 | 547.6 |
| 523.0 | 2.57 | 702.75 | 284.58 | | 0.50 | 22.0 | | | | | 23.2 | 458.6 | 553.7 |
| 524.0 | 4.27 | 21.44 | 10.72 | | 0.50 | 22.0 | | | | | 12.3 | 21.1 | 25.5 |
| 525.0 | 17.17 | 17.17 | 8.59 | 5 | 0.50 | 22.0 | 200 | 0.0770 | 1300 | 0.0500 | 11.6 | 17.4 | 21.1 |
| 526.0 | 10.74 | 678.74 | 272.57 | | 0.50 | 22.0 | | | | | 22.9 | 443.7 | 535.8 |
| 527.0 | 668.00 | 668.00 | 267.20 | 20 | 0.40 | 25.0 | | | | | 20.0 | 467.4 | 564.4 |

# APPENDIX C

# STORM DRAIN INFORMATION DATABASE

## Storm Drain Information Database

To assist with the collection, storage, and evaluation of information about the storm drain system, a storm drain information database was created for Albany. The database provided an efficient procedure for analysis of the system in determining existing deficiencies, and also provided a standardized procedure for determining the priority of proposed improvement projects. The database currently has information on about 280 storm drain pipe segments and open channel sections.

The database contains information gathered on individual drain segments in the city, including pipe size, material, length, slope, street location, invert elevation, ground elevation, and hydrology subarea. In addition, various information calculated during the analysis was also stored in the data base, including 10-year and 25-year flow values, and estimated pipe capacity.

ALBANY WATERSHED MANAGEMENT PLAN
STORM DRAIN INFORMATION DATABASE



CERRITO CREEK

| DRAIN NO. | D/S NODE | U/S NODE | MAP NO. | HT / DIAM. (in OR ft) | WIDTH | TYPE | LENGTH (ft) | SLOPE | TY | STREET | R/W | D/S INVERT (ft) | U/S INVERT (ft) | U/S GROUND (ft) | CAPACITY (cfs) | 10-YR FLOW (cfs) | CAPACITY EXCEEDED | 10-YR HGL (ft) | 25-YR FLOW (cfs) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.00 | 101.0 | | 1 | | | OPEN | 100 | 0.0050 | E | SF BAY | | | | | | 669.2 | | | 808.1 |
| 2.00 | | | 1 | | | BRDG | 150 | 0.0050 | E | I-580 | | | | | | 669.2 | | | 808.1 |
| 3.00 | | | 1 | | | OPEN | 40 | 0.0050 | E | | | | | | | 669.2 | | | 808.1 |
| 4.00 | | 102.0 | 1 | | | BRDG | 60 | 0.0050 | E | RAILROAD | | | | | | 669.2 | | | 808.1 |
| 5.00 | | 103.0 | 1 | | | OPEN | 490 | 0.0050 | E | CLEVELAND | | | | | | 677.1 | | | 817.6 |
| 6.00 | | | 1 | 12.00 | | RCP | 220 | 0.0100 | E | CLEVELAND | | | | | 3.6 | 1.6 | | | 1.9 |
| 7.00 | | | 1 | 12.00 | | RCP | 200 | 0.0100 | E | CLEVELAND | | | | | 3.6 | 1.6 | | | 1.9 |
| 8.00 | | | 1 | 12.00 | | RCP | 160 | 0.0100 | E | CLEVELAND | | | | | 3.6 | 1.6 | | | 1.9 |
| 9.00 | | 104.0 E | 1 | 12.00 | | RCP | 180 | 0.0100 | E | CLEVELAND | | | | | 3.6 | 1.6 | | | 1.9 |
| 10.00 | 103.0 | 105.0 | 1 | | | BRDG | 220 | 0.0050 | E | I-80 | | | 2.30 | 9.50 | | 681.3 | | | 822.7 |
| 11.00 | | | 1 | 30.00 | | RCP | 360 | 0.0200 | E | PIERCE | | | 12.20 | 18.20 | 58.0 | 24.7 | | | 29.9 |
| 12.00 | | 106.0 | 1 | 30.00 | | RCP | 300 | 0.0290 | | PIERCE | | | 20.90 | 26.60 | 69.9 | 24.7 | | | 29.9 |
| 13.00 | | | 1 | 30.00 | | RCP | 300 | 0.0270 | | PIERCE | | | 29.10 | 34.90 | 67.4 | 9.3 | | | 11.2 |
| 14.00 | | | 1 | 30.00 | | RCP | 155 | 0.0300 | | PIERCE | | | 33.80 | 39.10 | 71.0 | 9.3 | | | 11.2 |
| 15.00 | | 107.0 | 1 | 18.00 | | RCP | 245 | 0.0320 | | PIERCE | | | 41.60 | 45.70 | 18.8 | 9.3 | | | 11.2 |
| 16.00 | | | 1 | 18.00 | | RCP | 195 | 0.0585 | | PIERCE | | | 53.00 | 56.90 | 25.4 | 1.8 | | | 2.1 |
| 17.00 | | 108.0 E | 1 | 12.00 | | RCP | 200 | 0.0500 | E | PIERCE | | | | | 8.0 | 1.8 | | | 2.1 |
| 18.00 | 105.0 | 109.0 | 1 | | | OPN | 450 | 0.0050 | E | | | | | | | 679.5 | | | 820.6 |
| 19.00 | | 201.0 | 2 | | | OPEN | 1020 | 0.0050 | E | MIDDLE CREEK | | | | | | 694.6 | | | 838.8 |
| 20.00 | | 110.0 | 2 | | | OPEN | 270 | 0.0100 | E | | | | | | | 755.3 | | | 912.1 |
| 21.00 | | 111.0 | 2 | | | OPEN | 100 | 0.0100 | E | | | | | | | 296.1 | | | 357.6 |
| 22.00 | | 112.0 E | 2 | 10.00 | | RCP | 360 | 0.0100 | E | ADAMS ST | | | | | 2.2 | 4.4 | **** | | 5.4 |
| 23.00 | 111.0 | | 2 | | | OPEN | 250 | 0.0100 | E | | | | | | | 294.0 | | | 355.1 |
| 24.00 | | 113.0 | 2 | 4.00 | 7.00 | RCB | 130 | 0.0180 | | SAN PABLO AVE | | | | | 504.3 | 294.0 | | | 355.1 |
| 25.00 | | 114.0 | 2 | 4.00 | 7.00 | RCB | 400 | 0.0180 | | SAN PABLO AVE | | | | | 504.3 | 289.4 | | | 349.5 |

ABBREVIATIONS
D/S DOWNSTREAM
U/S UPSTREAM
TY TYPE
R/W RIGHT OF WAY

DRAIN TYPE
BRDG BRIDGE
CMP CORRUGATED METAL PIPE
CMPA CORRUGATED METAL PIPE ARCH
GUT STREET GUTTER
OPN OPEN CHANNEL
PVC PLASTIC
RCB REINFORCED BOX
RCP REINFORCED CONCRETE PIPE
VC VITRIFIED CLAY

SLOPE TYPE
A AVERAGE
E ESTIMATED

RIGHT OF WAY TYPE
PR PRIVATE
blank PUBLIC

CAPACITY EXCEEDED
. LESS THAN 10%
* 10% TO 25%
** 25% TO 50%
*** 50% TO 100%
**** GREATER THAN 100%

| DRAIN NO. | D/S NODE | U/S NODE | MAP NO. | HT / DIAM. (in OR ft) | WIDTH | TYPE | LENGTH (ft) | SLOPE | TY | STREET | R/W | D/S INVERT (ft) | U/S INVERT (ft) | U/S GROUND (ft) | CAPACITY (cfs) | 10-YR FLOW (cfs) | CAPACITY EXCEEDED | 10-YR HGL (ft) | 25-YR FLOW (cfs) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 26.00 | | 115.0 | 2 | | | OPEN | 270 | 0.0150 | E | EL CERRITO PLAZA | | | | | | 288.3 | | | 348.1 |
| 27.00 | | 116.0 | 2 | | | OPEN | 190 | 0.0200 | E | EL CERRITO PLAZA | | | 25.30 | | | 269.4 | | | 325.3 |
| 28.00 | | | 2 | 4.00 | 6.00 | RCB | 70 | 0.0180 | | CORNELL AVE | | 25.30 | 26.60 | | 415.6 | 261.5 | | | 315.8 |
| 29.00 | | | 2 | | | OPEN | 170 | 0.0100 | E | EL CERRITO PLAZA | | 26.60 | 27.80 | | | 261.5 | | | 315.8 |
| 30.00 | | | 2 | 42.00 | | 2RCP | 520 | 0.0310 | C | EVELYN AVE | | 27.80 | 44.00 | | 354.3 | 261.5 | | | 315.8 |
| 31.00 | | | 3 | | | OPEN | 35 | 0.0200 | E | BART | | | | | | 261.5 | | | 315.8 |
| 32.00 | | 117.0 | 3 | 6.00 | 7.50 | RCB | 30 | 0.0200 | E | BART | | | | | 1022.5 | 261.5 | | | 315.8 |
| 33.00 | | | 3 | 42.00 | | 2RCP | 550 | 0.0200 | E | ALBANY SCHOOL | | | | | 284.6 | 198.3 | | | 239.4 |
| 34.00 | | | 3 | | | OPEN | 40 | 0.0200 | E | | | | | | | 198.3 | | | 239.4 |
| 35.00 | | | 3 | 3.00 | 5.00 | RCB | 120 | 0.0200 | E | SPOKANE | | | | | 232.3 | 198.3 | | | 239.4 |
| 36.00 | | | 3 | 3.00 | 5.00 | RCB | 140 | 0.0200 | E | | | | | | 232.3 | 198.3 | | | 239.4 |
| 37.00 | | | 3 | | | OPEN | 100 | 0.0200 | E | KEY ROUTE | | | | | | 198.3 | | | 239.4 |
| 38.00 | | | 3 | 4.00 | 5.00 | RCB | 150 | 0.0200 | E | KEY ROUTE | | | | | 346.8 | 198.3 | | | 239.4 |
| 39.00 | | | 3 | | | OPEN | 120 | 0.0200 | E | | | | | | | 198.3 | | | 239.4 |
| 40.00 | | 118.0 | 3 | 4.00 | 5.00 | RCB | 250 | 0.0200 | E | POMONA | | | | | 346.8 | 198.3 | | | 239.4 |
| 41.00 | | | 3 | | | OPEN | 60 | 0.0200 | E | | | | | | | 199.3 | | | 240.7 |
| 42.00 | | | 3 | 4.00 | 5.00 | RCB | 120 | 0.0200 | E | RAMONA | | | | | 346.8 | 199.3 | | | 240.7 |
| 43.00 | | | 3 | | | OPEN | 200 | 0.0200 | E | | | | | | | 199.3 | | | 240.7 |
| 44.00 | | | 3 | 3.00 | 5.00 | RCB | 70 | 0.0200 | E | CARMEL | | | | | 232.3 | 199.3 | | | 240.7 |
| 45.00 | | | 3 | | | OPEN | 190 | 0.0200 | E | | | | | | | 199.3 | | | 240.7 |
| 46.00 | | | 3 | 3.50 | 5.00 | RCB | 60 | 0.0200 | E | SAN CARLOS | | | | | 288.4 | 199.3 | | | 240.7 |
| 47.00 | | 119.0 | 3 | | | OPEN | 180 | 0.0200 | E | | | | | | | 199.3 | | | 240.7 |
| 48.00 | | 120.0 E | 3 | 15.00 | | VC | 450 | 0.0200 | E | CURTIS | | | | | 9.1 | 8.7 | | | 10.5 |
| 49.00 | 119.0 | | 3 | | | OPEN | 100 | 0.0200 | E | | | | | | | 197.9 | | | 239.0 |
| 50.00 | | | 3 | 3.50 | 5.00 | RCB | 100 | 0.0200 | E | SANTA FE | | | | | 288.4 | 197.9 | | | 239.0 |
| 51.00 | | | 3 | 36.00 | | RCP | 120 | 0.0200 | E | SANTA FE | | | | | 94.3 | 197.9 | **** | | 239.0 |
| 52.00 | | | 3 | | | OPEN | 100 | 0.0200 | E | | | | | | | 197.9 | | | 239.0 |
| 53.00 | | 121.0 E | 3 | 36.00 | | RCP | 250 | 0.0200 | E | CURTIS | | | | | 94.3 | 197.9 | **** | | 239.0 |

ABBREVIATIONS
- D/S DOWNSTREAM
- U/S UPSTREAM
- TY TYPE
- R/W RIGHT OF WAY

DRAIN TYPE
- BRDG BRIDGE
- CMP CORRUGATED METAL PIPE
- CMPA CORRUGATED METAL PIPE ARCH
- GUT STREET GUTTER
- OPN OPEN CHANNEL
- PVC PLASTIC
- RCB REINFORCED BOX
- RCP REINFORCED CONCRETE PIPE
- VC VITRIFIED CLAY

SLOPE TYPE
- A AVERAGE
- E ESTIMATED

RIGHT OF WAY TYPE
- PR PRIVATE
- blank PUBLIC

CAPACITY EXCEEDED
- . LESS THAN 10%
- * 10% TO 25%
- ** 25% TO 50%
- *** 50% TO 100%
- **** GREATER THAN 100%

MIDDLE CREEK

| DRAIN NO. | D/S NODE | U/S NODE | MAP NO. | HT / DIAM. (in OR ft) | WIDTH | TYPE | LENGTH (ft) | SLOPE | TY | STREET | R/W | D/S INVERT (ft) | U/S INVERT (ft) | U/S GROUND (ft) | CAPACITY (cfs) | 10-YR FLOW (cfs) | CAPACITY EXCEEDED | 10-YR HGL (ft) | 25-YR FLOW (cfs) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 54.00 | 201.0 | 201.1 | 2 | | | OPN | 300 | 0.0200 | E | | | | | | | 127.1 | | | 153.5 |
| 55.00 | | | 2 | 48.00 | | RCP | 190 | 0.0090 | E | ADAMS | | | | | 136.3 | 124.5 | | | 150.3 |
| 56.00 | | | 2 | | | OPN | 200 | 0.0118 | A | ADAMS | PR | | | | | 124.5 | | | 150.3 |
| 57.00 | | 202.0 | 2 | 36.00 | 58.00 | CMPA | 120 | 0.0118 | A | ADAMS | PR | | | | 92.6 | 124.5 | ** | | 150.3 |
| 58.00 | | | 2 | 4.00 | 5.00 | RCB | 40 | 0.0118 | A | ADAMS | | | | | 266.4 | 121.5 | | | 146.7 |
| 59.00 | | | 2 | 4.00 | 5.00 | RCB | 40 | 0.0118 | A | ADAMS | PR | | 17.40 | 22.10 | 266.4 | 121.5 | | | 146.7 |
| 60.00 | | | 2 | 36.00 | 58.00 | CMPA | 90 | 0.0100 | E | ADAMS | PR | | 17.40 | 21.70 | 85.3 | 121.5 | ** | | 146.7 |
| 61.00 | | | 2 | 45.00 | | RCP | 100 | 0.0113 | A | ADAMS | PR | | | | 128.6 | 121.5 | | | 146.7 |
| 62.00 | | | 2 | 42.00 | | RCP | 100 | 0.0113 | A | ADAMS | PR | | | | 107.0 | 121.5 | . | | 146.7 |
| 63.00 | | 203.0 | 2 | 48.00 | | RCP | 100 | 0.0113 | A | CLAY | PR | | 20.80 | 25.20 | 152.7 | 121.5 | | | 146.7 |
| 64.00 | | 204.0 | 2 | 3.00 | 7.00 | RCB | 110 | 0.0100 | E | SAN PABLO | | | 20.50 | 24.20 | 248.0 | 111.5 | | | 134.6 |
| 65.00 | | | 2 | 3.00 | 5.00 | RCB | 150 | 0.0100 | E | SAN PABLO | PR | | | | 164.2 | 98.3 | | | 118.7 |
| 66.00 | | | 2 | 4.00 | 5.00 | RCB | 150 | 0.0100 | | KAINS | PR | | 23.50 | 29.70 | 245.3 | 98.3 | | | 118.7 |
| 67.00 | | 205.0 | 2 | 4.00 | 5.00 | RCB | 40 | 0.0100 | E | KAINS | | | 23.70 | 29.50 | 245.3 | 98.3 | | | 118.7 |
| 68.00 | | 206.0 | 2 | 4.00 | 5.00 | RCB | 400 | 0.0134 | A | STANNAGE | PR | | | 38.50 | 283.9 | 95.5 | | | 115.3 |
| 69.00 | | | 2 | 4.00 | 5.00 | RCB | 250 | 0.0134 | A | CORNELL | PR | | 32.40 | 42.00 | 283.9 | 92.4 | | | 111.5 |
| 70.00 | | 207.0 | 2 | 4.00 | 5.00 | RCB | 30 | 0.0167 | | CORNELL | | | 32.90 | 42.40 | 316.9 | 92.4 | | | 111.5 |
| 71.00 | | 208.0 | 2 | 4.00 | 5.00 | RCB | 250 | 0.0196 | | TALBOT | PR | | 37.80 | 48.10 | 343.4 | 89.7 | | | 108.3 |
| 72.00 | | 209.0 | 3 | 4.00 | 5.00 | RCB | 300 | 0.0213 | | EVELYN | PR | | 44.20 | 52.40 | 357.9 | 87.5 | | | 105.7 |
| 73.00 | | | 3 | 4.00 | 5.00 | RCB | 40 | 0.0133 | A | EVELYN | | | | | 282.8 | 85.3 | | | 103.0 |
| 74.00 | | 210.0 | 3 | | | OPN | 100 | 0.0133 | A | EVELYN | PR | | | | | 85.3 | | | 103.0 |
| 75.00 | | | 3 | 15.00 | | RCP | 100 | 0.0200 | E | MASONIC | PR | | 49.60 | 56.20 | 9.1 | 6.9 | | | 8.3 |
| 76.00 | | | 3 | 15.00 | | RCP | 40 | 0.0250 | | MASONIC | | | 50.60 | 57.30 | 10.2 | 6.9 | | | 8.3 |
| 77.00 | | | 3 | 15.00 | | RCP | 100 | 0.0240 | | BART | | | 53.00 | 59.80 | 10.0 | 6.9 | | | 8.3 |
| 78.00 | | 211.0 E | 3 | 15.00 | | RCP | 30 | 0.0130 | | SAN GABRIEL | | | 53.40 | 59.80 | 7.4 | 6.9 | | | 8.3 |
| 79.00 | 210.0 | | 3 | | | OPN | 200 | 0.0133 | A | MASONIC | PR | | | | | 82.1 | | | 99.2 |

ABBREVIATIONS
- D/S DOWNSTREAM
- U/S UPSTREAM
- TY TYPE
- R/W RIGHT OF WAY

DRAIN TYPE
- BRDG BRIDGE
- CMP CORRUGATED METAL PIPE
- CMPA CORRUGATED METAL PIPE ARCH
- GUT STREET GUTTER
- OPN OPEN CHANNEL
- PVC PLASTIC
- RCB REINFORCED BOX
- RCP REINFORCED CONCRETE PIPE
- VC VITRIFIED CLAY

SLOPE TYPE
- A AVERAGE
- E ESTIMATED

RIGHT OF WAY TYPE
- PR PRIVATE
- blank PUBLIC

CAPACITY EXCEEDED
- . LESS THAN 10%
- * 10% TO 25%
- ** 25% TO 50%
- *** 50% TO 100%
- **** GREATER THAN 100%

| DRAIN NO. | D/S NODE | U/S NODE | | MAP NO. | HT / DIAM. (in OR ft) | WIDTH | TYPE | LENGTH (ft) | SLOPE | TY | STREET | R/W | D/S INVERT (ft) | U/S INVERT (ft) | U/S GROUND (ft) | CAPACITY (cfs) | 10-YR FLOW (cfs) | CAPACITY EXCEEDED | 10-YR HGL (ft) | 25-YR FLOW (cfs) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 80.00 | | 212.0 | | 3 | 4.00 | 5.00 | RCB | 100 | 0.0133 | A | MASONIC | PR | | | | 282.8 | 82.1 | | | 99.2 |
| 81.00 | | 213.0 | | 3 | 4.00 | 5.00 | RCB | 120 | 0.0133 | A | PORTLAND | | | 51.70 | 64.20 | 282.8 | 84.8 | | | 102.5 |
| 82.00 | | 214.0 | | 3 | 27.00 | | VC | 200 | 0.0110 | | PORTLAND | | 53.70 | 55.90 | 65.70 | 32.5 | 46.0 | ** | | 55.5 |
| 83.00 | | 215.0 | | 3 | 24.00 | | VC | 250 | 0.0120 | | PORTLAND | | | 58.90 | 70.60 | 24.8 | 42.2 | *** | | 51.0 |
| 84.00 | | | E | 3 | 18.00 | | PVC | 250 | 0.0100 | E | KEY ROUTE | | | 66.40 | 72.30 | 13.7 | | | | |
| 85.00 | 215.0 | 222.0 | | 3 | 24.00 | | VC | 100 | 0.0150 | | PORTLAND | | | | | 27.7 | 41.3 | ** | | 49.8 |
| 86.00 | | 223.0 | | 3 | | | GUT | 660 | 0.0070 | | KEY ROUTE | | | | | | 13.2 | | | 16.0 |
| 87.00 | | 224.0 | | 3 | | | GUT | 530 | 0.0260 | | THOUSAND OAKS | | | | | | 8.9 | | | 10.7 |
| 88.00 | | 225.0 | E | 3 | | | GUT | 500 | 0.0200 | | THOUSAND OAKS | | | | | | 6.2 | | | 7.5 |
| 89.00 | 222.0 | | | 3 | 24.00 | | VC | 280 | 0.0150 | | PORTLAND | | | 64.70 | 76.80 | 27.7 | 42.0 | *** | | 50.7 |
| 90.00 | | 216.0 | | 3 | 24.00 | | VC | 260 | 0.0170 | A | PORTLAND | | | | | 29.5 | 42.0 | ** | | 50.7 |
| 91.00 | | 228.0 | | 3 | 24.00 | | VC | 200 | 0.0170 | A | PORTLAND | | | | | 29.5 | 37.5 | ** | | 45.2 |
| 92.00 | | 217.0 | | 3 | 24.00 | | VC | 300 | 0.0170 | A | PORTLAND | | | 77.60 | 88.00 | 29.5 | 33.8 | . | | 40.9 |
| 93.00 | | 218.0 | | 3 | 18.00 | | VC | 520 | 0.0237 | | PORTLAND | | | 89.90 | 99.50 | 16.2 | 21.2 | ** | | 25.6 |
| 94.00 | | 219.0 | E | 3 | 16.00 | | PVC | 250 | 0.0412 | | PORTLAND | | | 100.20 | 106.80 | 20.3 | 21.5 | * | | 25.9 |
| 95.00 | 213.0 | | E | 3 | 12.00 | | RCP | 200 | 0.0100 | E | PORTLAND | | | | | 3.6 | | | | |
| 96.00 | 213.0 | | | 3 | 4.00 | 5.00 | RCB | 250 | 0.0220 | | SPOKANE | PR | | 57.20 | 65.80 | 363.8 | 41.1 | | | 49.6 |
| 97.00 | | 220.0 | | 3 | 4.00 | 5.00 | RCB | 40 | 0.0125 | | SPOKANE | | | 57.70 | 65.90 | 274.2 | 41.1 | | | 49.6 |
| 98.00 | | 221.0 | | 3 | 4.00 | 5.00 | RCB | 320 | 0.0180 | | KEY ROUTE | PR | | 63.50 | 72.10 | 329.0 | 39.8 | | | 48.1 |
| 99.00 | | | E | 3 | 14.00 | | VC | 300 | 0.0100 | E | KEY ROUTE | | | 67.60 | 71.60 | 5.4 | | | | |
| 100.00 | 221.0 | 226.0 | | 3 | 4.00 | 5.00 | RCB | 290 | 0.0228 | | POMONA | PR | | 70.10 | 76.90 | 370.3 | 34.4 | | | 41.5 |
| 101.00 | | 227.0 | E | 3 | 18.00 | | VC | 300 | 0.0100 | E | POMONA | | | 72.80 | 76.20 | 10.5 | 8.2 | | | 9.9 |
| 102.00 | 226.0 | | E | 3 | 14.00 | | VC | 300 | 0.0100 | E | POMONA | | | | | 5.4 | | | | |
| 103.00 | 226.0 | 229.0 | | 3 | 4.00 | 5.00 | RCB | 250 | 0.0260 | A | RAMONA | PR | | | | 395.5 | 37.7 | | | 45.5 |
| 104.00 | | | | 3 | 4.00 | 5.00 | RCB | 50 | 0.0260 | A | RAMONA | | | 77.90 | 83.40 | 395.5 | 35.7 | | | 43.2 |
| 105.00 | | | | 6 | 4.00 | 5.00 | RCB | 350 | 0.0150 | | CARMEL | PR | | 83.30 | 89.00 | 300.4 | 35.7 | | | 43.2 |
| 106.00 | | 230.0 | | 6 | 4.00 | 5.00 | RCB | 30 | 0.0233 | | CARMEL | | | 84.00 | 89.70 | 374.4 | 35.7 | | | 43.2 |
| 107.00 | | 231.0 | | 6 | 4.00 | 5.00 | RCB | 150 | 0.0193 | | WASHINGTON | PR | | 86.90 | 92.30 | 340.7 | 29.5 | | | 35.6 |
| 108.00 | | | | 6 | 4.00 | 5.00 | RCB | 100 | 0.0220 | | SAN CARLOS | | | 89.10 | 95.40 | 363.8 | 27.2 | | | 32.9 |

ABBREVIATIONS
- D/S DOWNSTREAM
- U/S UPSTREAM
- TY TYPE
- R/W RIGHT OF WAY

DRAIN TYPE
- BRDG BRIDGE
- CMP CORRUGATED METAL PIPE
- CMPA CORRUGATED METAL PIPE ARCH
- GUT STREET GUTTER
- OPN OPEN CHANNEL
- PVC PLASTIC
- RCB REINFORCED BOX
- RCP REINFORCED CONCRETE PIPE
- VC VITRIFIED CLAY

SLOPE TYPE
- A AVERAGE
- E ESTIMATED

RIGHT OF WAY TYPE
- PR PRIVATE
- blank PUBLIC

CAPACITY EXCEEDED
- . LESS THAN 10%
- * 10% TO 25%
- ** 25% TO 50%
- *** 50% TO 100%
- **** GREATER THAN 100%

| DRAIN NO. | D/S NODE | U/S NODE | MAP NO. | HT / DIAM. (in OR ft) | WIDTH | TYPE | LENGTH (ft) | SLOPE | TY | STREET | R/W | D/S INVERT (ft) | U/S INVERT (ft) | U/S GROUND (ft) | CAPACITY (cfs) | 10-YR FLOW (cfs) | CAPACITY EXCEEDED | 10-YR HGL (ft) | 25-YR FLOW (cfs) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 109.00 | | 232.0 | 6 | 4.00 | 5.00 | RCB | 40 | 0.0275 | | SAN CARLOS | | | 90.20 | 96.00 | 406.7 | 27.2 | | | 32.9 |
| 110.00 | | 233.0 | 6 | 4.00 | 5.00 | RCB | 280 | 0.0217 | A | SANTA FE | PR | | | | 361.3 | 22.7 | | | 27.4 |
| 111.00 | | E | 6 | 12.00 | | RCP | 150 | 0.0200 | E | SANTA FE | | | | | 5.0 | | | | |
| 112.00 | 233.0 | | 6 | 27.00 | | RCP | 240 | 0.0217 | A | CURTIS | PR | | 101.50 | 111.80 | 45.6 | 17.3 | | | 20.9 |
| 113.00 | | 234.0 | 6 | 4.00 | 5.00 | RCB | 30 | 0.0270 | | CURTIS | PR | | 102.30 | 112.00 | 403.0 | 17.3 | | | 20.9 |
| 114.00 | | E | 6 | 10.00 | | VC | 150 | 0.0200 | E | CURTIS | | | | | 3.1 | | | | |
| 115.00 | 234.0 | | 6 | 3.00 | 4.50 | RCB | 100 | 0.0313 | | NEILSON | PR | | 109.50 | 117.70 | 254.5 | 11.7 | | | 14.2 |
| 116.00 | | 235.0 E | 6 | | | OPN | 100 | 0.0200 | E | NEILSON | | | | | | 11.7 | | | 14.2 |
| 117.00 | 229.0 | 236.0 E | 6 | 12.00 | | VC | 312 | 0.0120 | E | RAMONA | | | 80.60 | 85.00 | 3.9 | 5.0 | ** | | 6.1 |
| 118.00 | 212.0 | 237.0 | 3 | 10.00 | | VC | 112 | 0.0100 | E | MASONIC | | | 58.40 | 61.70 | 2.2 | 8.4 | **** | | 10.1 |
| 119.00 | | 238.0 | 6 | 12.00 | | VC | 620 | 0.0058 | | MASONIC | | | 62.00 | 65.00 | 2.7 | 7.4 | **** | | 8.9 |
| 120.00 | | 239.0 E | 6 | | | GUT | 800 | 0.0050 | | MASONIC | | | | | | 5.5 | | | 6.6 |
| 121.00 | 204.0 | 240.0 | 2 | | | GUT | 1000 | 0.0169 | | SAN PABLO | | | | | | 15.0 | | | 18.1 |
| 122.00 | | 241.0 | 2 | | | GUT | 500 | 0.0065 | | PORTLAND | | | | | | 11.5 | | | 13.8 |
| 123.00 | | 242.0 E | 2 | | | GUT | 500 | 0.0132 | | PORTLAND | | | | | | 6.4 | | | 7.7 |
| 124.00 | 203.0 | | 2 | 12.00 | | RCP | 40 | 0.0150 | E | SAN PABLO | | | | | 4.4 | 13.6 | **** | | 16.4 |
| 125.00 | | 243.0 | 2 | | | GUT | 700 | 0.0157 | | SAN PABLO | | | | | | 13.6 | | | 16.4 |
| 126.00 | | 244.0 E | 5 | | | GUT | 1170 | 0.0166 | | SAN PABLO / WASH | | | | | | 8.8 | | | 10.6 |
| 127.00 | 202.0 | 245.0 E | 2 | 12.00 | | VC | 350 | 0.0200 | E | CLAY | | | | | 5.0 | 5.8 | . | | 7.0 |
| 128.00 | 201.1 | 246.0 | 2 | | | OPN | 400 | 0.1160 | | MADISON | | | 61.10 | 62.50 | | 8.7 | | | 10.5 |
| 129.00 | | | 2 | 10.00 | 17.00 | CMPA | 300 | 0.0092 | A | MADISON | | | | | 2.9 | 6.9 | **** | | 8.3 |
| 130.00 | | | 2 | 15.00 | | VC | 470 | 0.0092 | A | MADISON | | | 68.20 | 72.10 | 6.2 | 6.9 | . | | 8.3 |
| 131.00 | | 247.0 | 2 | 12.00 | | VC | 220 | 0.2640 | | HILLSIDE | | | 126.30 | 129.50 | 18.3 | 6.9 | | | 8.3 |
| 132.00 | | | 2 | 12.00 | | RCP | 30 | 0.0600 | | HILLSIDE | | | 128.10 | 130.00 | 8.7 | 2.5 | | | 3.0 |
| 133.00 | | 248.0 | 2 | 12.00 | | RCP | 200 | 0.0380 | E | HILLSIDE | | | | | 7.0 | 2.5 | | | 3.0 |
| 134.00 | | 249.0 E | 2 | 12.00 | | RCP | 190 | 0.0700 | E | HILLSIDE | | | | | 9.4 | 1.9 | | | 2.3 |
| 135.00 | 248.0 | 250.0 E | 2 | 10.00 | | RCP | 240 | 0.5400 | E | TAFT | | | | | 16.1 | 0.6 | | | 0.7 |
| 136.00 | 247.0 | 251.0 E | 5 | | | GUT | 790 | 0.0485 | | HILLSIDE | | | | | | 2.6 | | | 3.2 |

| ABBREVIATIONS | | DRAIN TYPE | | | | SLOPE TYPE | | RIGHT OF WAY TYPE | | CAPACITY EXCEEDED | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| D/S | DOWNSTREAM | BRDG | BRIDGE | PVC | PLASTIC | A | AVERAGE | PR | PRIVATE | . | LESS THAN 10% |
| U/S | UPSTREAM | CMP | CORRUGATED METAL PIPE | RCB | REINFORCED BOX | E | ESTIMATED | blank | PUBLIC | * | 10% TO 25% |
| TY | TYPE | CMPA | CORRUGATED METAL PIPE ARCH | RCP | REINFORCED CONCRETE PIPE | | | | | ** | 25% TO 50% |
| R/W | RIGHT OF WAY | GUT | STREET GUTTER | VC | VITRIFIED CLAY | | | | | *** | 50% TO 100% |
| | | OPN | OPEN CHANNEL | | | | | | | **** | GREATER THAN 100% |

| DRAIN NO. | D/S NODE | U/S NODE | MAP NO. | HT / DIAM. (in OR ft) | WIDTH | TYPE | LENGTH (ft) | SLOPE | TY | STREET | R/W | D/S INVERT (ft) | U/S INVERT (ft) | U/S GROUND (ft) | CAPACITY (cfs) | 10-YR FLOW (cfs) | CAPACITY EXCEEDED | 10-YR HGL (ft) | 25-YR FLOW (cfs) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MARIN CREEK | | | | | | | | | | | | | | | | | | | |
| 137.00 | 301.0 | | 4 | 78.00 | | RCP | 520 | 0.0030 | A | I-80 | | -0.10 | | 10.00 | 287.2 | 552.7 | *** | | 667.5 |
| 138.00 | | | 4 | 67.00 | 90.00 | RCB | 200 | 0.0030 | A | | | | | | 358.7 | 552.7 | *** | | 667.5 |
| 139.00 | | | 4 | 81.00 | | RCP | 180 | 0.0030 | A | | | | | | 317.6 | 552.7 | *** | | 667.5 |
| 140.00 | | | 4 | 5.50 | 8.50 | RCB | 75 | 0.0030 | A | | | | | | 11.3 | 552.7 | **** | | 667.5 |
| 141.00 | | 301.2 | 4 | 5.50 | 6.00 | RCB | 75 | 0.0030 | A | | | | | | 262.8 | 552.7 | **** | | 667.5 |
| 142.00 | | | 4 | 18.00 | | RCP | 270 | 0.0150 | E | CLEVELAND | | | | | 12.9 | 6.4 | | | 7.7 |
| 143.00 | | 303.0 E | 4 | | | GUT | 370 | 0.0076 | E | CLEVELAND | | | | | | 6.4 | | | 7.7 |
| 144.00 | 301.2 | 304.0 | 9 | 78.00 | | RCP | 240 | 0.0030 | A | USDA | | | | 13.00 | 287.2 | 553.4 | *** | | 668.3 |
| 145.00 | | 305.0 | 9 | 78.00 | | RCP | 360 | 0.0030 | A | USDA | | | 4.90 | 17.70 | 287.2 | 556.5 | *** | | 672.0 |
| 146.00 | | | 9 | 84.00 | | RCP | 280 | 0.0064 | | USDA | | | 6.70 | 20.00 | 511.1 | 563.1 | . | | 679.9 |
| 147.00 | | 306.0 | 9 | 84.00 | | RCP | 300 | 0.0094 | A | PARK | | | | 20.00 | 619.4 | 563.1 | | 20.0 | 679.9 |
| 148.00 | | 307.0 | 5 | 18.00 | | RCP | 200 | 0.0200 | E | BUCHANAN | | | | | 14.9 | 22.1 | ** | | 26.7 |
| 149.00 | | 308.0 | 5 | | | GUT | 960 | 0.0390 | E | CERRITO | | | | | | 8.7 | | | 10.5 |
| 150.00 | | 309.0 E | 5 | | | GUT | 670 | 0.0560 | E | CERRITO | | | | | | 5.3 | | | 6.3 |
| 151.00 | 307.0 | 310.0 E | 5 | 15.00 | | VC | 300 | 0.0150 | E | BUCHANAN | | | | | 7.9 | 3.6 | | | 4.4 |
| 152.00 | 306.0 | 311.0 | 9 | 84.00 | | RCP | 200 | 0.0094 | A | MIDDLE SCHOOL | | | | 23.00 | 619.4 | 548.7 | | 22.0 | 662.5 |
| 153.00 | | 312.0 | 9 | 84.00 | | RCP | 350 | 0.0094 | A | MIDDLE SCHOOL | | | | 28.40 | 619.4 | 550.3 | | 25.2 | 664.5 |
| 154.00 | | | 5 | 30.00 | | RCP | 80 | 0.0038 | | JACKSON | | 21.80 | 22.10 | 28.80 | 25.3 | 25.0 | | | 30.2 |
| 155.00 | | 313.0 | 5 | 30.00 | | RCP | 120 | 0.0083 | | JACKSON | | | 23.10 | 29.90 | 37.4 | 25.0 | | | 30.2 |
| 156.00 | | 314.0 | 5 | 27.00 | | RCP | 240 | 0.0120 | E | BUCHANAN | | | | 34.20 | 33.9 | 20.9 | | | 25.3 |
| 157.00 | | 315.0 | 5 | 18.00 | | RCP | 830 | 0.0100 | E | MADISON | | | 34.30 | 38.90 | 10.5 | 13.7 | ** | | 16.5 |
| 158.00 | | 316.0 E | 5 | 12.00 | | VC | 240 | 0.0133 | | SOLANO | | | 37.50 | 40.80 | 4.1 | 5.1 | . | | 6.2 |
| 159.00 | 312.0 | | 9 | 84.00 | | RCP | 260 | 0.0065 | | JACKSON | | | 16.40 | 27.60 | 515.0 | 538.3 | * | | 650.0 |
| 160.00 | | 317.0 | 9 | 75.00 | | RCP | 830 | 0.0120 | | GILL TRACT | | | 26.40 | 40.80 | 517.3 | 538.3 | * | 39.3 | 650.0 |
| 161.00 | | | 9 | 27.00 | | RCP | 60 | 0.0040 | E | SAN PABLO | | | 28.20 | 40.00 | 19.6 | 22.3 | . | | 26.9 |
| 162.00 | | | 5 | 24.00 | | RCP | 360 | 0.0042 | | SAN PABLO | | | 29.70 | 40.70 | 14.7 | 22.3 | *** | | 26.9 |
| 163.00 | | 318.0 | 5 | 24.00 | | RCP | 980 | 0.0044 | | SAN PABLO | | | 34.00 | 44.30 | 15.0 | 22.3 | ** | | 26.9 |

ABBREVIATIONS
- D/S DOWNSTREAM
- U/S UPSTREAM
- TY TYPE
- R/W RIGHT OF WAY

DRAIN TYPE
- BRDG BRIDGE
- CMP CORRUGATED METAL PIPE
- CMPA CORRUGATED METAL PIPE ARCH
- GUT STREET GUTTER
- OPN OPEN CHANNEL
- PVC PLASTIC
- RCB REINFORCED BOX
- RCP REINFORCED CONCRETE PIPE
- VC VITRIFIED CLAY

SLOPE TYPE
- A AVERAGE
- E ESTIMATED

RIGHT OF WAY TYPE
- PR PRIVATE
- blank PUBLIC

CAPACITY EXCEEDED
- . LESS THAN 10%
- * 10% TO 25%
- ** 25% TO 50%
- *** 50% TO 100%
- **** GREATER THAN 100%

| DRAIN NO. | D/S NODE | U/S NODE | MAP NO. | HT / DIAM. (in OR ft) | WIDTH | TYPE | LENGTH (ft) | SLOPE | TY | STREET | R/W | D/S INVERT (ft) | U/S INVERT (ft) | U/S GROUND (ft) | CAPACITY (cfs) | 10-YR FLOW (cfs) | CAPACITY EXCEEDED | 10-YR HGL (ft) | 25-YR FLOW (cfs) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 164.00 | | | 5 | 18.00 | | VC | 530 | 0.0043 | | SAN PABLO | | | 36.30 | 45.40 | 6.9 | 11.5 | *** | | 13.9 |
| 165.00 | | 319.0 | 5 | 12.00 | | CMP | 270 | 0.0300 | E | WASHINGTON | | | | | 3.3 | 11.5 | **** | | 13.9 |
| 166.00 | | 320.0 E | 6 | | | GUT | 730 | 0.0100 | E | WASHINGTON | | | | | | 8.2 | | | 9.9 |
| 167.00 | 318.0 | 321.0 | 5 | 18.00 | | VC | 20 | 0.0300 | E | SOLANO | | | 39.70 | 44.00 | 18.2 | 9.8 | | | 11.9 |
| 168.00 | | 322.0 E | 6 | | | GUT | 760 | 0.0130 | E | SOLANO | | | | | | 5.7 | | | 6.8 |
| 169.00 | 317.0 | | 9 | 69.00 | | RCP | 30 | 0.0230 | | MARIN | | | 27.10 | 40.50 | 573.4 | 580.2 | * | | 700.6 |
| 170.00 | | 323.0 | 9 | 69.00 | | RCP | 230 | 0.0170 | | MARIN | | | 31.10 | 43.60 | 492.9 | 580.2 | . | | 700.6 |
| 171.00 | | 324.0 | 10 | 69.00 | | RCP | 250 | 0.0144 | A | MARIN | | | | 47.30 | 453.7 | 572.4 | ** | | 691.3 |
| 172.00 | | 325.0 | 10 | 75.00 | | RCP | 250 | 0.0144 | A | MARIN | | | 38.30 | 49.80 | 566.7 | 572.8 | * | | 691.7 |
| 173.00 | | | 6 | 75.00 | | RCP | 250 | 0.0148 | | MARIN | | | 42.00 | 53.80 | 574.5 | 568.6 | | | 686.6 |
| 174.00 | | 326.0 | 6 | 69.00 | | RCP | 220 | 0.0200 | | MARIN | | | 46.40 | 58.20 | 534.7 | 568.6 | * | | 686.6 |
| 175.00 | | 327.0 | 6 | 69.00 | | RCP | 250 | 0.0180 | | MARIN | | | 50.90 | 62.10 | 507.2 | 566.2 | . | | 683.7 |
| 176.00 | | 327.5 | 6 | 66.00 | | RCP | 180 | 0.0233 | | MARIN | | | 55.10 | 66.80 | 512.6 | 565.5 | . | | 682.8 |
| 177.00 | | | 6 | 60.00 | | RCP | 300 | 0.0260 | | MARIN | | | 62.90 | 74.50 | 420.0 | 561.3 | ** | | 677.8 |
| 178.00 | | 328.0 | 6 | 66.00 | | RCP | 320 | 0.0184 | | MARIN | | | 68.80 | 80.60 | 455.5 | 561.3 | . | | 677.8 |
| 179.00 | | | 6 | 66.00 | | RCP | 280 | 0.0171 | | MARIN | | | 73.60 | 84.30 | 439.1 | 559.9 | ** | | 676.1 |
| 180.00 | | 329.0 | 6 | 69.00 | | RCP | 290 | 0.0155 | | MARIN | | | 78.10 | 88.30 | 470.7 | 559.9 | . | | 676.1 |
| 181.00 | | 330.0 | 6 | 60.00 | | RCP | 430 | 0.0205 | | MARIN | | | 86.90 | 97.30 | 372.9 | 558.3 | ** | | 674.2 |
| 182.00 | | 331.0 | 6 | 60.00 | | RCP | 310 | 0.0265 | | MARIN | | | 95.10 | 105.40 | 424.0 | 555.3 | ** | | 670.6 |
| 183.00 | | 332.0 | 7 | 57.00 | | RCP | 200 | 0.0335 | | MARIN | | | 101.80 | 111.20 | 415.8 | 551.2 | ** | | 665.6 |
| 184.00 | | | 7 | 42.00 | | RCP | 100 | 0.0485 | A | PERALTA | | | | | 221.6 | 220.9 | | | 266.8 |
| 185.00 | | | 7 | 39.00 | | RCP | 300 | 0.0485 | A | PERALTA | | | 121.20 | 129.60 | 181.8 | 220.9 | . | | 266.8 |
| 186.00 | | 333.0 E | 7 | 57.00 | | RCP | 380 | 0.0066 | | PERALTA | | | 123.70 | 130.80 | 184.5 | 220.9 | . | | 266.8 |
| 187.00 | 332.0 | 334.0 | 7 | 48.00 | | RCP | 420 | 0.0335 | | MARIN | | | 115.90 | 125.30 | 262.9 | 337.3 | ** | | 407.3 |
| 188.00 | | 335.0 | 7 | 45.00 | | RCP | 140 | 0.0350 | | MARIN | | | 120.80 | 130.00 | 226.2 | 328.8 | ** | | 397.1 |
| 189.00 | | 336.0 | 7 | 48.00 | | RCP | 260 | 0.0327 | | MARIN | | | 129.30 | 138.60 | 259.8 | 329.1 | ** | | 397.4 |
| 190.00 | | 337.0 E | 7 | 42.00 | | RCP | 260 | 0.0438 | | MARIN | | | 140.70 | 147.90 | 210.6 | 324.0 | *** | | 391.2 |

VILLAGE CREEK

| ABBREVIATIONS | | DRAIN TYPE | | | | SLOPE TYPE | | RIGHT OF WAY TYPE | | CAPACITY EXCEEDED | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| D/S | DOWNSTREAM | BRDG | BRIDGE | PVC | PLASTIC | A | AVERAGE | PR | PRIVATE | . | LESS THAN 10% |
| U/S | UPSTREAM | CMP | CORRUGATED METAL PIPE | RCB | REINFORCED BOX | E | ESTIMATED | blank | PUBLIC | * | 10% TO 25% |
| TY | TYPE | CMPA | CORRUGATED METAL PIPE ARCH | RCP | REINFORCED CONCRETE PIPE | | | | | ** | 25% TO 50% |
| R/W | RIGHT OF WAY | GUT | STREET GUTTER | VC | VITRIFIED CLAY | | | | | *** | 50% TO 100% |
| | | OPN | OPEN CHANNEL | | | | | | | **** | GREATER THAN 100% |

| DRAIN NO. | D/S NODE | U/S NODE | MAP NO. | HT / DIAM. (in OR ft) | WIDTH | TYPE | LENGTH (ft) | SLOPE | TY | STREET | R/W | D/S INVERT (ft) | U/S INVERT (ft) | U/S GROUND (ft) | CAPACITY (cfs) | 10-YR FLOW (cfs) | CAPACITY EXCEEDED | 10-YR HGL (ft) | 25-YR FLOW (cfs) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 191.00 | 401.0 | | 8 | 60.00 | | RCP | 500 | 0.0100 | E | | | | | | 260.4 | 100.5 | | | 121.3 |
| 192.00 | | | 9 | | | OPN | 350 | 0.0100 | E | | | | | | | 100.5 | | | 121.3 |
| 193.00 | | 403.0 | 9 | | | BRDG | 80 | 0.0100 | E | UP RR | | | | | | 100.5 | | | 121.3 |
| 194.00 | | | 9 | | | OPN | 650 | 0.0100 | E | UC VILLAGE | | | | | | 97.7 | | | 118.0 |
| 195.00 | | 404.0 | 9 | 42.00 | | RCP | 660 | 0.0100 | E | UC VILLAGE | | | | | 100.6 | 97.7 | | | 118.0 |
| 196.00 | | | 9 | 24.00 | | RCP | 40 | 0.0100 | E | UC VILLAGE | | | | | 22.6 | 77.2 | **** | | 93.3 |
| 197.00 | | | 9 | 28.00 | | RCP | 300 | 0.0100 | E | UC VILLAGE | | | | | 34.1 | 77.2 | **** | | 93.3 |
| 198.00 | | | 9 | 24.00 | 24.00 | RCB | 45 | 0.0100 | E | | | | | | 28.8 | 77.2 | **** | | 93.3 |
| 199.00 | | | 9 | 30.00 | | RCP | 410 | 0.0100 | E | | | | | | 41.0 | 77.2 | *** | | 93.3 |
| 200.00 | | 405.0 | 9 | 48.00 | 60.00 | CMPA | 45 | 0.0100 | E | JACKSON | | | | | 132.8 | 77.2 | | | 93.3 |
| 201.00 | | | 9 | | | OPN | 730 | 0.0100 | E | SAN PABLO | | | 33.30 | 39.20 | | 77.4 | | | 93.5 |
| 202.00 | | 406.0 | 9 | 2.50 | 4.00 | RCB | 70 | 0.0214 | | SAN PABLO | | | 34.80 | 39.90 | 140.4 | 77.4 | | | 93.5 |
| 203.00 | | | 9 | 24.00 | 24.00 | RCB | 230 | 0.0200 | | KAINS | PR | | 39.40 | 43.30 | 40.7 | 74.2 | *** | | 89.6 |
| 204.00 | | 407.0 | 9 | 24.00 | 24.00 | RCB | 30 | 0.0100 | | KAINS | | | 39.70 | 43.50 | 28.8 | 74.2 | **** | | 89.6 |
| 205.00 | | | 10 | 24.00 | 24.00 | RCB | 230 | 0.0117 | | STANNAGE | PR | | 42.40 | 46.50 | 31.2 | 71.9 | **** | | 86.9 |
| 206.00 | | 408.0 | 10 | 24.00 | 24.00 | RCB | 30 | 0.0233 | | STANNAGE | | | 43.10 | 46.90 | 44.0 | 71.9 | *** | | 86.9 |
| 207.00 | | | 10 | 24.00 | 24.00 | RCB | 220 | 0.0080 | A | CORNELL | PR | | 47.40 | 49.80 | 25.8 | 69.8 | **** | | 84.3 |
| 208.00 | | 409.0 | 10 | 24.00 | 24.00 | RCB | 30 | 0.0080 | A | CORNELL | | | 45.10 | 49.70 | 25.8 | 69.8 | **** | | 84.3 |
| 209.00 | | | 10 | 24.00 | 24.00 | RCB | 220 | 0.0123 | | TALBOT | PR | | 47.80 | 51.40 | 31.9 | 67.2 | **** | | 81.2 |
| 210.00 | | 410.0 | 10 | 24.00 | 24.00 | RCB | 30 | 0.0124 | A | TALBOT | | | 50.30 | 52.30 | 32.1 | 67.2 | **** | | 81.2 |
| 211.00 | | | 10 | 24.00 | 26.00 | RCB | 220 | 0.0124 | A | EVELYN | PR | | 50.90 | 55.90 | 35.7 | 62.9 | *** | | 75.9 |
| 212.00 | | 411.0 | 10 | 24.00 | 26.00 | RCB | 30 | 0.0300 | | EVELYN | | | 51.80 | 56.10 | 55.5 | 62.9 | . | | 75.9 |
| 213.00 | | | 10 | 24.00 | 26.00 | RCB | 220 | 0.0168 | | MASONIC | PR | | 55.50 | 59.50 | 41.5 | 58.3 | ** | | 70.4 |
| 214.00 | | 412.0 | 10 | 24.00 | 26.00 | RCB | 40 | 0.0100 | | MASONIC | | | 55.90 | 60.30 | 32.0 | 58.3 | *** | | 70.4 |
| 215.00 | | | 10 | 24.00 | 26.00 | RCB | 50 | 0.0100 | A | BART | | | | | 32.0 | 55.6 | *** | | 67.2 |
| 216.00 | | 413.0 | 10 | 24.00 | | RCP | 100 | 0.0100 | A | KEY ROUTE | PR | | 57.40 | 64.20 | 22.6 | 55.6 | **** | | 67.2 |
| 217.00 | | 414.0 | 10 | 21.00 | | RCP | 410 | 0.0051 | | KEY ROUTE | | | 59.50 | 63.60 | 11.3 | 51.0 | **** | | 61.6 |
| 218.00 | | 415.0 E | 10 | 12.00 | | RCP | 300 | 0.0140 | | KEY ROUTE | | | 63.70 | 66.70 | 4.2 | 5.2 | . | | 6.2 |

ABBREVIATIONS
- D/S DOWNSTREAM
- U/S UPSTREAM
- TY TYPE
- R/W RIGHT OF WAY

DRAIN TYPE
- BRDG BRIDGE
- CMP CORRUGATED METAL PIPE
- CMPA CORRUGATED METAL PIPE ARCH
- GUT STREET GUTTER
- OPN OPEN CHANNEL
- PVC PLASTIC
- RCB REINFORCED BOX
- RCP REINFORCED CONCRETE PIPE
- VC VITRIFIED CLAY

SLOPE TYPE
- A AVERAGE
- E ESTIMATED

RIGHT OF WAY TYPE
- PR PRIVATE
- blank PUBLIC

CAPACITY EXCEEDED
- . LESS THAN 10%
- * 10% TO 25%
- ** 25% TO 50%
- *** 50% TO 100%
- **** GREATER THAN 100%

| DRAIN NO. | D/S NODE | U/S NODE | MAP NO. | HT / DIAM. (in OR ft) | WIDTH | TYPE | LENGTH (ft) | SLOPE | TY | STREET | R/W | D/S INVERT (ft) | U/S INVERT (ft) | U/S GROUND (ft) | CAPACITY (cfs) | 10-YR FLOW (cfs) | CAPACITY EXCEEDED | 10-YR HGL (ft) | 25-YR FLOW (cfs) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 219.00 | 414.0 | | 10 | 18.00 | | VC | 30 | 0.0100 | E | KEY ROUTE | | | 59.50 | 63.50 | 10.5 | 48.5 | **** | | 58.6 |
| 220.00 | | 416.0 | 10 | 18.00 | | VC | 270 | 0.0104 | | POMONA | PR | | 62.30 | 67.80 | 10.7 | 48.5 | **** | | 58.6 |
| 221.00 | | 417.0 | 10 | 14.00 | | VC | 330 | 0.0085 | | SANTA FE | PR | | 65.20 | 72.50 | 5.0 | 43.5 | **** | | 52.5 |
| 222.00 | | | 10 | 14.00 | | VC | 80 | 0.0225 | | SANTA FE | | | 66.90 | 73.40 | 8.1 | 37.9 | **** | | 45.8 |
| 223.00 | | | 10 | 14.00 | | VC | 130 | 0.0280 | A | SANTA FE | PR | | | | 9.0 | 37.9 | **** | | 45.8 |
| 224.00 | | | 10 | 14.00 | | VC | 50 | 0.0280 | A | SANTA FE | PR | | | | 9.0 | 37.9 | **** | | 45.8 |
| 225.00 | | | 10 | 14.00 | | VC | 140 | 0.0280 | A | CURTIS | PR | | 75.90 | 82.80 | 9.0 | 37.9 | **** | | 45.8 |
| 226.00 | | 418.0 | 10 | 14.00 | | VC | 30 | 0.0300 | | CURTIS | | | 76.80 | 83.10 | 9.3 | 37.9 | **** | | 45.8 |
| 227.00 | | | 10 | 10.00 | | PVC | 270 | 0.0340 | | NEILSON | PR | | 86.00 | 89.30 | 5.3 | 33.7 | **** | | 40.7 |
| 228.00 | | 419.0 | 10 | 14.00 | | VC | 30 | 0.0570 | | NEILSON | | | 87.70 | 90.30 | 12.8 | 33.7 | **** | | 40.7 |
| 229.00 | | | 10 | 14.00 | | VC | 250 | 0.0228 | | ALBANY | | | 93.40 | 103.40 | 8.1 | 28.4 | **** | | 34.4 |
| 230.00 | | | 10 | 14.00 | | VC | 100 | 0.0200 | | TEVLIN | | | 95.40 | 102.00 | 7.6 | 28.4 | **** | | 34.4 |
| 231.00 | | | 10 | 14.00 | | VC | 90 | 0.0200 | | TEVLIN | | | 97.20 | 103.80 | 7.6 | 28.4 | **** | | 34.4 |
| 232.00 | | | 11 | 18.00 | | VC | 140 | 0.0307 | | PERALTA | PR | 98.70 | 103.00 | 109.20 | 18.4 | 28.4 | *** | | 34.4 |
| 233.00 | | 420.0 | 11 | 18.00 | | VC | 40 | 0.0500 | | PERALTA | | | 105.00 | 110.20 | 23.5 | 28.4 | . | | 34.4 |
| 234.00 | | | 11 | 18.00 | | VC | 250 | 0.0768 | | ORDWAY | PR | | 124.20 | 130.20 | 29.1 | 12.0 | | | 14.5 |
| 235.00 | | 421.0 | 11 | 18.00 | | VC | 40 | 0.0500 | | ORDWAY | | | 126.20 | 131.10 | 23.5 | 12.0 | | | 14.5 |
| 236.00 | | | 11 | 18.00 | | VC | 230 | 0.0861 | | VENTURA | PR | | 146.00 | 151.90 | 30.8 | 7.7 | | | 9.4 |
| 237.00 | | 422.0 E | 11 | 18.00 | | VC | 20 | 0.0550 | | VENTURA | | | 147.10 | 153.40 | 24.6 | 7.7 | | | 9.4 |
| 238.00 | 403.0 | 423.0 E | 4 | | | OPN | 2000 | 0.0020 | E | UPRR | | | | | | 5.0 | | | 6.0 |

CODORNICES CREEK

| DRAIN NO. | D/S NODE | U/S NODE | MAP NO. | HT / DIAM. (in OR ft) | WIDTH | TYPE | LENGTH (ft) | SLOPE | TY | STREET | R/W | D/S INVERT (ft) | U/S INVERT (ft) | U/S GROUND (ft) | CAPACITY (cfs) | 10-YR FLOW (cfs) | CAPACITY EXCEEDED | 10-YR HGL (ft) | 25-YR FLOW (cfs) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 239.00 | 501.0 | | 8 | | | OPN | 800 | 0.0030 | E | | | | | | | 379.2 | | | 457.9 |
| 240.00 | | 502.0 | 8 | 6.00 | 6.00 | RCB | 330 | 0.0030 | E | I-80 | | | | | 295.4 | 379.2 | ** | | 457.9 |
| 241.00 | | | 9 | | | OPN | 540 | 0.0030 | E | | | | | | | 389.4 | | | 470.2 |
| 242.00 | | 503.0 | 9 | | | BRDG | 70 | 0.0030 | E | | | | | | | 389.4 | | | 470.2 |
| 243.00 | | | 9 | | | OPN | 580 | 0.0050 | E | | | | | | | 416.7 | | | 503.2 |
| 244.00 | | | 9 | 72.00 | | CMP | 25 | 0.0050 | E | 5TH | | | | | 162.2 | 416.7 | **** | | 503.2 |

ABBREVIATIONS
- D/S DOWNSTREAM
- U/S UPSTREAM
- TY TYPE
- R/W RIGHT OF WAY

DRAIN TYPE
- BRDG BRIDGE
- CMP CORRUGATED METAL PIPE
- CMPA CORRUGATED METAL PIPE ARCH
- GUT STREET GUTTER
- OPN OPEN CHANNEL
- PVC PLASTIC
- RCB REINFORCED BOX
- RCP REINFORCED CONCRETE PIPE
- VC VITRIFIED CLAY

SLOPE TYPE
- A AVERAGE
- E ESTIMATED

RIGHT OF WAY TYPE
- PR PRIVATE
- blank PUBLIC

CAPACITY EXCEEDED
- . LESS THAN 10%
- * 10% TO 25%
- ** 25% TO 50%
- *** 50% TO 100%
- **** GREATER THAN 100%

| DRAIN NO. | D/S NODE | U/S NODE | MAP NO. | HT / DIAM. (in OR ft) | WIDTH | TYPE | LENGTH (ft) | SLOPE | TY | STREET | R/W | D/S INVERT (ft) | U/S INVERT (ft) | U/S GROUND (ft) | CAPACITY (cfs) | 10-YR FLOW (cfs) | CAPACITY EXCEEDED | 10-YR HGL (ft) | 25-YR FLOW (cfs) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 245.00 | | | 9 | 72.00 | | RCP | 25 | 0.0050 | E | 5TH | | | | | 299.5 | 416.7 | ** | | 503.2 |
| 246.00 | | | 9 | | | OPN | 300 | 0.0100 | E | | | | | | | 416.7 | | | 503.2 |
| 247.00 | | | 9 | 5.00 | 8.00 | RCB | 75 | 0.0100 | E | 6TH | | | | | 609.3 | 416.7 | | | 503.2 |
| 248.00 | | | 9 | | | OPN | 580 | 0.0100 | E | | | | | | | 416.7 | | | 503.2 |
| 249.00 | | 504.0 | 9 | 5.00 | 8.00 | RCB | 80 | 0.0100 | E | 8TH | | | | | 609.3 | 416.7 | | | 503.2 |
| 250.00 | | | 9 | | | OPN | 580 | 0.0100 | E | | | | | | | 430.4 | | | 519.7 |
| 251.00 | | | 9 | 5.00 | 8.00 | RCB | 150 | 0.0100 | E | 10TH | | | | | 609.3 | 430.4 | | | 519.7 |
| 252.00 | | | 9 | | | OPN | 260 | 0.0100 | E | | | | | | | 430.4 | | | 519.7 |
| 253.00 | | 505.0 | 9 | 5.00 | 8.00 | RCB | 100 | 0.0100 | E | SAN PABLO | | | | | 609.3 | 430.4 | | | 519.7 |
| 254.00 | | 506.0 | 9 | 12.00 | | VC | 150 | 0.0150 | E | SAN PABLO | | | | | 4.4 | 14.4 | **** | | 17.4 |
| 255.00 | | 507.0 | 10 | 18.00 | | CMP | 270 | 0.0122 | E | DARTMOUTH | | | | | 6.3 | 13.8 | **** | | 16.7 |
| 256.00 | | 508.0 | 10 | 18.00 | | CMP | 250 | 0.0140 | E | | | | | | 6.7 | 12.1 | *** | | 14.6 |
| 257.00 | | 509.0 | 10 | 18.00 | | CMP | 250 | 0.0136 | E | | | | | | 6.6 | 9.9 | ** | | 11.9 |
| 258.00 | | 510.0 | 10 | 18.00 | | CMP | 250 | 0.0112 | E | | | | | | 6.0 | 7.7 | ** | | 9.3 |
| 259.00 | | 511.0 | 10 | 18.00 | | CMP | 250 | 0.0084 | E | | | | | | 5.2 | 5.0 | | | 6.1 |
| 260.00 | | 512.0 E | 10 | 18.00 | | CMP | 250 | 0.0248 | E | | | | | | 9.0 | 1.7 | | | 2.1 |
| 261.00 | 505.0 | | 9 | 60.00 | | RCP | 100 | 0.0100 | E | | | | | | 260.4 | 424.2 | *** | | 512.2 |
| 262.00 | | | 10 | | | OPN | 160 | 0.0100 | E | | | | | | | 424.2 | | | 512.2 |
| 263.00 | | 513.0 | 10 | 6.00 | 6.00 | RCB | 80 | 0.0100 | E | KAINS | | | | | 539.2 | 424.2 | | | 512.2 |
| 264.00 | | | 10 | | | OPN | 200 | 0.0100 | E | | | | | | | 430.2 | | | 519.5 |
| 265.00 | | 514.0 | 10 | 6.00 | 6.00 | RCB | 120 | 0.0100 | E | STANNAGE | | | | | 539.2 | 430.2 | | | 519.5 |
| 266.00 | | 515.0 | 10 | 6.00 | 6.00 | RCB | 110 | 0.0100 | E | CORNELL | | | | | 539.2 | 431.2 | | | 520.7 |
| 267.00 | | | 10 | | | OPN | 190 | 0.0100 | E | | | | | | | 442.2 | | | 534.0 |
| 268.00 | | | 10 | 6.00 | 6.00 | RCB | 90 | 0.0100 | E | TALBOT | | | | | 539.2 | 442.2 | | | 534.0 |
| 269.00 | | | 10 | | | OPN | 160 | 0.0100 | E | | | | | | | 442.2 | | | 534.0 |
| 270.00 | | 516.0 | 10 | 6.00 | 6.00 | RCB | 90 | 0.0100 | E | EVELYN | | | | | 539.2 | 442.2 | | | 534.0 |
| 271.00 | | | 10 | | | OPN | 200 | 0.0100 | E | | | | | | | 453.4 | | | 547.5 |
| 272.00 | | | 10 | 6.00 | 6.00 | RCB | 80 | 0.0100 | E | MASONIC | | | | | 539.2 | 453.4 | | | 547.5 |
| 273.00 | | | 10 | | | OPN | 100 | 0.0100 | E | | | | | | | 453.4 | | | 547.5 |

ABBREVIATIONS
- D/S DOWNSTREAM
- U/S UPSTREAM
- TY TYPE
- R/W RIGHT OF WAY

DRAIN TYPE
- BRDG BRIDGE
- CMP CORRUGATED METAL PIPE
- CMPA CORRUGATED METAL PIPE ARCH
- GUT STREET GUTTER
- OPN OPEN CHANNEL
- PVC PLASTIC
- RCB REINFORCED BOX
- RCP REINFORCED CONCRETE PIPE
- VC VITRIFIED CLAY

SLOPE TYPE
- A AVERAGE
- E ESTIMATED

RIGHT OF WAY TYPE
- PR PRIVATE
- blank PUBLIC

CAPACITY EXCEEDED
- . LESS THAN 10%
- * 10% TO 25%
- ** 25% TO 50%
- *** 50% TO 100%
- **** GREATER THAN 100%

| DRAIN NO. | D/S NODE | U/S NODE | MAP NO. | HT / DIAM. (in OR ft) | WIDTH | TYPE | LENGTH (ft) | SLOPE | TY | STREET | R/W | D/S INVERT (ft) | U/S INVERT (ft) | U/S GROUND (ft) | CAPACITY (cfs) | 10-YR FLOW (cfs) | CAPACITY EXCEEDED | 10-YR HGL (ft) | 25-YR FLOW (cfs) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 274.00 | | | 10 | 6.00 | 8.00 | RCB | 90 | 0.0100 | E | BART | | | | | 785.9 | 453.4 | | | 547.5 |
| 275.00 | | 517.0 | 10 | 6.00 | 6.00 | RCB | 90 | 0.0100 | E | SANTA FE | | | | | 539.2 | 453.4 | | | 547.5 |
| 276.00 | | 518.0 | 10 | 2.00 | 2.00 | RCB | 690 | 0.0064 | | SANTA FE | | 60.70 | 65.10 | 71.90 | 23.0 | 11.4 | | | 13.7 |
| 277.00 | | 519.0 E | 10 | 2.00 | 2.00 | RCB | 380 | 0.0063 | | SANTA FE | | | 67.50 | 71.00 | 22.9 | 5.4 | | | 6.6 |
| 278.00 | 517.0 | | 10 | | | OPN | 250 | 0.0100 | E | | | | | | | 453.4 | | | 547.6 |
| 279.00 | | 520.0 | 10 | 6.00 | 6.00 | RCB | 60 | 0.0100 | E | CURTIS | | | | | 539.2 | 453.4 | | | 547.6 |
| 280.00 | | | 10 | | | OPN | 80 | 0.0100 | E | | | | | | | 456.1 | | | 550.8 |
| 281.00 | | 521.0 | 10 | 6.00 | 6.00 | RCB | 250 | 0.0100 | E | NEILSON | | | | | 539.2 | 456.1 | | | 550.8 |
| 282.00 | | 522.0 | 10 | | | OPN | 100 | 0.0100 | E | | | | | | | 453.5 | | | 547.6 |
| 283.00 | | | 10 | | | OPN | 200 | 0.0100 | E | | | | | | | 458.6 | | | 553.7 |
| 284.00 | | 523.0 | 10 | 6.00 | 6.00 | RCB | 50 | 0.0100 | E | | | | | | 539.2 | 458.6 | | | 553.7 |
| 285.00 | | 524.0 | 10 | 12.00 | | VC | 190 | 0.0400 | E | PERALTA | | | | | 7.1 | 21.1 | **** | | 25.5 |
| 286.00 | | 525.0 E | 11 | 12.00 | | VC | 380 | 0.0387 | | POSEN | | | 101.10 | 106.40 | 7.0 | 17.4 | **** | | 21.1 |
| 287.00 | 523.0 | 526.0 | 10 | 6.00 | 6.00 | RCB | 350 | 0.0200 | E | | | | | | 762.6 | 443.7 | | | 535.8 |
| 288.00 | | | 11 | | | OPN | 620 | 0.0200 | E | | | | | | | 467.4 | | | 564.4 |
| 289.00 | | | 11 | | | BRDG | 30 | 0.0200 | E | | | | | | | 467.4 | | | 564.4 |
| 290.00 | | 527.0 E | 11 | | | OPN | 230 | 0.0200 | E | | | | | | | 467.4 | | | 564.4 |

# APPENDIX D

# STORM WATER RUNOFF CONTROL METHODS

**Storm Water Management Alternatives**

Through urbanization, the functions of the watershed have changed. Storm water and the aquifers it filled used to be the source for plants and animals living in the watershed. Creeks remain primarily for their utilitarian function of carrying storm water runoff away from the city.

The effect of urban development is more water being diverted into smaller areas. Prior to the development of impervious surfaces, primarily concrete, water flowed over soil and grass surfaces in sheets across flat surfaces. At low points water converged to become creeks. When water reached the flat plains prior to the Bay, it slowed down and sunk into and through (infiltrated and percolated) the ground, into an underground water storage, an aquifer or water table.

In the now urbanized landscape water flows predominantly over impervious surfaces; rooftops, sidewalks, streets, and rapidly collects in the small spaces in which humans have relegated the water; narrow creek channels and the finite spaces of underground pipes. Reducing the risk of damage to property inherent in this situation is the charge of the public sector. Conventional approaches to managing this water flow typically include piping the water underground to quickly and efficiently get rid of it.

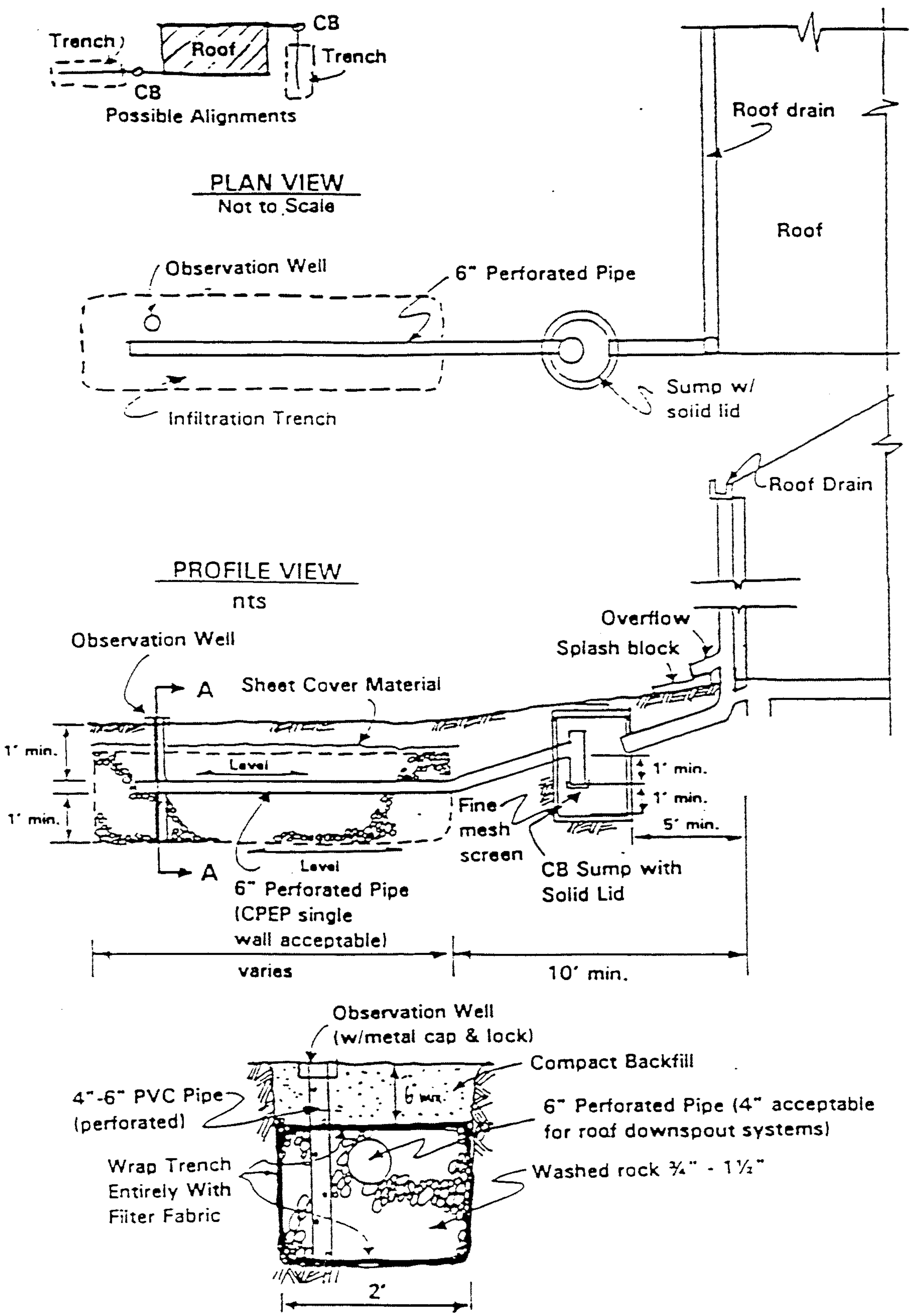
Alternative management of storm water runoff includes reducing the amount of storm water reaching the streets or the creeks. There are a number of alternative techniques that could be considered for reducing storm runoff in Albany. These include:

- Roof-down spout systems;
- Parking lot perimeter trenches;
- Composite pavement material for parking lots and streets; and
- Modification of street areas.

These could be implemented either as conditions of approval with private development or by incorporation into public works projects sponsored by the City. Locations for implementation of these alternative techniques generally requires space, of which Albany has little. Some alternative techniques might be incorporated into redevelopment of larger parcels, such as the proposed Middle School and the El Cerrito Plaza sites on Cerrito Creek, and along Codornices Creek in conjunction with the planned housing and site improvements at University Village.

Problems for implementation of these methods in Albany include low soil permeability, lack of available open space because of the built-out urban density, and relatively small residential lots. Goals for runoff reduction should consider a long term approach, with implementation of small, demonstration sites considered on a site availability basis.

# Figure D-1 Roof Down Spout System

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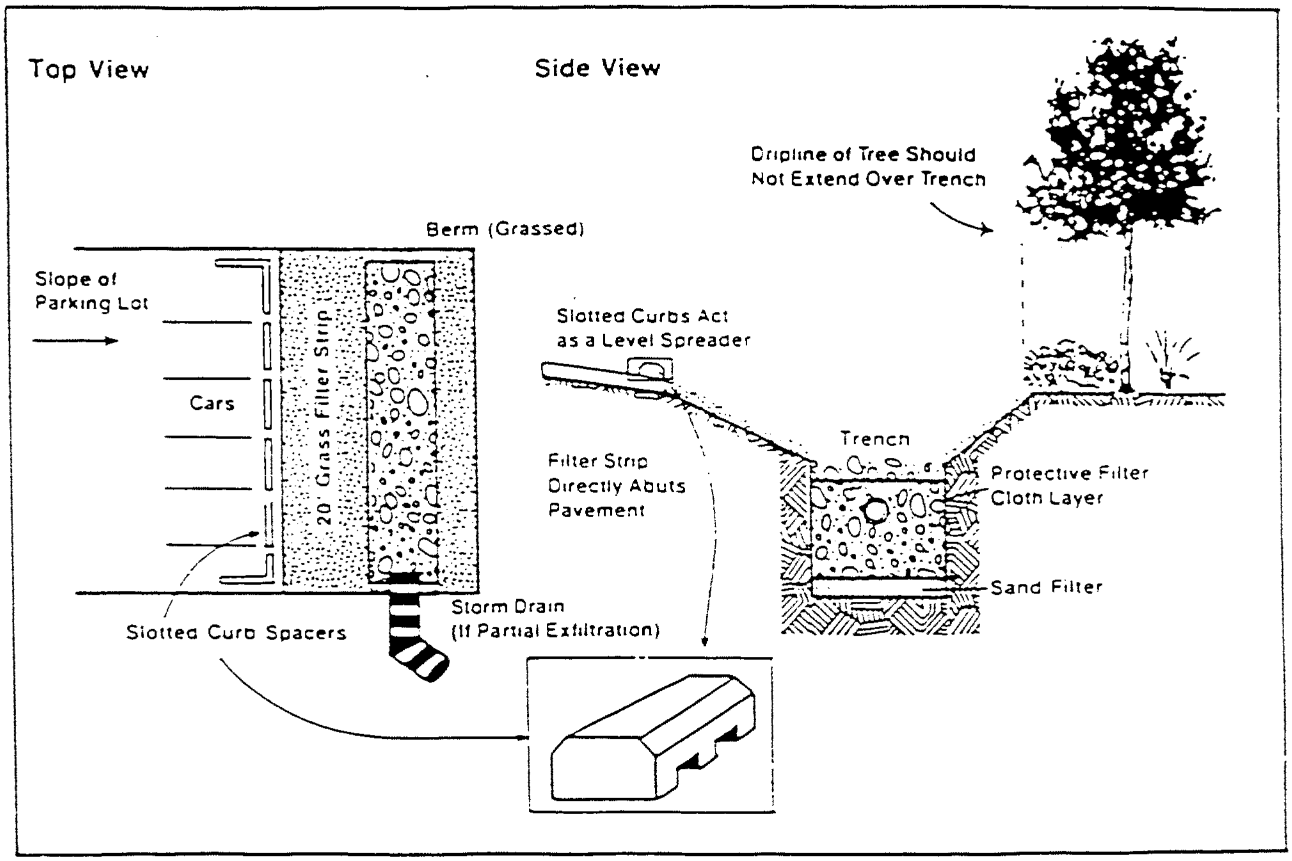
## Figure D-2 Parking Lot Perimeter Trench Design

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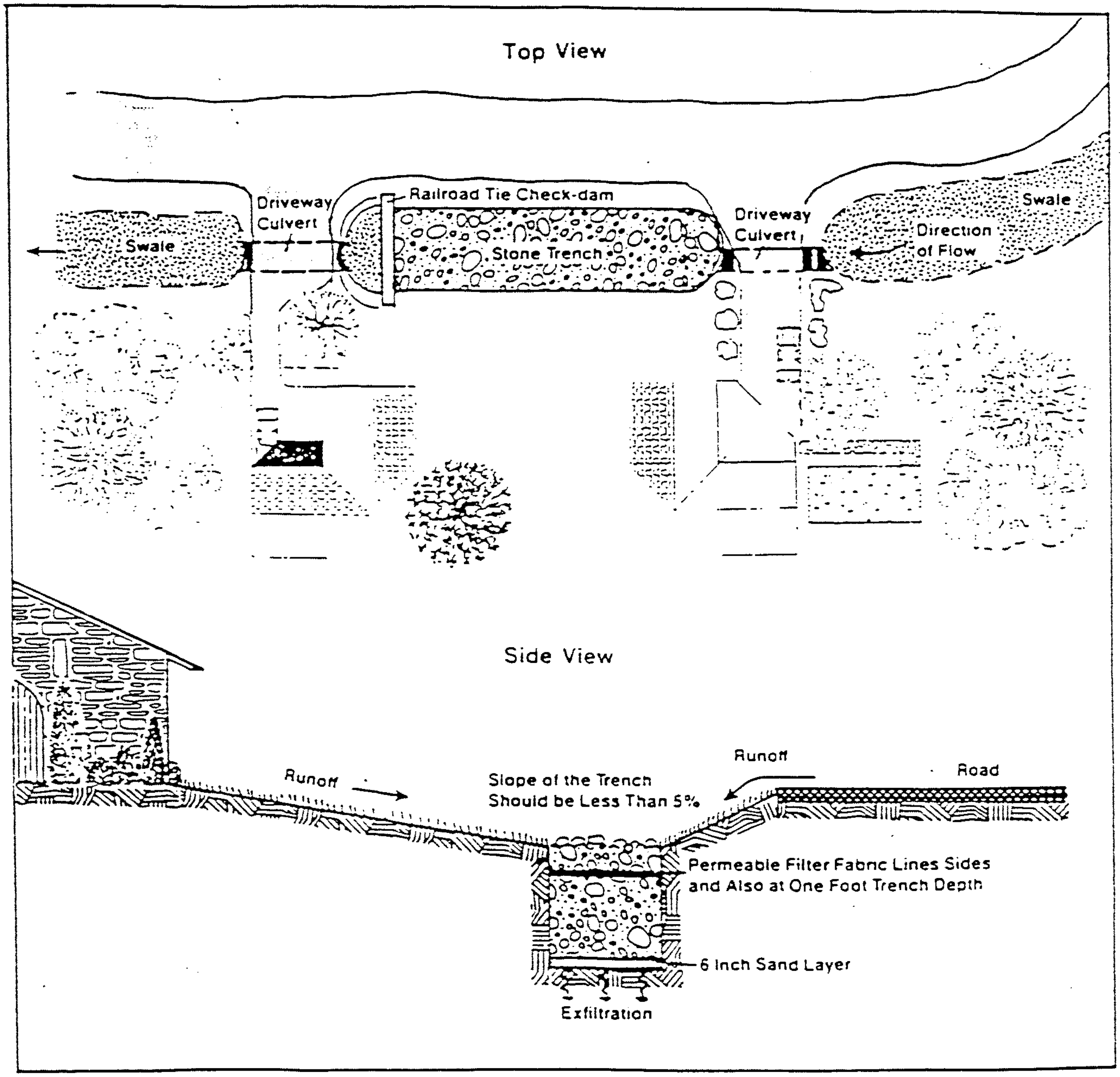
## Figure D-3 Composite Materials and Modifications of Street Areas

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# APPENDIX E

# WATER QUALITY & NPDES PERFORMANCE STANDARDS

Tables E-1 through E-4 provide detail on water quality in Albany's Creeks.

# TABLE E-1

## WATER QUALITY IN CODORNICES CREEK DURING STORMS AND IN DRY WEATHER, 1989 to 1991: CONCENTRATIONS OF METALS

| CONSTITUENT | Wet Weather (ug) | Acute Water Quality Objective (ug) | Dry Weather (ug) | Chronic Water Quality Objective (ug) | Comments |
|---|---|---|---|---|---|
| Arsenic, total | 2 to 13 | 360 | <1 to 2 | 190 | No wet or dry exceedances. |
| Arsenic, dissolved | 1 to 4 | 360 | <1 to 2 | 190 | No wet or dry exceedances. |
| Cadmium, total | 0.3 to 1.3 | 2.2 to 4.8 | <0.1 to 0.4 | 1.6 | No wet or dry exceedances. |
| Cadmium, dissolved | <0.1 to 0.2 | 2.2 to 4.8 | <0.1 to 0.4 | 1.6 | No wet or dry exceedances. |
| Chromium, total | 6 to 63 | 1127 to 2016 | <1 to 4 | 304 | No wet or dry exceedances. |
| Chromium, dissolved | <1 to 3 | 1127 to 2016 | <1 to 1 | 304 | No wet or dry exceedances. |
| Copper, total | 11 to 71 | 11 to 21 | <1 to 3 | 18 | All wet weather values exceed the objective. |
| Copper, dissolved | 3 to 12 | 11 to 21 | <1 to 2 | 18 | One wet weather value exceeds the objective. |
| Lead, total | 23 to 166 | 44 to 103 | <1 to 5 | 5.8 | Two of five wet weather values exceed objective. |
| Lead, dissolved | 1 to 2 | 44 to 103 | <1 to 7 | 5.8 | No wet or dry exceedances. |
| Mercury, total | <0.2 to 0.91 | 2.4 | < 0.2 to 0.6 | -- | No wet or dry exceedances. |
| Mercury, dissolved | <0.2 to 0.3 | 2.4 | <0.2 to 0.4 | -- | No wet or dry exceedances. |
| Nickel, total | 12 to 88 | 946 to 1655 | 1 to 4 | 235 | No wet or dry exceedances. |
| Nickel, dissolved | <1 to 12 | 946 to 1655 | 1 to 4 | 235 | No wet or dry exceedances. |
| Selenium, total | <0.2 | 20 | < 0.2 | 5 | No wet or dry exceedances. |
| Selenium, dissolved | < 0.2 | 20 | < 0.2 | 5 | No wet or dry exceedances. |
| Silver, total | < 0.2 to 0.8 | 2.3 | < 0.2 to <0.5 | -- | No wet or dry exceedances. |
| Silver, dissolved | < 0.2 | 2.3 | < 0.2 to <0.5 | 0.12 | No wet or dry exceedances. |
| Zinc, total | 65 to 400 | 75 to 137 | <5 to 8 | 158 | Four of five wet weather values exceed objective. |
| Zinc, dissolved | <5 to 79 | 75 to 137 | <5 to 8 | 158 | One wet weather value exceeds the objective. |

Source: Loads Assessment Report (Appendix D), Woodward-Clyde Consultants, 1991.

Notes:

1. All samples taken between 12/15/89 and 3/2/91, during 7 dry weather events and 5 wet weather events.
2. Water quality objectives estimated by Woodward-Clyde Consultants, from the S. F. Regional Water Quality Control Board, Basin Plan, 1991.

# TABLE E-2

## WATER QUALITY IN CODORNICES CREEK DURING STORMS AND IN DRY WEATHER, 1989 to 1991: CONCENTRATIONS OF NON-METALS

| CONSTITUENT | | Units | Wet Weather (1) | Dry Weather (1) | COMMENTS |
|---|---|---|---|---|---|
| Ammonia | ( | mg/l | < 0.1 to 0.25 | < 0.1 to 0.41 | biostimulating constituent |
| Nitrate | | mg/l | 0.48 to 2.7 | < 0.05 to 1.4 | biostimulating constituent |
| Total Kjeldahl Nitrogen | | mg/l | 0.24 to 0.51 | <0.1 to 0.5 | |
| Total Hardness | | mg/l | 59 to 120 | 160 to 460 | |
| Biological Oxygen Demand | | mg/l | 3.5 to 12.9 | <1 to 1.8 | |
| Specific Conductance | (3) | umnos/cm @ 25°C | — | 440 to 780 | |
| Total dissolved solids | | mg/l | 78 to 210 | 270 to 8700 | |
| Total suspended solids | | mg/l | 110 to 690 | <4 to 7 | |
| Total organic carbon | | mg/l | 13 to 24 | <0.1 to 5 | |
| Total coliform bacteria | (4) | MPN | 1600 to >1600 | 300 to 1600 | |
| Fecal coliform bacteria | (4) | MPN | 1600 to >1600 | 50 to 1600 | |

Source: Loads Assessment Report (Appendix D), Woodward-Clyde Consultants, 1991.

Notes:

1. All samples taken between 12/15/89 and 3/2/91, during 7 dry weather events and 5 wet weather events
2. Reported as ammonia. Un-ionized ammonia concentrations exceeding 0.025 mg/l can be toxic.
3. Conductance not analysed on wet-weather samples from this station. Units for specific conductance are probably umhos/cm @ 25°C, not ug/l as reported by Woodward Clyde.
4. Units for coliform counts are probably 'most probable number per 100 ml (MPN)', and not 'mg/l', as reported by Woodward-Clyde. Values shown exceed the Regional Board water quality objectives for water-contact recreation (MPN=25).

# TABLE E-3

## SEDIMENT QUALITY IN CODORNICES CREEK DURING DRY WEATHER SAMPLING.

| CONSTITUENT | Sediment Concentration (mg/kg) | Title 22 TTLC (mg/kg) | COMMENTS |
|---|---|---|---|
| Arsenic | 0.8 | 500 | No exceedance of TTLC. |
| Cadmium | 0.63, 0.37 | 100 | No exceedance of TTLC. |
| Chromium | 68, 66 | 2500 | No exceedance of TTLC. |
| Copper | 39, 29 | 2500 | No exceedance of TTLC. |
| Lead | 180, 101 | 2000 | No exceedance of TTLC. |
| Mercury | 0.29, 0.49 | 20 | No exceedance of TTLC. |
| Nickel | 74, 75 | 2000 | No exceedance of TTLC. |
| Selenium | < 0.003, <0.026 | 100 | No exceedance of TTLC. |
| Silver | 0.20, 0.145 | 500 | No exceedance of TTLC. |
| Zinc | 180, 171 | 5000 | No exceedance of TTLC. |
| Ammonia (3) | < 1, 80 (?), < 1 | Not Applicable | |
| Nitrate (3) | 2.2, 5.4, 1.1 | Not Applicable | |
| Kjeldahl Nitrogen (3) | 1065, 1890 | Not Applicable | |
| Organic carbon (3) | 9802, 54000 | Not Applicable | |

Source: Loads Assessment Report (Appendix E), Woodward-Clyde Consultants, 1991.

Notes:

1. All samples taken 4/2/90 and 1/2/91 during dry weather conditions.
2. TTLC=Total Threshold Limit Concentration (wet weight) for classification of solids as Hazardous Materials, Title 22, California Code of Regulations, 1991.
3. Maximum allowable holding time exceeded by the laboratory on at least one sample.

# TABLE E-4

## NOTES ON WATER QUALITY CONDITIONS OBSERVED IN ALBANY CREEKS ON AUGUST 5-6, 1997

| UPPER BOUNDARY of reach | LOWER BOUNDARY of reach | SPECIFIC COND. in field (umhos/cm) | Temp. (°C) | SPECIFIC COND. at 25°C (umhos/cm) | COMMENTS [1] |
|---|---|---|---|---|---|
| | | | | | [SC=Specific Conductance; gpm = gallons per minute] |
| **Cerrito Creek** | | | | | |
| Santa Fe | San Carlos | 720 | 21.2 | 774 | SC @ 14:30 PM ~50' upstream of San Carlos culvert outlet from Carmel culvert. Meanders at East end (more open). |
| San Carlos | Carmel | | | | Tree over channel; paint, etc stored below house near creek |
| Carmel | Ramona | 700 | 18.2 | 810 | SC @ 14:10 PM at outlet from Carmel culvert. Homeowner reports road culvert @ Ramona appears to be failing (dip—same as @ Key Route). |
| Pomona | Key Route | 690 | 19.4 | 775 | SC @ 14:05 PM at east end of lots (~2 gpm), then goes subsurface and channel is dry adjacent to Key Route. |
| Key Route | Spokane | | DRY | | Channel dry |
| Spokane | Bart Tracks | | | | Empty lot (future Middle School site) |
| Talbot | Cornell | | | | Creek beneath apartment parking lot |
| Cornell | Stannage | | | | Drains discharge street runoff from Cornell. |
| Stannage | Kains | | | | Discharge from culvert under Plaza parking lot = 5-10 gpm (~50% of flow); clear; surface drainage discharges street runoff from Stannage |
| Kains | San Pablo | | | | Buildings on Albany side closely abut Creek |
| San Pablo | Adams | 540 | 19.2 | 610 | SC @ 12:40 PM at outlet beneath San Pablo Blvd. |
| | | 390 | 21.5 | 416 | SC @ 12:30 PM downstream of 3 box culverts. Lots of algae. Multiple 4" outlets from park to creek. Surface inflow from North side channel by gunshop. |
| Creekside Park | Pierce | 368 | 20.3 | 404 | SC @ 12:05 PM @ East end of park. 40-50 gpm. Channel choked w/aquatics and reeds. |
| San Pablo | I-80 | 540 | 19.8 | 601 | SC @ 12:50 PM in creek just upstream of 3 box culverts. Flowing ~2 gpm and shady. Creek filled w/riprap |
| | | 1,520 | 21.0 | 1642 | SC @ 11:55 AM @ plum trees, East border of North side parking lot/west end of park. Clear. |
| | | 4,900 | 23.0 | 5053 | SC @ 11:45 AM @ North bank eucalyptus trees, downstream of North side parking lot. No discernible flow; clear. |
| | | 25,700 | 29.0 | 23421 | SC @ 11:30 AM 20' East of culvert under Highway I-80. No discernible flow; visibility ~18-24". Large parking lot and construction zone to North; path/road and residential (towers) to South. Mallard hen. |
| I-80 | I-580 | | | | Did Not Walk |

# TABLE E-4

## NOTES ON WATER QUALITY CONDITIONS OBSERVED IN ALBANY CREEKS AUGUST 5-6, 1997.

| UPPER BOUNDARY of reach | LOWER BOUNDARY of reach | SPECIFIC COND. in field (umhos/cm) | Temp. (°C) | SPECIFIC COND. at 25°C (umhos/cm) | COMMENTS |
|---|---|---|---|---|---|
| **Codornices Creek** | | | | | |
| Albany Border | Bridge at St. Mary's High School | | | | Upstream end is ~flume; armored along South bank, open to North; 55 space parking lot on North side drains to creek through a 12" culvert flowing 0.5 gpm (other sources); drain pipes exit concrete wall on south side. |
| Bridge at St. Mary's High School | Ordway | | | | 8" pipes at 8' and 10' high under bridge; pump in channel; flex hose discharge pipe (grey water? runoff?) from South bank btw. 1st & 2nd check dams; good oxygenation; clear & odorless; root wads ; 6" crayfish; collapsed walls and rubble in channel |
| Peralta | Stannage | | | | Did Not Walk |
| Stannage | Kains | | | | Yoshi Kuraishi (owns Victorian) reports that creek overflowed (barely) to North in January 1997; also reported a 13" trout living in creek under overhang |
| Kains | San Pablo | | | | Abuts Villa Motel site (present concrete channel to be naturalized) |
| San Pablo | 10th St. | | | | Good structure & meander, w/floodplain w/i channel |
| 10th St. | 8th St. | | | | Good meander—blends w/restored area; ball fields to N |
| 8th St. | 6th | | | | Storm drains discharge into creek from shed/garage to South, and also receives runoff from parking lot/large open area to West of structures |
| 6th | 5th | 500 | 22.6 | 520 | SC @14:55 PM at downstream end of 5th St. culvert. All flow (~30 gpm) North to bypass channel; 18" visibility |
| 5th | SP RR tracks | 520 | 20.2 | 573 | SC @14:40 PM in pool d/s of culvert. 18" garter snake. |
| | | 860 | 20.8 | 934 | SC @14:35 PM @ 50' East of SW corner of soccer field. Turtle in channel (heard, not seen). Ponded east to culvert section, then dry until pool at next culvert. Open to south side; soccer field to North. |
| | | 205 | 22.2 | 215 | SC @13:10 PM @ in Codornices bypass channel, flowing @ 30-40 gpm upstream of homeless camp |
| SP RR tracks | East Shore Blvd | | | | |
| Race track | Bay mudflats | 42,100 | 25.4 | 41182 | Bay SC @ 12:00 PM @ ~ 50' from culvert into marsh. |
| | | 15,500 | 27.5 | 14529 | SC @12:30 PM in channel paralleling freeway 1/4 mile from Gilman exit. Culvert entering from racetrack side discharges maintenance lot/parking lot runoff? |
| | | 10,100 | 28.2 | 9341 | SC @12:35 PM in channel (little water) paralleling freeway opposite Berkeley city limits sign. Caltrans has constructed an overbank wetland along the east bank as a retention basin for freeway runoff. Village Creek flows carried under freeway in culvert |

# TABLE E-4

## NOTES ON WATER QUALITY CONDITIONS OBSERVED IN ALBANY CREEKS ON AUGUST 5-6, 1997

| UPPER BOUNDARY of reach | LOWER BOUNDARY of reach | SPECIFIC COND. in field (umhos/cm) | Temp. (°C) | SPECIFIC COND. at 25°C (umhos/cm) | COMMENTS |
|---|---|---|---|---|---|
| **Village Creek** | | | | | |
| San Pablo | 8th St. | | DRY | | Open areas on either side (North and South); some portions of East end of channel overgrown w/ berries |
| U.C. Village | SP RR tracks | 205 | 22.2 | 215 | SC @13:10 PM @ in Village channel upstream of eucalyptus grove, in ponded area near large parking lot to North (open), then dry in channel where creek bends south through eucalyptus grove |
| | | 520 | 20.6 | 567 | SC @13:15 PM @ confluence of bypass and Village channels -- clear, flowing through (pruned) cattails |
| SP RR tracks | Eastshore Blvd | 520 | 19.7 | 580 | SC @ 12:50 PM @ downstream outlet from RR tracks, no discernible flow, cattails in channel. Large homeless encampment. Cleared fields N & South. Goes underground beneath buildings (parking lot and yard to south), Eastshore Blvd., and freeway. |
| Eastshore Blvd | Eastshore Blvd | 840 | 18.2 | 972 | SC @ 13:30 PM @ pool downstream of wooden bridge. |
| **Middle Creek** | | | | | |
| pipe between 518 and 520 Adams | Cerrito Creek | | | | Creek exits culvert (3' x 4.5') between 518 and 520 Adams, earthen bed, 4' banks, clear, tadpoles, irrigation pump; creek widens to north passing through open area before passing under SW corner Orientation School for Blind through barred inlet. |
| | | 520 | 22.0 | 549 | SC @ 15:10 PM. Creek exits the school, passes through narrow (8-10'), overgrown channel w/downed willow tree @ 4', plus 10" pipe @ 18" and and wire fence @3.5', flows over 1' drop. |
| | | 480 | 17.8 | 561 | SC @ 12:15 PM just above confluence w/Cerrito Creek. Flow ~15-20 gpm. |

Notes:

1. Specific conductance in umhos/cm @ 25° C is roughly equal to 1.4 [TDS], where TDS =Total Dissolved Solids in mg/L. For comparison, SC of rainfall is ~20 umhos/cm; and SC greater than 5,000 umhos/cm is considered to be brackish water.
2. Cerrito, Middle, Village and lower Codornices Creeks were walked on August 5; upper Codornices Creek on August 6.
3. Tidal flows: Tide Table has Berkeley + 20 minutes vs. Golden Gate Bridge. August 5 low tide was at 7:19 AM with high tide at 2: 26 PM

Tables E-5 through E-7 provide detail on the performance standards outlined in the Alameda Countywide Stormwater Management Plan.

# TABLE E-5

**TIER 1 PERFORMANCE STANDARDS, NPDES STORM WATER MANAGEMENT PLAN FOR MUNICIPAL DISCHARGES, CITY OF ALBANY CLEAN WATER PROGRAM (all subelements functionally implemented).**

| ELEMENT/subelement | TIER 1 (BASELINE) Performance Standards |
|---|---|
| **5.0 Public Information and participation (PI/P)** | |
| 1. Participation in PI/P subcommittee and General Program activities | Designate a staff person responsible for implementing PI/P activities. |
| | Staff person chairs PI/P activity on a rotating basis. |
| | Complete PI/P reports on time. |
| 2. Internal agency communication/training | Inform municipal staff and elected officials about ACCWP. |
| | Inform new Clean Water Program staff about ACCWP. |
| | Develop written procedure to handle storm water related phone calls; train municipal staff in using it. |
| 3. Use of program outreach | Distribute and account for ACCWP informational materials. |
| 4. Agencies' community outreach program | Participate in two community outreach activities (attend fairs; initiate new events; contact media or advertise; send out information; integrated outreach; watershed awareness). |
| 5. Coordination with public schools | Distribute ACCWP educational materials and information. |
| **6.0 Municipal Maintenance** | |
| *Street Cleaning* | |
| 1. Street cleaning frequency | [Tier 2 only] |
| 2. Street cleaning thoroughness | Scheduling, equipment type and maintenance, back-up to maximize pollutant removal. |
| 3. Street cleaning efficiency | Maintain regular schedule; notify residents. |
| | Facilitate leaf removal. |
| | Avoid interference from street trees. |
| 4. Record keeping | Track street miles cleaned, volume/weight of material removed, problem areas for intensive efforts. |
| 5. Contract sweepers | Update bid specifications re completion and operations back-up. |
| *Storm drainage facilities and mainteance of watercourses* | |
| 1. Routine inspection and cleaning | [Tier 2 only] |
| 2. Record keeping | Prepare monthly report of the amount of material removed when cleaning storm drain. |
| | Document spill incidents and responses. |

## TABLE E-5

**TIER 1 PERFORMANCE STANDARDS, NPDES STORM WATER MANAGEMENT PLAN FOR MUNICIPAL DISCHARGES, CITY OF ALBANY CLEAN WATER PROGRAM.**

| ELEMENT/subelement | TIER 1 (BASELINE) Performance Standards |
|---|---|
| *Storm drainage facilities and maintenance of watercourses (continued)* | |
| 2. Record keeping | Identify "problem" inlets for enhanced effort or additional public education. |
| | Document maintenance activities (e.g., inspections, spills, vegetation removal, chemical applications) at pump stations and watercourses. |
| 3. Disposal of material | Properly store and dispose of material removed from drainage facilities. |
| 4. Spill response | Respond to spill reports appropriately (hazardous/non-hazardous). |
| | Establish response/removal procedures for spills reported after hours. |
| | Develop spill follow-up procedure. |
| 5. Geographical problem areas | [Tier 2 only] |
| 6. Inspection and maintenance | Inspect pump stations after wet season and schedule dry season maintenance activities |
| | Inspect trash racks and oil absorbent booms after each significant storm. |
| 7. Permits and regulatory requirements | Comply with agency permit requirements before commencing work. |
| 8. Target areas for improvements | Identify illegal dumping hot spots, report, and inspect, post and follow-up; coordinate with law enforcement agency. |
| 9. Pesticide use | [Tier 2 only] |
| 10. Desilting and disposal | [Tier 2 only] |
| 11. Vegetation | [Tier 2 only] |
| *Litter control* | Provide adequate number of receptacles in commercial areas; empty sufficiently frequently. |
| *Graffiti abatement* | No removal activities during storms; protect storm drain inlets during graffiti removal; no debris, washwater, sand to be discharged to storm drains; cleanup site thoroughly afterwards. |
| | Train staff and volunteers in BMPs; supervise appropriately |
| *Road repair and maintenance* | |
| 1. General practices | Schedule excavation/road maintenance activities for dry weather. |
| | Repair/maintain equipment in Corporation yard. |
| | If refueling or repairing equipment on-site, locate away from drains or watercourses. |

# TABLE E-5

## TIER 1 PERFORMANCE STANDARDS, NPDES STORM WATER MANAGEMENT PLAN FOR MUNICIPAL DISCHARGES, CITY OF ALBANY CLEAN WATER PROGRAM.

| ELEMENT/subelement | TIER 1 (BASELINE) Performance Standards |
|---|---|
| *Road repair and maintenance (continued)* | |
| 1. General practices | Recycle used motor oil, diesel oil, concrete, asphalt. |
| | Train staff in BMP use. |
| 2. Asphalt/concrete removal | Protect storm drain inlets during removal; cleanup site thoroughly afterwards to minimize material discharged to storm drains. |
| | Protect storm drains to prevent entry of saw-cut slurry; remove slurry wastes at end of day. |
| 3. Patching and resurfacing | Do not maintain stockpiles in streets unless protected from runoff to storm drains or streams; remove promptly after work is completed. |
| | Protect manholes and storm drain inlets during seal coat/slurry operations. |
| | Don't wash excess paving materials into storm drains; clean up and dispose properly. |
| | Minimize water used for dust control to minimize runoff. |
| | Prevent uncontrolled drips from paving equipment (pans or berms). |
| | Clean-up spills and leaks using "dry" (absorbent) methods and dispose of materials properly; if spills on dirt, dig up and remove soil promptly. |
| | If rain occurs unexpectedly, minimize contamination (e.g., cover equipment, divert runoff). |
| 4. Signing and striping | Store absorbent materials on trucks to use in case of spills. |
| | Contain and cleanup waste materials and dispose of them properly. |
| 5. Equipment clean up/storage | Clean sprayers, patch and paving equipment at day's end; flush paint sprayer supply lines at Corporation yard; use approved collection methods; dispose of waste properly. |
| *Corporation yards* | |
| 1. General BMPs | Delegate responsibility for BMP implementation and staff training to one person. |
| | Prepare spill containment kits; store in appropriate locations. |
| | Stencil storm drain inlets. |
| | Incorporate storm water BMPs into Hazardous Materials Business Plan (HMBP) or Spill Prevention plans and periodically review. |
| | Prepare Storm Water Pollution Prevention Plan (SWPP) for each facility; survey facilities annually. |

# TABLE E-5

## TIER 1 PERFORMANCE STANDARDS, NPDES STORM WATER MANAGEMENT PLAN FOR MUNICIPAL DISCHARGES, CITY OF ALBANY CLEAN WATER PROGRAM.

| ELEMENT/subelement | TIER 1 (BASELINE) Performance Standards |
|---|---|
| *Corporation yards (continued)* | |
| 2. Washing vehicles and equipment | Clean all vehicles and equipment on designated wash pads; monitor to verify consistent use; assign use schedules if needed. |
| | Drain washwater to sanitary sewer or recycling system (or wash off-site); check pre-treatment requirements. |
| | Ensure wash pad and sump are large enough to contain washwater and drains to sewer or recycling |
| 3. Refuse holding areas | Store material removed from drainage facilities on a concrete or asphalt pad; cover in wet season; drain to sanitary sewer or let evaporate. |
| 4. Fuel dispensing areas | Store containment kits nearby; if spill occurs, use dry methods, refer to HMBP or Spill Prevention plans. |
| | Train employees in proper fueling and cleaning procedures |
| 5. Chemical storage | Store paint and chemicals in approved, covered, secure area having a spill containment system; label drums and keep closed. |
| | If 55 gallon drums are stored outside, keep closed and provide containment. |
| | Review HMBP and MSDS sheets for storage requirements. |
| 6. Chemical usage | Maintain safety equipment and spill containment accessible; regularly inspect to ensure safety equipment is operational. |
| | Review MSDS sheets. |
| | Minimize use of chemicals; use water based paints and non-toxic chemicals where possible. |
| | Recycle excess chemicals or dispose at an approved Hazardous Waste facility |
| | Filter and reuse or dispose of thinners; recycle or dispose of excess oil-based paint at an approved Hazardous Waste facility. |
| | Discharge water-based paint washwater to sanitary sewer; dry paint cans and brushes and dispose to trash; dispose of excess at an approved Hazardous Waste facility or recycle |
| | Collect used automotive fluids, solvents or cleaning solutions and recycle them or dispose of them at an appropriate facility. |

# TABLE E-5

## TIER 1 PERFORMANCE STANDARDS, NPDES STORM WATER MANAGEMENT PLAN FOR MUNICIPAL DISCHARGES, CITY OF ALBANY CLEAN WATER PROGRAM.

| ELEMENT/subelement | TIER 1 (BASELINE) Performance Standards |
|---|---|
| 7. Fleet maintenance/parking areas | Regularly inspect equipment for leaks; use drip pans or repair significant leaks |
| | Drain and replace motor fluids in a covered area; If outdoors, designate area away from storm drains or sanitary sewer where spills can be contained or cleaned up. |
| | Periodically dry sweep area. |
| 8. Auxiliary storage areas/yards | Store chemicals in appropriate areas. |
| 9. General housekeeping | Inspect yard routinely to prevent illegal discharges to storm drains and ensure that during storms, discharges are controlled to the maximum extent practicable. |
| | Keep chemical storage areas neat and orderly. |
| | Sweep corporation yard; dispose of materials removed from streets and storm drain facilities often to limit exposure to rainfall and runoff. |
| *Pesticide usage and pest management* | |
| 1. General BMPs | Consider alternatives for pest control (e.g., no control; physical/mechanical controls; cultural controls; biological controls; less toxic chemical controls). |
| | Use the most effective, least toxic pesticides. |
| | Follow all federal, state, and local laws and regulations. |
| | Appropriate agency personnel will read and follow label instructions. |
| | Applicators will be encouraged to pursue continuing education classes. |
| 2. Pesticide usage | Review site history to assess pest condition; establish action threshold for each pest species; monitor problem areas periodically to identify pest levels in relation to action threshold. |
| | Apply pesticides at appropriate time to maximize effectiveness and minimize risk of mobilization in storm runoff. |
| | Do not mix pesticides near storm drain inlets, culverts or watercourse. |
| | Along roadsides, select herbicides and application methods which retain some vegetative cover to reduce erosion and trap pollutants. |
| | Calibrate field equipment before use; mix only as much material as needed. |
| | Follow all legal requirements for Pesticide Management Zones (CCR Sec. 3, Title 3). |
| | Train applicators in safe use of pesticides and proper inspection of equipment condition |

## TABLE E-5

### TIER 1 PERFORMANCE STANDARDS, NPDES STORM WATER MANAGEMENT PLAN FOR MUNICIPAL DISCHARGES, CITY OF ALBANY CLEAN WATER PROGRAM.

| ELEMENT/subelement | TIER 1 (BASELINE) Performance Standards |
|---|---|
| *Pesticide usage and pest management (continued)* | |
| 3. Copper as an active ingredient | Reduce use of copper-based pesticides to maximum extent practicable; if applying copper as algicide, use chelated form to maintain solubility. |
| | Summarize annual copper usage and report to ACCWP. |
| 4. Diazinon as an active ingredient | Explore possibility of using alternative controls or less toxic chemicals to manage pest problems. |
| | Promote public outreach to homeowners regarding effects on aquatic life of home use of diazinon. |
| 5. Pesticide storage | Contact local fire department and County Agricultural Commissioner re pesticide storage requirements. |
| | Provide secondary containment for liquid products; provide spill kits, stored near pesticides, and train employees in their use. |
| | Store pesticides in labeled containers, in a locked and posted storage unit |
| 6. Pesticide disposal | If changing pesticides or cleaning spray tanks, use tank rinsewater as product over targeted area on application site. |
| | Rinse empty pesticide containers and empty rinsewater in the spray. |
| | Dispose of triple-rinsed containers per recommendations of manufacturer or County Ag. Commissioner. |
| | Try to find qualified user for unwanted pesticides, return to manufacturer (if unopened), recycle, or dispose of per hazardous waste regulations. |
| *Fertilizer usage* | |
| 1. General BMPs | [Tier 2 only] |
| 2. Fertilizer application | Avoid applications if runoff is probable; on hillsides, avoid applying more liquid than soil can absorb. |
| | Prior to applying fertilizer, check N-P-K concentrations; calibrate distributor to apply correct amounts. |
| | Prior to applying fertilizer, check that irrigation equipment is working properly; monitor irrigation system to avoid overwatering. |
| | Avoid high applications at times when crop usage is low. |
| 3. Park and general landscape areas | Select fertilizers to suit local soils conditions, climate and plant health. |
| | Fertilize plants based on plant type, physical appearance, soil or foliage testing. |
| 4. Golf courses | Distribute this information performance standard to golf course operators. |

# TABLE E-5

## TIER 1 PERFORMANCE STANDARDS, NPDES STORM WATER MANAGEMENT PLAN FOR MUNICIPAL DISCHARGES, CITY OF ALBANY CLEAN WATER PROGRAM.

| ELEMENT/subelement | TIER 1 (BASELINE) Performance Standards |
| --- | --- |
| *Fertilizer usage (continued)* | |
| 5. Fertilizer storage | Store fertilizers indoors in a shed or storage cabinet.<br>Dispose of triple-rinsed containers per recommendations of manufacturer or County Ag. Commissioner. |
| 7.0 New development and construction site controls | |
| 1. Measures and policies to control storm runoff | [Tier 2 only] |
| 2. Educational activities | Provide educational materials to municipal staff, developers, contractors, construction site operators, and owner/builders as appropriate.<br>Educate staff responsible for development application and plan review about storm water issues and controls; provide information on municipal design guidelines, ordinances, conditions of approval, contract specifications, protected sensitive areas.<br>Educate construction site inspectors on proper implementation and maintenance of erosion and sediment controls and materials/waste management BMPs |
| 3. Development application and plan review | Evaluate effect of development on stormwater runoff and wetlands in the CEQA process (revise checklist).<br>Consider water quality impacts in context of review and possible approval of public and private development projects. |
| 4. Erosion and sedimentation control | Review erosion control program for adequacy, based on the recommendations and ABAG's Manual of Standards for Erosion and Sediment Control Measures, and identify needed improvements.<br>As a condition of issuing a grading permit, require submittal of an effective erosion and sediment control plan for review and approval. |
| 5. State General Permit | For projects disturbing 5 or more acres, require submittal of a Notice of Intent (NOI) to the State Water Resources Control Board for coverage under the NPDES Construction Activity storm water permit. |
| 6. Construction site field inspections | Regularly inspect construction sites for adequacy of storm water control measures, with frequency based on size of project, amount of construction activity, and potential impact on storm water quality.<br>For construction sites requiring erosion and sediment control plans, inspect sites prior to beginning of wet season, to ensure adequacy of erosion and sediment control measures. |

# TABLE E-5

## TIER 1 PERFORMANCE STANDARDS, NPDES STORM WATER MANAGEMENT PLAN FOR MUNICIPAL DISCHARGES, CITY OF ALBANY CLEAN WATER PROGRAM.

| ELEMENT/subelement | TIER 1 (BASELINE) Performance Standards |
|---|---|
| 7.0 New development and construction site controls (continued) | |
| 6. Construction site field inspections | Inspectors will review Storm Water Pollution Prevention Plan before conducting inspection. During inspection, inspectors will: Inspect for and effectively prohibit non-storm water discharges, except those containing no pollutants; where possible, visually observe the quality of storm water runoff; require proper implementation of erosion control and waste management BMPs (e.g., covering stockpiles) to minimize discharge of pollutants and, where possible, visually observe the quality of storm water runoff; require proper implementation of erosion control and waste management BMPs (e.g., covering stockpiles) to minimize discharge of pollutants.<br><br>If appropriate, Inspectors will require correction of problems and will document illicit discharges so that they are reported in the ACCWP annual report. |
| 7. Watershed resource inventory and planning | [Tier 2 only] |
| 8. Coordination with ACFC&WCD and Zone 7 of ACFC&WCD | [Tier 2 only] |
| 9. Subcommittee meetings and workshops | At least one representative will attend ACCWP annual workshops.<br><br>Chair the New Development Subcommittee on a rotating basis<br><br>Designate staff person responsible for implementing New Development component, staying Informed, and acting as liaison to the New Development Subcommittee. |
| 8.0 Illicit discharge control | |
| 1. Develop an illicit discharge control inspection program | Prepare a written Action Plan demonstrating the agency's commitment to conducting an effective investigation, tracking and elimination of illicit discharges and describing the level of effort. The Action Plan should demonstrate that the agency has:<br><br>identified, verified and prioritized field screening areas for investigation and/or repeat inspections; developed a schedule for investigating high priority areas during the next year; selected the agency or group to conduct field activities and estimated labor hours required for implementation; determined how the investigations will be conducted, and how activities will be documented; adopted minimum enforcement requirements.<br><br>Develop procedures for followup enforcement or referral to another agency. |

# TABLE E-5

## TIER 1 PERFORMANCE STANDARDS, NPDES STORM WATER MANAGEMENT PLAN FOR MUNICIPAL DISCHARGES, CITY OF ALBANY CLEAN WATER PROGRAM.

| ELEMENT/subelement | TIER 1 (BASELINE) Performance Standards |
|---|---|
| 8.0 Illicit discharge control (continued) | |
| 2. Conduct field investigations | Conduct field investigations, including inspecting portions of the municipal storm drain system for potential illicit discharges: survey high priority areas (from Action Plan) and make observations; |
| | record observed or suspected dry weather flows; attempt to determine type of flow; trace to source using storm drain maps, inspecting manholes, making surface observations; record findings; if |
| | party identified, educate re impacts of actions, explain storm water requirements, provide BMPs; initiate follow-up or enforcement actions as necessary; record activities. |
| | Send a representative to General Program workshops to obtain additional training and share experiences. |
| 3. Evaluate compliance of non-stormwater dischargers | |
| A. Follow-up activities | If a discharge is traced to a residential source, inspectors will follow-up or coordinate follow-up with the appropriate agency until compliance is achieved. Staff will meet with responsible party to discuss methods of eliminating the illicit discharge. |
| | Provide program information. Begin enforcement procedures, if appropriate. If discharge is traced to a commercial or industrial activity, inspectors will coordinate with the industrial and commercial discharge control program |
| B. Enforcement | Conduct enforcement activities; report as outlined in the "Protocol for reporting Enforcement Activities". |
| | Inspectors will be provided sufficient responsibility and authority to initiate enforcement procedures. |
| 4. Investigate spill reports and complaints | Inspectors will investigate spill reports within their jurisdiction and record their activities. |
| | Inspectors will become familiar with existing spill response and clean-up programs covering agencies jurisdiction, and coordinate illicit discharge program activities with existing programs. |
| | Through internal comunication and public education, encourage use of "911" to report large or hazardous spills, or publicize alternative phone number for reporting. |
| | Establish a mechanism for obtaining information on spills so that source identificatin and follow-up actions can be conducted. |
| 5. Document and report completion | Summarize field investigations and follow-up activities on Illicit Discharge Inspection Quarterly Summary Report and incorporate into ACCWP annual reports. |

# TABLE E-5

## TIER 1 PERFORMANCE STANDARDS, NPDES STORM WATER MANAGEMENT PLAN FOR MUNICIPAL DISCHARGES, CITY OF ALBANY CLEAN WATER PROGRAM.

| ELEMENT/subelement | TIER 1 (BASELINE) Performance Standards |
|---|---|
| 8.0 Illicit discharge control (continued) | |
| 5. Document and report completion | Document the number and type of spills reported and responded to within agencies jurisdiction; Incorporate into ACCWP annual reports. |
| | Review annually the Illicit Discharge Action Plan and investigation results; assess whether or not goals were met and changes necessary. |
| 9.0 Industrial and commercial discharge controls | |
| 1. Develop an industrial and commercial business inspection plan | Prepare a written Inspection Plan outlining steps for conducting effective facility inspections in upcoming year. The Plan will contain: a review of types of business within jurisdiction; listing by businesses with greater potential to cause storm water pollution; priority list of businesses including number to be inspected during upcoming year; summary of efforts to coordinate inter/intra-agency Incorporate Inspection Plan into ACCWP mid-fiscal year report for submittal to the Regional Board. |
| | Ensure facility inspectors are adequately trained to conduct effective storm water inspections (regulations and requirements; impacts; techniques;BMPs; follow-up and enforcement procedures). |
| | Inspect high-priority facilities at least once each year, and all businesses potentially impacting storm water quality at least once every five years. |
| | Beyond inspection, conduct outreach to inform facility reps. about appropriate storm water BMPs. |
| 2. Inspection activities | Respond to complaints or referrals from agencies concerning a facility. Responses can include: interview; inspection; source-tracing; education; follow-up. |
| | Update list of businesses regularly. |
| --Preparing for a site visit | Review existing information on site and regulatory history; notification of upcoming inspection is at inspector's discretion. |
| --During a site visit | Review facility layout to locate storm drain system, drainage pathways, process areas, equipment maintenance areas; storm water sampling locations. |
| | Review/inspect the following areas for potential to discharge pollutants or exposure to runoff: outdoor process/mfg. areas; outdoor storage areas; outdoor waste storage/disposal areas; outdoor vehicle and equipment maintenance areas; outdoor parking areas; equipment on rooftops; outdoor wash areas; outdoor drainage from indoor areas; storm water conveyance system maintenance; emergency response practices; record information on appropriate reporting form. |
| | Inspectors may use a facilities SWPPP as a tool in assessing storm water pollution control compliance. |

# TABLE E-5

## TIER 1 PERFORMANCE STANDARDS, NPDES STORM WATER MANAGEMENT PLAN FOR MUNICIPAL DISCHARGES, CITY OF ALBANY CLEAN WATER PROGRAM.

| ELEMENT/subelement | TIER 1 (BASELINE) Performance Standards |
|---|---|
| 9.0 Industrial and commercial discharge controls (continued) | |
| --During a site visit | Inspectors will identify and inform facility representative about problems and violations; coordinate a schedule for correcting problems and verifying implementation; record on form. |
| | Inspectors will provide facility representative with BMP information and other education materials or agency referrals. |
| | Inspectors will obtain ongoing training, with representative attending General Program inspector training workshops. |
| 3. Evaluating facility compliance | |
| Repeat/follow-up inspections | Inspector to determine whether facility is in compliance with local storm water ordinance; Inspector will prioritize facility for re-inspection; if problem was previously identified, provide for follow-up or other means of verification of correction; begin enforcement procedures if appropriate. |
| Enforcement | Conduct enforcement activities. Report as outlined in the "Protocol for Reporting Enforcement Activities". |
| 4. Reporting | Review the Inspection Plan and inspection results annually and assess whether goals were met. Incorporate review into ACCWP annual reports to the Regional Board. |

Source: ACCWP Storm Water Management Plan (1997 - 2001)

# TABLE E-6

## TIER 2 PERFORMANCE STANDARDS, NPDES STORM WATER MANAGEMENT PLAN FOR MUNICIPAL DISCHARGES, CITY OF ALBANY CLEAN WATER PROGRAM (most subelements completed or to be implemented by the close of the current permit I

| ELEMENT/subelement | TIER 2 Performance Standards (to be implemented in 1997-2002) |
|---|---|
| **5.0 Public Information and participation (PI/P)** | |
| 3. Use of program outreach | (Year 3) Stencil >90% of storm drain inlets; maintain stencil readability. |
| 4. Agencies' community outreach program | (Year 3) Participate in four community outreach activities (including one focused on watershed awareness, repeated at least annually). |
| | (Year 3) Identify special needs of residents re adapting Clean Water Program materials (e.g., alternate language). |
| | (Year 5) Prepare and distribute materials adapted to the groups special needs. |
| 5. Coordination with public schools | (Year 3) Develop outreach materials and work with school officials to see that information about storm water pollution prevention and aquatic resource protection is taught to students. |
| **6.0 Municipal Maintenance** | |
| *Street Cleaning* | |
| 1. Street cleaning frequency | (Year 1) At-least monthly street cleaning on a fixed schedule. |
| | (Year 1) Identify areas for more frequent cleanings, or for cleaning just before fall rains. |
| *Storm drainage facilities and mainteance of watercourses* | |
| 1. Routine inspection and cleaning | (Year 1) Clean storm drain facilities (inlets, culverts, water course, open channels) annually, on average, preferably just before first rains. To minimize discharges, remove the maximum amount of material at the nearest access point. |
| | (Year 3) Develop a storm drain facility inspection and maintenance plan. |
| | (Year 3) Inspect locations where pollutants accumulate; clean prior to/immediately after rainy season. |
| | (Year 3) Inspect drain inlets monthly in wet season at locations where illegal dumping suspected. |
| | (Year 3) Modify street sweeping operations to minimize pushing debris into storm drain inlets. |
| 4. Spill response | (Year 2) Mail "notice of violation" letters; copy to local illicit discharge coordinator; notify other authorities if needed. |
| 5. Geographical problem areas | (Year 2) Identify alternate procedures for narrow/steep streets unsuited to street sweepers. |
| | (Year 3) Identify alternate procedures for streets with continual parking. |
| | (Year 3) Consider posting temporary No Parking signs on cleaning days. |

# TABLE E-6

## TIER 2 PERFORMANCE STANDARDS, NPDES STORM WATER MANAGEMENT PLAN FOR MUNICIPAL DISCHARGES, CITY OF ALBANY CLEAN WATER PROGRAM.

| ELEMENT/subelement | TIER 2 Performance Standards (implement in 1997-2002) |
|---|---|
| 6.0 **Municipal Maintenance (continued)** | |
| *Storm drainage facilities and mainteance of watercourses* | |
| 8. Target areas for improvements | (Year 3) Evaluate additional areas for watercourse enhancement (e.g., trash racks, oil absorbent booms). |
| 9. Pesticide use | (Year 2) Reduce to maximum extent use of algicides containing copper where discharges may enter watercourse or Bay. |
| 10. Desilting and disposal | (Year 2) Minimize desilted areas and disturbance of channel bottoms during desilting. |
| | (Year 2) Dispose of desilted material appropriately (away from watercourse). |
| 11. Vegetation | (Year 2) Consider retaining low-growing vegetation in channel bottoms and slopes when evaluating needs to mantain channel design capacity. |
| *Litter control* | (Year 2) Encourage litter reduction through public education (residential/commercial). |
| | (Year 2) Encourage enforcement of anti-littering laws. |
| | (Year 2) Document areas targeted for litter removal; total amount of litter removed. |
| | (Year 2) Label receptacles with anti-littering messages. |
| *Graffiti abatement* | (Year 2) If using washwater, protect storm drains and direct washwater to sanitary sewer. |
| | (Year 2) Consider using waterless removal method. |
| *Road repair and maintenance* | |
| 5. Equipment clean up/storage | (Year 1) Cover sprayers, patch and paving equipment to prevent rainfall from contacting pollutants. |
| *Corporation yards* | |
| 1. General BMPs | (Year 2) Consider developing/posting BMP notices for agencies using corporation yard. |
| | (Year 2) Develop educational materials and post them in appropriate areas. |
| 4. Fuel dispensing areas | (Year 1) Discourage mobile fueling; if mobile fueling necessary, perform only in designated area. |
| | (Year 1) Install signs reminding staff not to "top off" tanks. |

# TABLE E-6

## TIER 2 PERFORMANCE STANDARDS, NPDES STORM WATER MANAGEMENT PLAN FOR MUNICIPAL DISCHARGES, CITY OF ALBANY CLEAN WATER PROGRAM.

| ELEMENT/subelement | TIER 2 Performance Standards (implement in 1997-2002) |
|---|---|
| 6.0 Municipal Maintenance (continued) | |
| *Pesticide usage and pest management* | |
| 2. Pesticide usage | (Year 2) Maintain a record of all pesticide treatments at each site. |
| | (Year 2) Notify the public prior to spraying, as needed or requested. |
| *Fertilizer usage* | |
| 1. General BMPs | (Year 3) Work with PI/P subcommittee to develop educational materials to distribute to golf course designers, operators, landscape service companies and nurseries. |
| | (Year 3) Refer to the Fertilizer Usage standards in contract specifications. |
| 2. Fertilizer application | (Year 3) Confine fertilizer to targeted area; sweep, vacuum or otherwise remove from hardscaped areas (e.g., sidewalks) before irrigation or rainfall. |
| 4. Golf courses | (Year 1) Test well water or other irrigation source water for nutrient content (e.g., nitrates) as part of evaluating fertilizer needs. |
| | (Year 1) Test soil and foliage on greens and tees, as needed, to assess fertilizer needs; if copper is not needed eliminate it from the micronutrient mix. |
| 7.0 New development and construction site controls | |
| 1. Measures and policies to control storm water runoff | (Year 1) Incorporate New Development Subcommittee's conditions of approval into its development standards, as appropriate. |
| | (Year 1) Document permanent erosion and stormwater quality controls, controls during construction, operation and maintenance of structural controls in conditions of approval for public and private projects. |
| | Select suitable Best Management Practices (BMPs). |
| | (Year 1) Ensure that storm water quality requirements are included in plans and contract specifications for municipal projects. |
| | (Year 3) Develop and implement design guidelines and practices incorporating water quality protection measures for both public and private projects. |
| | (Year 3) Review existing legal authority in erosion control and storm water management and discharge control ordinances to determine ability to implement General Plan policies and authorize discretionary review of development projects. |
| | If necessary, amend existing ordinances or develop and adopt new ordinances. |

# TABLE E-6

## TIER 2 PERFORMANCE STANDARDS, NPDES STORM WATER MANAGEMENT PLAN FOR MUNICIPAL DISCHARGES, CITY OF ALBANY CLEAN WATER PROGRAM.

| ELEMENT/subelement | TIER 2 Performance Standards (implement in 1997-2002) |
|---|---|
| 7.0 New development and construction site controls (continued) | |
| | (When General Plans are amended), incorporate policies and implementation measures to preserve and enhance water quality. Designate specific areas as "water quality sensitive" to control water quality of storm water runoff in these areas, if applicable. |
| 2. Educational activities | (Year 3) Develop and provide to developers pre-application materials containing information on storm water controls (e.g., BASMAA site planning manual). |
| 3. Development application and plan review | (Year 1) Require public and private development projects to include site planning and design techniques to prevent or minimize impacts on water quality, including: |
| | minimize land disturbance; minimize directly connected impervious surfaces; use clustering; maintain/restore riparian areas and wetlands as amenities; establish buffer zones to reduce runoff into waterways. |
| | (Year 1) Require public and private development projects to include site permanent storm water controls. if sufficient site planning measures are not implemented or feasible. |
| 4. Erosion and sedimentation control | (Year 2) Make any needed improvements to erosion control program in areas of enforcement authority, minimum BMPs required, training and tools for inspectors, and information for developers and |
| | (Year 3) Require developers to provide permanent erosion and stormwater controls on plans submitted for projects. |
| 6. Construction site field inspections | (Year 1) For construction sites requiring erosion and sediment control plans, inspect sites following each major storm event or series of events during the wet season, to observe the effectiveness of erosion and sediment control measures. |
| 7. Watershed resource Inventory and planning | (Year 1) Determine criteria for sensitive areas. |
| | (Year 3) Review existing information on sensitive areas and watershed maps. |
| | (Year 3) Evaluate need for conducting a watershed resource inventory to identify and map sensitive areas, and to use as a tool for identifying development opportunities and constraints; if appropriate, develop an approach and schedule. |

## TABLE E-6

### TIER 2 PERFORMANCE STANDARDS, NPDES STORM WATER MANAGEMENT PLAN FOR MUNICIPAL DISCHARGES, CITY OF ALBANY CLEAN WATER PROGRAM.

| ELEMENT/subelement | TIER 2 Performance Standards (implement in 1997-2002) |
|---|---|
| **7.0 New development and construction site controls (continued)** | |
| 8. Coordination with ACFC&WCD and Zone 7 of ACFC&WCD | (Year 1) Through the New Development Subcommittee, initiate discussions with ACFC&WCD and Zone 7 to establish policies on operation and maintenance of new flood control facilities to maximize storm water quality control. |
| | (Year 3) Study, and if appropriate and feasible, implement operation and maintenance procedures for new flood control facilities which maximize storm water quality control. |
| **8.0 Illicit discharge control** | |
| 1. Develop an illicit discharge control inspection program | (Year 3) Include in Action Plan evaluation of inspection results from previous year and an assessment of which types of non-stormwater discharges were most prevalent. Use to revise Action Plan. |
| | (Year 5) Expand the illicit discharge inspection program to include low or medium priority field screening sites, until the entire drainage area has ben inspected once. |
| | (Year 5) Determine the appropriate frequency for repeat inspections of low and medium priority areas based on investigation of entire drainage area. |
| | (Year 5) Use electronic information on significant storm drainage facilities to track illicit discharges from neighboring jurisdictions which may enter storm drain system. |
| **9.0 Industrial and commercial discharge controls** | |
| 1. Develop an industrial and commercial business inspection plan | (Year 1) Evaluate inspection results from previous year to assess industry types most impacting storm water quality; adjust Inspection Plan as necessary |

Source: Alameda County Clean Water Program Storm Water Management Plan (1997 - 2002).

# TABLE E-7

## TIER 3 PERFORMANCE STANDARDS, NPDES STORM WATER MANAGEMENT PLAN FOR MUNICIPAL DISCHARGES, CITY OF ALBANY CLEAN WATER PROGRAM (under review for possible implementation after 2002).

| ELEMENT/subelement | TIER 3 Performance Standards (may be implemented at a later date) |
|---|---|
| 5.0 Public Information and participation (PI/P) | None proposed at this time. |
| 6.0 Municipal Maintenance | |
| *Corporation yards* | |
| 4. Fuel dispensing areas | Cover fuel dispensing areas; conduct fueling only over sealed concrete or asphalt. |
| | Design fueling area to contain spills, prevent storm water entry. |
| 8. Auxillary storage areas/yards | Drain all fluids from out-of-service equipment and vehicles; store materials under cover. |
| *Pesticide usage and pest management* | |
| 2. Pesticide usage | Use state-certified pesticide applicators. |
| 3. Copper as an active ingredient | Eliminate use of copper-based pesticides if comparable alternative available. |
| 4. Diazinon as an active ingredient | Eliminate use of diazinon. |
| *Fertilizer usage* | |
| 2. Fertilizer application | Use a drop spreader within first four feet of paved surfaces. |
| 3. Park and general landscape areas | To avoid overapplication, test soil and/or plant tissue for nutrients and trace elements before applying fertilizer; if copper is not needed eliminate it from the micronutrient mix. |
| 4. Golf courses | Design golf course to restore and/or maintain riparian areas, wetlands, and establish buffer zones along sensitive wetland areas to reduce runoff to waterways. |
| | Consider using detention ponds to control runoff and remove excess nutrients; divert excess irrigation water to roughs. |
| | Test soil and foliage on fairways, as needed, to assess fertilizer needs; if copper is not needed eliminate it from the micronutrient mix. |
| 7.0 New development and construction site controls | |
| 5. State General Permit | Prior to construction of a project disturbing 5 or more acres, require submittal of a copy of the projects Storm Water Pollution Prevention Plan. |
| | For projects disturbing less than 5 acres, require submittal of an abbreviated Storm Water Pollution Prevention Plan to show that BMPs to protect storm water quality are incorporated into the project. |
| | Coordinate construction inspections and enforcement of corrective actions with Regional Board staff. |
| 9. Subcommittee meetings/workshops | A designated representative will attend all New Development Subcommittee meetings. |

# TABLE E-7

**TIER 3 PERFORMANCE STANDARDS, NPDES STORM WATER MANAGEMENT PLAN FOR MUNICIPAL DISCHARGES, CITY OF ALBANY CLEAN WATER PROGRAM** (continued).

| ELEMENT/subelement | TIER 3 Performance Standards (study for potential implementation at a later date) |
|---|---|
| **8.0 Illicit discharge control** | |
| 3. Evaluate compliance of non-stormwater dischargers | |
| B. Enforcement | Assist Industrial and Illicit Discharge Subcommittee to develop criteria to initiate each enforcement level described in the "Protocol for reporting Enforcement Activities". |
| 4. Investigate spill reports complaints | Identify an appropriate role for agency participation in spill response drills, in cooperation with other agencies or industries, and ensure adequate spill response supplies are available. |
| 5. Document and report completion | Develop a computerized data management system for managing and tracking information colected during field investigations and follow-up activities. |
| | Link information to storm drain and area maps through GIS or other system to improve coordination and efficiency of future activities. |
| **9.0 Industrial and commercial discharge controls** | |
| 1. Develop an industrial and commercial business inspection plan | Coordinate outreach info with other ACCWP subcommittees and storm water inspection programs. |
| | Expand inspection program to include additional types of outreach and inspection activities. |

Source: Alameda County Clean Water Program Storm Water Management Plan (1997 - 2002).

# APPENDIX F

# EXISTING CREEK CHANNEL CONDITIONS

## GEOLOGIC SETTING

The existing watersheds and drainage channels located within Albany have their origin in the natural drainage patterns which existed here before there was any influence from humans.

These patterns are based on the dominating topographic feature of the area, the Berkeley Hills rising to the east of Albany. Streams originating on the west side of the hills have a dominant flow pattern from east to west. The steepest portion of these channels are located in the eastern region, with progressively flatter slopes being found as the creeks flow west.

The upper portion of these creeks are cut into the overlying weathered sediments and underlying bedrock, and are gradually removing the hills through erosion. Remnants of the hills can be seen in Albany Hill, and the ridge along which Solano Avenue is located. At the base of the Berkeley Hills, the creeks periodically overflowed, depositing additional material on the creek banks. This sediment formed a broad alluvial plain, which today forms most of the area on which Albany is located. Remnants of this overflow and deposition pattern can be seen in the present day topography of some areas near Cerrito Creek, Codornices Creek, and the former Marin Creek, where the existing land actually slopes away from the creek, rather than towards the creek.

*Examples of bedrock material in creek channels can be seen in the Codornices Creek channel east of Albinia Street, near St. Mary's High School.*

Where the streams met the Bay, finer sediments were deposited in mudflats, and tidal marsh covered wide areas. Many of these marsh areas have since been filled and covered.

*These flatter sections of the creeks can cause maintenance and flooding problems.*

Today, there are five main creeks and watersheds located in and surrounding the City, as shown in Figure 1.

A number of areas in Albany lack underground storm drains, and storm runoff is carried in street gutters and shallow cross street drains. Many of these areas have shallow culverts that serve to carry water across the street or across pedestrian crosswalks. These drainage structures consist of shallow pipes with inlets on the uphill side of the intersection, and outlets to the street gutter on the down hill side of the intersection. Because these pipes are shallow with a flat slope, many of these drainage systems are subject to frequent plugging, and require considerable maintenance. In addition, many of the metal sections are corroding, and the metal fragments tend to snag maintenance hoses, and cause debris to collect rapidly. Since these pipes were often constructed with a concrete encasing, most of these facilities are probably structurally adequate in spite of the corrosion of the metal pipe (although several have required replacement recently, and others are currently in need of repair), but they continue to be a maintenance problem.

In order to upgrade the existing storm drain system to current day standards, the construction of regular storm drains would probably be desirable in some of these areas. This would also have the benefit of reducing the maintenance problems that are currently being experienced with the cross street drains in these areas.

Table 5 shows the areas where street gutter flows in Albany were estimated using the hydraulic analysis, and where underground storm drain systems could be considered for construction.

Table 5
Street Gutter Flows

| Downstream Location | Upstream Location | Downstream Flow (cfs) | Upstream Flow (cfs) |
|---|---|---|---|
| **Middle Creek Watershed** | | | |
| Key Route Boulevard at Portland Avenue (east side) | Thousand Oaks Boulevard at San Carlos Avenue (north Side) | 13.2 | 6.2 |
| San Pablo Avenue at Clay Street (east side) | Portland Avenue at Talbot Avenue (south side) | 15.0 | 6.4 |
| San Pablo Avenue at Clay Street (west side) | Washington Avenue at Madison Avenue (north side) | 13.6 | 8.8 |
| **Marin Creek Watershed** | | | |
| Cleveland Avenue at Buchanan Street (east side) | Cleveland Avenue at Solano Avenue (east side) | | 6.4 |
| Buchanan Street at Polk Street (north side) | Cerrito Street at Solano Avenue (west side) | 8.7 | 5.3 |
| Washington Avenue at Kains Avenue (south side) | Washington Avenue at Talbot Avenue (south side) | 11.5 | 8.2 |

Although the Philip Williams hydraulic analysis estimates a capacity of 350 cfs at Interstate-80, this is based on an overflow water surface elevation of 12.2 feet. Using the 1997 topographic maps, overflows from Codornices Creek would occur at 2nd Street when water levels reached an elevation of about 9 feet (a GPS control survey point at the north end of 2nd Street is 8.81 feet). The capacity of the culvert is estimated to be about 200 cfs if this lower water surface is used. Overflows at 2nd Street would spread both to the north and the south of the creek.

Table 6
Codornices Creek Culvert Capacities

| Location | Culvert Size | Street Elevation (ft) | Invert Elevation (ft) | Maximum Channel Depth (ft) | Flow Capacity (cfs) |
|---|---|---|---|---|---|
| Ordway Street | 6 x 6 concrete arch | | | 14 est. | 500 |
| Peralta Avenue | 6 x 6 concrete arch | 90.1<br>89.0 | 76.1 | 14.0 | 500 |
| Neilson Street | 6 x 6 concrete arch | 81.2<br>80.9 | 67.2<br>67.1 | 14.0 | 500 |
| Curtis Street | 6 x 6 concrete arch obstructed height 3.1 ft | 75.6<br>75.8 | 62.2 | 13.6 | 490 (full opening)<br>250 (reduced opening) |
| Santa Fe Avenue | 6 x 6 concrete arch | 72.8 | 59.8 | 13.0 | 475 |
| Masonic Avenue | 6 x 6 concrete arch | 70.6 | 58.4 | 12.2 | 455 |
| Evelyn Avenue | 6 x 6 concrete arch | 66.8 est. | 55 est. | 11.8 | 440 |
| Talbot Avenue | 6 x 6 concrete arch | 64 est. | 52 est. | 12 | 450 |
| Cornell Avenue | 6 x 6 concrete arch | 58 est. | 47 est. | 11 | 420 |
| Stannage Avenue | 6 x 6 concrete arch | 53.4 | 43.0 | 10.4 | 400 |
| Kains Avenue | 6 x 6 concrete arch | 47.9 | 40.9 | 7.0 | 265 |
| San Pablo Avenue | 5.5 x 9.8 box obstructed height 3.5 ft | 43.6 est | 35 | 8 | 510 (max. height)<br>390 (obstructed height) |
| 10th Street | 3 x 8 box | 37.3 | 31.6 | 5.7 | 220 |
| 8th Street | 4 x 8 box | 28.4 | 21.5 | 6.9 | 310 |

| | | | | | |
|---|---|---|---|---|---|
| 6th Street | 3 x 9 box available depth | 18.0 | 12.3 | 5.7 | 250 |
| 5th Street | 72 inch concrete pipe & metal pipe | 15.5 | 8.5 | 7.0 | 285 |
| Railroad | trestle | | | | 200 |
| 2nd Street | bridge | | | | |
| Interstate I-80 | 6 x 6 concrete arch | 9 overflow at 2nd Street | 3.3 | 5.7 | 200 |
| Culvert capacities based on inlet control hydraulic conditions. Where two street elevations are given, upstream side is shown first and downstream side second. Measured street elevations and depths east of San Pablo Avenue surveyed July 1997 at inlet grates using GPS methods. Elevations west of San Pablo Avenue based on 1993 hydraulic study by Philip Williams Associates. Estimated elevations are from 1997 topographic maps. | | | | | |

The invert of the culvert at Curtis Street is set below the existing creek level, so the clear opening at this location is reduced to about half the total culvert depth, and water is ponded to a depth of 2 to 3 feet at this location. (It should be noted that this ponding is part of the wildlife habitat of the area, as a 6-inch trout was observed in this area.) High flows during major storms probably scour out at least some of this accumulated sediment. The fact that during the January 1997 storm, no indication was given of overflows to the street in this area appears to confirm this.

The water levels in Codornices Creek are expected to generally be controlled by the capacities of the street culverts. Although the culverts are more efficient from a hydraulic standpoint than open channel areas (because culverts have a lower roughness coefficient), the culverts usually have considerably less cross-sectional area available than the adjacent channel areas. Therefore, the culverts represent a constriction to flow during major storm events such as the 10-year and larger storm flows. This is confirmed by the hydraulic analysis of Codornices Creek from Interstate-80 to San Pablo Avenue, where the capacity of the culverts at 5th Street, 6th Street, and 10th Street were found to be impediments to flow, as compared to the open channel sections.

# APPENDIX G

# EXISTING CREEKSIDE VEGETATION AND WILDLIFE

## EXISTING CREEKSIDE VEGETATION AND WILDLIFE

Nomenclature used throughout this report conforms to Hickman (1993) for plants and Holland (1986) for plant communities; plant community names according to Sawyer and Keeler-Wolf (1995) are also given where appropriate. Nomenclature for special-status plant species conforms to CDFG (1997a) and Skinner and Pavlik (1995). Additional references consulted include Ertter (1997) and Munz (1968).

### EXISTING VEGETATION

#### Vegetation Communities

Major natural plant communities occurring along existing creek segments in the City of Albany include northern coastal salt marsh, Central Coast riparian scrub, coastal brackish marsh and coastal freshwater marsh. Coast live oak woodland is also present immediately adjacent to some creek sections. Prominent non-native habitats occurring onsite include ruderal, non-native mixed woodland/brush and eucalyptus woodland. Intensively developed and maintained landscaped areas are also a common feature of the creeks.

The vegetation throughout much of the four daylighted creeks has been greatly altered by human activities. Creek channelization, road construction and development have resulted in the removal of much of the indigenous vegetation and confined that which remains to a mostly narrow band immediately adjacent to each channel. Landscaping and colonization by invasive exotic species has further degraded the native plant communities.

Despite historic impacts and current threats, remnants of the natural vegetation that once occurred throughout the region can still be found within the study area. Native and non-native plant communities detected during the present study are described below.

#### Special-status Plants, Animals and Natural Communities

Certain plants, animals and natural communities are designated as having "special-status" due to their overall rarity, endangerment, restricted distribution, and/or unique habitat requirements. In general, it is a combination of these factors that leads to the designation of a species as sensitive. The federal Endangered Species Act (ESA), as amended, enacted by Congress in 1973, outlines the procedures whereby species are listed as endangered or threatened and establishes a program for the conservation of such species and the habitats in which they occur. Many individual states have enacted their own listing procedures to provide for the protection of additional locally sensitive biological resources. The California Endangered Species Act of 1984 amends the California Fish and Game Code to protect species deemed to be locally endangered and essentially expands the number of species protected under the ESA.

## Special-status Plant Taxa

Special-status plant species include those listed as endangered, threatened, rare, or as candidates for listing by the U.S. Fish and Wildlife Service (USFWS 1995, 1996a, b), the California Department of Fish and Game (CDFG 1997a, b), the California Native Plant Society (CNPS) (Skinner and Pavlik 1997). The CNPS listing is sanctioned by the CDFG and serves essentially as their list of "candidate" plant species. The CDFG generally requires that all taxa on CNPS lists 1B and 2 be addressed in California Environmental Quality Act (CEQA) documents and recommends that taxa on CNPS lists 3 and 4 also be considered.

Based on a review of the CNDDB (CDFG 1997c), Skinner and Pavlik (1997) and Olson (1994), a total of 33 special-status plant taxa were determined to have a potential for occurring in the project vicinity. A summary of the status, habitat affinities, reported localities in the project area, blooming period, and potential for occurrence onsite for each of the target plant species is presented in Table D-1 in Appendix D.

Of the 33 target special-status plant taxa searched for, only one, marsh gumplant, occurs within the study area. Although not believed to be naturally occurring, northern California black walnut, was also detected. Both species are described in more detail below. One additional taxon, soft bird's-beak, is considered to have a moderate potential for occurrence onsite due to the presence of suitable habitat and the fact that it is recorded in the vicinity. Soft bird's-beak is also described below.

Of the remaining 30 target species, none are considered to have a high potential for occurrence onsite and seven are considered to have only a low potential for occurrence. The remaining target species are not believed to have any potential for occurrence within the study area due to a lack of suitable habitat or the fact that they would have been readily detectable during the present survey.

## Special-Status Animal Taxa

Special-status wildlife species include those listed as endangered, threatened, rare or candidates for listing by the USFWS (1995, 1996a, b) or CDFG (1997d), those listed as "Special Animals" by the CDFG (1994). Additional species receive federal protection under the Bald Eagle Protection Act (*i.e.*, bald eagle, golden eagle) and the Migratory Bird Treaty Act CEQA Section 15380(d). The CDFG further classifies some species under the following categories: "fully protected", "protected fur-bearer", "protected amphibian", and "protected reptile". The designation as "protected" indicates that a species may not be taken or possessed except under special permit from the CDFG; "fully protected" indicates that a species can be taken for scientific purposes by permit only.

The Audubon Society's Blue List (Tate 1986) is a list of bird species considered to be declining in the United States. The list does not include species already listed by the federal government as endangered or threatened. Local populations may, and often do, differ in status from the Blue List status for the entire U.S. and the actual degree of sensitivity of species on the Blue

List depends on their local status.

The USFWS recently changed its policy on candidate species. The term "candidate" now strictly refers to species for which the USFWS has on file enough information to propose listing. Former Category 2 candidate species are now regarded as "Species of Concern" but are no longer monitored by the USFWS. However, the USFWS encourages the consideration of these taxa during project planning and environmental review as they may become candidate species in the future.

Based on a review of the Natural Diversity Data Base (CDFG 1997d), a total of 20 special-status animal species are known to occur in the project vicinity. A summary of the status, habitat affinities, reported localities in the project area, and potential for occurrence onsite for each of the target plant species is presented in Table D-2 in Appendix D.

Of the 20 target special-status animal taxa only one, northwestern pond turtle, was detected during the present surveys. An unidentified species of trout, possibly steelhead (rainbow) trout, was also observed. Salt marsh harvest mouse is considered to have a moderate to high potential for occurrence within the study area based on the presence of suitable habitat onsite and in the project vicinity. One additional taxa, monarch butterfly, is considered to have a potential roost within the study area, and has been reported sighted in the eucalyptus stands in the UC Village and on the Gill tract.

Of the remaining 16 target species, eight are considered to have only a low potential for occurrence. The remaining eight target species are not believed to have any potential for occurrence within the study area due to a lack of suitable habitat or the fact that they would have been readily detectable during the present survey.

### Special-Status Natural Communities

Special-status natural communities are those which are considered rare in the region, support special-status plant or wildlife species, or receive regulatory protection (*i.e.*, §404 of the Clean Water Act and/or the CDFG §§1600 *et seq.* of the California Fish and Game Code). In addition, the CNDDB has designated a number of communities as rare; these communities are given the highest inventory priority (Holland, 1986; CDFG, 1990). In addition, policies outlined in the Contra Costa County General Plan (1991) calls for the preservation of significant trees, significant ecological resources, important wildlife habitats and natural vegetation, including creeks, wetlands and woodlands. Impacts to special-status natural communities would be regarded as significant by the CDFG which would recommend avoidance or the implementation of mitigation procedures during the review of CEQA documents.

The study area supports four special-status natural communities that are regulated by state, federal or county legislation or policies. These include Central Coast riparian scrub, coastal brackish marsh, coastal freshwater marsh and northern coastal salt marsh.

Wetlands such as Central Coast riparian scrub, coastal brackish marsh, coastal freshwater marsh and northern coastal salt marsh are considered to be sensitive and declining resources by several regulatory agencies including the CDFG and the USFWS. Impacts to wetlands are specifically addressed by the CDFG Code §§1600 *et seq*. and fall under the jurisdiction of the § 404 permit process. Permit provisions of the Clean Water Act regulating dredge and fill operation are enforced by the U.S. Army Corps of Engineers (ACOE) and U.S. Environmental Protection Agency (EPA), with technical input from the USFWS, the Natural Resources Conservation Service (NRCS-formerly the Soil Conservation Service), and the National Marine Fisheries Service (NMFS). The ACOE exerts jurisdiction over "waters of the U.S." which include territorial seas, tidal waters, and non-tidal waters in addition to wetlands and drainages that support wetland vegetation, exhibit ponding or scouring, show obvious signs of channeling, or have discernible banks and high water marks.

The ACOE considers wetlands to be important to the public interest by performing vital functions (Corps of Engineers Regulatory Program Regulations, §33 CFR 320.4). Wetlands serve significant biological functions by providing nesting, breeding, foraging, and spawning habitat for a wide variety of resident and migratory wildlife species. Wetlands also provide for the movement of water and sediments, ground-water recharge, water purification, storage of storm runoff, and recreation and transport.

**Other Significant Botanical Resources**

Botanically significant resources consist of species that are considered unusual in the East Bay (Lake 1995).
Regionally significant plant species occurring within the study area include marsh gumplant and Oregon ash. These species are described below.

<u>Northern Coastal Salt Marsh</u>
Northern coastal salt marsh consists of highly productive, herbaceous and suffrutescent perennials up to 3-4 feet tall. Usually found along sheltered margins of bays, lagoons and estuaries, this plant community develops a dense to moderate cover. Subject to continuously fluctuating salinity and water levels, northern coastal salt marsh is typically dominated by a low diversity of salt tolerant hydrophytes. Depending on topography, clear transitions in species composition are frequently evident as one progresses from the lower to middle to upper littoral zones. Northern coastal salt marsh occurs extensively in the San Francisco Bay, Morro Bay, Elkhorn Slough and Tomales and extends from near Point Conception to the Oregon border.

Within the study area, northern coastal salt marsh is best developed on flats within the high tide zone at the mouth of Codornices Creek and Cerrito Creek. These are limited to highly modified areas that have been altered by road and railway construction and grading. Lower littoral sites are dominated by Pacific cordgrass (*Spartina foliosa*). Middle littoral zones are dominated by pickleweed (*Salicornia virginica*) with lesser amounts of alkali heath (*Frankenia salina*), jaumea (*Jaumea carnosa*) and marsh gumplant (*Grindelia stricta* var. *angustifolia*).

Northern coastal salt marsh conforms to the cordgrass series and pickleweed series as described in Sawyer and Keeler-Wolf (1995) and would be classified as estuarine intertidal emergent persistent wetland following Cowardin, *et al.* (1979).

Central Coast Riparian Scrub

Central Coast riparian scrub typically consists of a scrubby streamside, open to impenetrable thicket composed of any of several species of willows. This plant community occurs close to river channels and near the coast on fine-grained sand and gravel bars with a high water table. It is distributed along and at the mouths of most perennial and many intermittent streams of the South Coast Ranges, from the Bay Area to near Point Conception (Holland 1986). Central Coast riparian scrub is generally regarded as early seral, meaning that it typically precedes the development of other riparian woodland or forest communities in the absence of severe flooding. However, outside of riparian situations, that is, near groundwater seeps, willow-dominated scrub is not considered seral.

Within the study area, Central Coast riparian scrub is restricted to narrow drainages in the southern half of the study area. It has also formed small clumps around seeps and springs at several locations. Characteristic native species occurring onsite include arroyo willow (*Salix lasiolepis*), red willow (*Salix laevigata*), California blackberry (*Rubus ursinus*), evergreen thornless blackberry (*Rubus ulmifolius* var. *inermis*), Fremont's cottonwood (*Populus fremontii* ssp. *fremontii*) and poison oak, among others. Other native riparian tree species occurring within the study area include big leaf maple (*Acer macrophylla*), box elder (*Acer negundo* ssp. *californicum*), blue elderberry (*Sambucus mexicana*), white alder (*Alnus rhombifolia*) and California sycamore (*Platanus racemosa*).

Onsite, Central Coast riparian scrub conforms to the red willow and arroyo willow series as described in Sawyer and Keeler-Wolf (1995) and palustrine shrub-scrub wetland following Cowardin, *et al.* (1979).

Coastal Brackish Marsh

Coastal brackish marsh is typically dominated by perennial, emergent and herbaceous monocots to 2 meters tall. Cover is often complete and dense. Species composition is characterized as being intermediate between coastal salt marsh and coastal freshwater marsh communities, supporting species from both. Sites are subject to salt water intrusion from high tides but made brackish from freshwater run-off. Salinity levels vary considerably by season. coastal brackish marshes are typically found at the interior edges of coastal bays, estuaries and lagoons and are most extensive in Suisun Bay at the mouth of the Sacramento-San Joaquin River delta. Onsite, coastal brackish marsh conforms to the Cattail Bulrush Series as classified by Sawyer and Keeler-Wolf (1995) and would be classified as a riverine tidal emergent wetland following Cowardin, *et al.* (1979).

Within the study area, coastal brackish marsh consists of scattered stands of emergent wetland species such as cattail (*Typha latifolia*), California bulrush (*Scirpus californicus*), saltmarsh bulrush (*Scirpus maritimus*) and marsh gumplant, among others.

Coastal Freshwater Marsh

Coastal freshwater marsh typically occurs in low-lying sites that are permanently flooded with fresh water and lacking significant current. It is found on nutrient-rich mineral soils that are saturated for all or most of the year. This vegetation community is most extensive where surface flow is slow or stagnant or where the water table is so close to the surface as to saturate the soil from below. Coastal freshwater marsh is distributed along the coast and in coastal valleys near river mouths and around the margins of lakes, springs, and streams (Holland 1986). This vegetation community characteristically forms a dense vegetative cover dominated by perennial, emergent monocots 1-15 feet high that reproduce by underground rhizomes.

Within the study area, coastal freshwater marsh consists of scattered patches and continuous bands along drainage courses. Characteristic native species occurring onsite include narrowleaf cattail (*Typha angustifolia*), common large monkey-flower (*Mimulus guttatus*), umbrella sedge (*Cyperus eragrostis*), duckweed (*Lemma* sp.), Pacific oenanthe (*Oenanthe sarmentosa*) and common horsetail (*Equisetum arvense*), among others.

Within the study area, this vegetation type does not conform to any particular series as classified by Sawyer and Keeler-Wolf (1995). It would be classified as a palustrine permanently flooded wetland following Cowardin, *et al.* (1979).

Coast Live Oak Woodland

Coast live oak woodland is typically found on north-facing slopes and shaded ravines in the southern and inland portions of the state and on more exposed, mesic sites in the north. This community is dominated by coast live oak (*Quercus agrifolia*) which frequently occurs in pure, dense stands with a closed canopy. Coast live oak woodland is restricted primarily to the coast side of the state and is distributed from Sonoma County to Baja California. It occurs throughout the outer South Coast Ranges and coastal slopes of the Transverse and Peninsular ranges, usually below 4,000 feet in elevation.

Other tree species commonly associated with coast live oak woodland and detected onsite include big-leaf maple, California buckeye (*Aesculus californica*), California bay (*Umbellularia californica*) and toyon (*Heteromeles arbutifolia*), among others. Within this plant community, the shrub layer is typically poorly developed and the herbaceous layer is continuous. Characteristic shrub species detected onsite include snowberry (*Symphoricarpus mollis*), poison oak (*Toxicodendron diversilobum*), Himalayan blackberry (*Rubus discolor*) and coyote bush (*Baccharis pilularis*). Characteristic herbaceous plants detected onsite include such non-native species as bromes (*Bromus* spp.), wild oat (*Avena* spp.) and goose grass (*Galium aparine*) as well as native species such as miner's lettuce (*Claytonia perfoliata*) and bracken fern (*Pteridium aquilinum*), among others.

Onsite, this vegetation type conforms to the coast live oak series as classified by Sawyer and Keeler-Wolf (1995) and primarily as an upland as described in Cowardin, *et al.* (1979).

Ruderal/Landscaped

Ruderal habitat is that from which the native vegetation has been completely removed by grading, cultivation, or other surface disturbances. Such areas, if left undeveloped, may become recolonized by invasive exotic species as well as native species. The native vegetation may ultimately become at least partially restored if the soils are left intact and there is no further disturbance.

Numerous areas onsite have been highly disturbed by channelization of the creek, development, grading and landscaping. On sites that have been cleared but left fallow, ruderal (weedy) non-native and native plant species have become established. Weedy species common encountered include sweet fennel, black mustard (*Brassica nigra*), brome grasses (*Bromus* spp.), Italian thistle (*Carduus pycnocephalus*), bristly ox-tongue (*Picris echioides*), horse weed (*Conyza bilboana*), wild oats (*Avena* spp.) and filaree (*Erodium* spp.), among others. Ruderal habitat is not specifically described by Sawyer and Keeler-Wolf (1995) and would be classified as upland following Cowardin, *et al.* (1979).

Eucalyptus Woodland

This non-native plant community has naturalized in California since eucalyptus trees were first brought to the state in the mid 1880s. Numerous species of the genus were imported for their horticultural interest and their potential utility as a fast-growing hardwood. Groves of eucalypts were first planted in the vicinity of Berkeley and later planted in groves throughout the Central Coast and into southern California. Because climatic conditions in the western half of the state are very similar to the range of many of the imported species of eucalypts in Australia, the planted groves managed to persist and spread without cultivation. It is estimated that there are between 600 and 800 species of *Eucalyptus*, about 18 of which have become fairly widespread in California. The most common and widely grown species is Tasmanian blue gum. Because the so-called gum trees form dense, expanding groves, drop a tremendous amount of bark and leaf litter, and greatly alter the chemistry of the soil, eucalypts have contributed to the loss of native plant communities which typically cannot persist in the understory. Eucalypts have had an especially adverse effect on the coastal scrub and coast grassland communities.

Within the study area, eucalyptus woodland is dominated by Tasmanian blue gum (*Eucalyptus globulus*). Trees were planted for ornament or as wind breaks, consisting of scattered indivuduals or rows along the creeks' upper banks.

Eucalyptus woodland is not a native plant community and is therefore not described in Sawyer and Keeler-Wolf (1995); it would be classified as an upland following Cowardin, *et al.* (1979).

## Special-status Plant Taxa

Marsh Gumplant

Marsh gumplant (*Grindelia stricta* var. *angustifolia*) is a perennial in the sunflower family. It is a prostrate to erect sub-shrub reaching five feet in height. It has reddish-brown stems and glandular sticky oblong leaves up to six inches in length. It produces numerous inflorescences with bright yellow ray flowers from August through October and occurs infrequently in coastal salt marshes throughout the Central Coast from Napa and Sonoma counties to Monterey County. Marsh gumplant is on the CNPS List 4; it has no status as a state or federally protected taxon, although the CDFG recommends that impacts to it be addressed in CEQA documents.

Within the most downstream sections of Cerrito Creek and Codornices Creek marsh gumplant occurs in dense to sparse bands along the creek banks and around the periphery of the salt marsh at or above the high tide line.

Northern California Black Walnut

Northern California black walnut (*Juglans californica* var. *hindsii*) is a federal species of special concern and is on the CNPS list 1B as a species that is rare or endangered in California and elsewhere. Only 2 out of 3 natural stands of this native variety are still extant in Napa and Contra Costa counties (Skinner and Pavlik 1997). Northern California black walnut is a large, single-trunked deciduous tree reaching 80 feet in height. It once was found mostly around old Indian campsites and occurred from Lake and Napa counties to Contra Costa and Stanislaus counties. It is frequently found growing as a street tree in central California and was widely used as root stock for budding English walnuts (*Juglans regia*), with which it freely hybridizes.

Northern California black walnut occurs onsite and in the project vicinity. The presence of these trees is not regarded as significant: it is believed that they were either planted for ornament or have sprouted from former orchard plantings. English walnut, the common eating walnut, also occurs in the project vicinity.

Soft Bird's-beak

Soft bird's-beak (*Cordylantus mollis* ssp. *mollis*) is an annual hemiparasite belonging to the figwort family (Scrophulariaceae). It produces few to many gray-green, glandular pubescent stems reaching four to 16 inches in height. Flowers are whitish and are produced July through November. It occurs in coastal salt marshes in Contra Costa, Napa, and Solano counties; it is believed to be extinct in Sonoma and Marin counties. Soft bird's-beak listed as Rare by the state of California and has been proposed for listing as Endangered by federal government. It is on the CNPS List 1B:3-2-3.

Although soft bird's-beak was not detected during the present survey and is expected to have been recognizable, it is considered to have a moderate potential for occurrence onsite due to the presence of abundant suitable habitat and because it has been recorded from Point Pinole approximately nine miles to the north.

## Special-Status Animal Taxa

### Western Pond Turtle

Western pond turtle (*Clemmys marmorata*) is a moderate-sized, drab brown or khaki-colored turtle lacking prominent marking on its carapace. The belly or plastron is variously marked with varying degrees of dark and light markings. The iris is straw-colored with a brown eyestripe extending through the eye. Western pond turtle is a distinct taxon that has not been confused with any other turtle. northern and southern subspecies hae been described that exhibit some morphological differentiation and are believed to intergrade over a broad range in central California. Western pond turtle is a thoroughly aquatic turtle restricted to permanent water of ponds, marshes, rivers, streams, and irrigation ditches with a mud or rocky bottom and lined with aquatic vegetation. They are usually seen basking on logs, mats of floating vegetation, and mud banks. They usually leave their aquatic habitat to reproduce, aestivate, and over-winter. Historically, the species had a relatively continuous distribution in most Pacific slope drainages from Klickitat County, Washington to northern Baja California. Their known elevational range is from sea level to nearly 4,700 feet. Western pond turtle is currently regarded as a species of concern by both the state and federal governments.

Within the study area, western pond turtle was observed in the downstream portion of Codornices Creek. A single, mature individual was observed basking on two separate occasions in the channelized portion of the creek just upstream from the Southern Pacific Railroad tracks. The site is not considered to have any special habitat value for the species and its presence was regarded with surprise. Suitable habitat for western pond turtle is present upstream in more natural settings. However, due to the lack of large, deep pools and because of the accessible and disturbed nature of the lower portion of Codornices Creek, the western pond turtle is not expected to represent part of a viable population.

### Steelhead (Rainbow) Trout

Steelhead or rainbow trout (*Oncorhyncus mykiss*) is an native, pelagic, anadromous fish that spawns in freshwater and migrates to the open ocean where it remains. The species inhabits the cold headwaters of coastal creeks, small to large rivers and lakes. It is native to the Pacific slope from Alaska to Baja California. As adults, steelhead trout typically migrate from the ocean into their native streams when stream flows are high, spawning in the spring. They are known to spawn in intermittent streams, but juveniles emigrate into perennial streams soon after hatching. Central Coast populations of steelhead trout (*O. m. irideus*), including the San Francisco Bay Area, are listed as a threatened by both the state of California and the federal government. A possible steelhead was sighted during the present survey in Codornices Creek between Curtis and Santa Fe streets. An anecdotal claim by a neighbor indicates that the species has also been seen between Peralta and Nielson streets. While Codornices Creeks supports suitable habitat for the species, including perennial flows, riffle pools and abundant overhanging vegetation, channelization and culvert construction of the lower portions of the creek leading to the San Francisco Bay are believed to seriously restrict the migration of the species.

## Other Significant Botanical Resources

Oregon Ash

Oregon ash (*Fraxinus latifolia*) is a stout tree in the olive family (Oleaceae). Specimens grow up to 80 feet high or more. It has pinnately compound leaves with 5-7 oblong to oval leaflets 2-3 inches long. Plants are dioecious (producing either male or female flowers), flowering from March through May. Fruits are winged samaras. Oregon ash is found in canyons, woodlands and near stream banks. It occurs in the Coast Ranges from Santa Clara County to British Columbia and at the western base of the Sierra Nevada from Kern to Modoc counties. In the East Bay, Oregon ash is known from the East Bay hills, near Antioch and the Los Vaqueros watershed. Although it is on the CNPS East Bay Chapter's rank "A-2" list (Lake 1995), it is frequently difficult to determine whether individuals represent natural populations because the species is widely planted as a landscape tree.

## TABLE 1

## POTENTIALLY OCCURRING SPECIAL-STATUS PLANT SPECIES IN THE CITY ALBANY WATERSHED STUDY AREA

| Family<br>Scientific Name<br>Common Name | Status[1] | Habitat Affinities and Reported Localities in the Project Area | Blooming Period/ Life Form | Potential for Occurrence Onsite |
|---|---|---|---|---|
| **Apiaceae** | | | | |
| *Lilaeopsis masonii*<br>Mason's lilaeopsis | Federal SC<br>State CR<br>CNPS 1B:2-2-3 | Intertidal brackish and freshwater marshes along streambanks. Recorded in the San Joaquin and Sacramento River Delta and lower Napa River channel. | April-Oct<br>Perennial herb | None: no suitable habitat present. |
| **Asteraceae** | | | | |
| *Aster lentus*<br>Suisun Marsh aster | Federal SC<br>State CEQA<br>CNPS 1B:2-2-3 | Freshwater and brackish marshes. Known from the Napa River and San Joaquin/Sacramento River Delta. | May-Nov<br>Perennial herb | None: marginally suitable habitat present. Would have been detectable. |
| *Grindelia stricta* var. *angustifolia*<br>marsh gumplant | Federal none<br>State CEQA?<br>CNPS 4:1-1-3 | Coastal saltmarsh. Found from Monterey County to the San Francisco Bay. | Aug-Oct<br>Perennial herb | Detected: abundant at down-stream end of Codornices and Cerrito creeks (see text). |
| *Helianthella castanea*<br>Diablo helianthella | Federal SC<br>State CEQA<br>CNPS 1B:3-2-3 | Broadleaf upland forest, chaparral, cismontane woodland, coastal scrub, riparian woodland, and Valley/foothill grassland. Occurs in Alameda, Contra Costa and San Mateo counties; presumed extinct in Marin and San Francisco counties. Recorded near San Pablo Reservoir. | April-June<br>Perennial herb | None: no suitable habitat present. Would have been detectable. |
| *Holocarpha macradenia*<br>Santa Cruz tarplant | Federal C<br>State CE<br>CNPS 1B:2-3-3 | Coastal prairie, Valley/foothill grassland, often on heavy clay soils. Known from Contra Costa, Monterey and Santa Cruz counties; presumed extinct in Alameda and Marin counties. Recorded near Appian Way and the Pinole Vista Shopping Mall in Pinole, Wildcat Canyon Regional Park along San Pablo Ridge, in Richmond near Atlas Road and on Sobrante Ridge near Olinda School. | June-Oct<br>Annual herb | None: no suitable habitat present. Would have been detectable. |
| *Lasthenia conjugens*<br>Contra Costa goldfields | Federal FPE<br>State CEQA<br>CNPS 1B:3-3-3 | Mesic sites in Valley/foothill grassland, vernal pools. Restricted to Napa and Solano counties; presumed extinct in Alameda, Contra Costa, Mendocino, Santa Barbara and Santa Clara counties. | Mar-June<br>Annual herb | None: no suitable habitat present. |

## TABLE 1 (continued)

| | | | | |
|---|---|---|---|---|
| *Madia radiata*<br>showy madia | Federal none<br>State CEQA<br>CNPS 1B:2-3-3 | Valley/foothill grasslands below 250 feet, and cismontane woodland. Occurs throughout the Central Coast and Central Valley. Presumed extinct in Contra Costa County. | March-May<br>Annual herb | None: no suitable habitat present. |
| *Micropus amphibolus*<br>Mt. Diablo cottonweed | Federal none<br>State CEQA?<br>CNPS 4:1-1-3 | Broadleaf upland forest, cismontane woodland, Valley/foothill grass-land. Known from Lake to Santa Cruz counties, San Francisco Bay area. | April-May<br>Annual herb | None: no suitable habitat present. |
| *Senecio aphanactis*<br>rayless ragwort | Federal none<br>State CEQA<br>CNPS 2:3-2-1 | Coastal scrub and cismontane woodland on alkaline soils. Known from the South Coast, Central Coast, Central Valley and San Francisco Bay. | Jan-April<br>Annual herb | None: no suitable habiat present. |
| **Brassicaceae** | | | | |
| *Streptanthus albidus* ssp. *peramoenus*<br>most beautiful jewel-flower | Federal C<br>State CEQA<br>CNPS 1B:2-2-3 | Chaparral, cismontane woodland and Valley/foothill grasslands on serpentinite. Known from Alameda, Santa Clara and Contra Costa counties. | April-June<br>Annual herb | None: no suitable habiat present. |
| **Chenopodiaceae** | | | | |
| *Suaeda californica*<br>California suaeda | Federal: FE<br>State: CEQA<br>CNPS: 1B:3-3-3 | Coastal salt marshes. Extirpated from San Francisco, Alameda, Santa Clara counties. Restricted to Morro Bay, San Luis Obispo County. Believed extirpated in Alameda and Santa Clara Counties. Recorded near Fleming along the Southern Pacific Railroad in 1912. | July-Oct<br>shrub<br>(evergreen) | Low: suitable habitat present. Would have been detectable. |
| **Cyperaceae** | | | | |
| *Carex comosa*<br>bristly sedge | Federal none<br>State CEQA<br>CNPS 2:3-3-1 | Marshes and swamps, lake margins. Believed extirpated in San Francisco, San Bernardino and Santa Cruz counties. Extant in Contra Costa, Lake, Shasta, San Joaquin and Sonoma counties. | May-Sept.<br>Perennial herb<br>(rhizomatous) | Low: marginally suitable habitat present onsite. Would have been detectable. |
| *Eleocharis parvula*<br>small spikerush | Federal none<br>State CEQA?<br>CNPS 4:1-1-1 | Wet, generally saline flats, coastal salt marsh. Recorded from Orange to Humboldt counties. | June-Sept<br>Perennial herb | Low: suitable habitat present. Would have been detectable. |
| **Ericaceae** | | | | |
| *Arctostaphylos pallida*<br>pallid manzanita | Federal PT<br>State CE<br>CNPS 1B:3-3-3 | Broadleaved upland forest, closed cone coniferous forest, cismontane woodland, chaparral and coastal scrub, on siliceous shale, sandy and gravelly soils on uplifted marine terraces. Restricted to Alameda and Contra Costa counties. Recorded from Sobrante Ridge Regional Preserve and in the ne corner of Tilden Regional Park. | Dec-Mar.<br>Evergreen shrub | None: no suitable habitat present. Would have been detectable. |

## TABLE 1 (continued)

| | | | | |
|---|---|---|---|---|
| **Fabaceae** | | | | |
| *Astragalus tener* var. *tener*<br>alkali milk-vetch | Federal none<br>State CEQA<br>CNPS 1B:3-2-3 | Playas, Valley/foothill grasslands, on adobe clay and alkaline vernal pools. Extant in Merced, Solano and Yolo counties. Extinct throughout the Bay Area and San Joaquin Valley. | March-June<br>Annual herb | None: no suitable habitat present. |
| *Lathyrus jepsonii* var. *jepsonii*<br>Delta tule pea | Federal SC<br>State CEQA<br>CNPS 1B:2-2-3 | Freshwater and brackish marshes. Occurs throughout the Sacramento -San Joaquin River delta, San Francisco Bay, and Central Valley. | May-Sept.<br>Perennial herb | None: marginally suitable habitat present. Would have been detectable. |
| **Juglandaceae** | | | | |
| *Juglans californica* var. *hindsii*<br>Northern California black walnut | Federal SC<br>State CEQA<br>CNPS 1B:3-3-3 | Riparian forests and riparian woodlands. Known from only two extant populations in Napa and Contra Costa counties. Presumed extinct in Sacramento, Solano and Yolo counties. Widely naturalized in cismontane Calif., used as a root stock for *J. regia*. | April-May<br>Deciduous tree | Cultivated trees present. No naturally occurring stands present. |
| **Lamiaceae** | | | | |
| *Monardella antonina* ssp. *antonina*<br>San Antonio Hills monardella | Federal none<br>State CEQA?<br>CNPS 3:?-?-3 | Chaparral and cismontane woodland. Recorded from Monterey County; possible also in Alameda, Contra Costa, San Benito and Santa Clara counties. | Jun-Aug<br>Perennial herb (rhizomatous) | None: no suitable habitat present. Would have been detectable. |
| *Monardella villosa* ssp. *globosa*<br>robust monardella | Federal none<br>State CEQA<br>CNPS 1B:3-2-3 | Openings in chaparral, cismontane woodland. Occurs from the San Francisco Bay Area to Humboldt County. | June-July<br>Perennial herb (rhizomatous) | None: no suitable habitat present. Would have been detectable. |
| **Liliaceae** | | | | |
| *Calochortus pulchellus*<br>Mt. Diablo fairy-lantern | Federal none<br>State CEQA<br>CNPS 1B:2-2-3 | Chaparral, cismontane woodland, Valley/foothill grassland. Known from Contra Costa and possibly Solano counties. | April-June<br>Perennial herb (bulbiferous) | None: no suitable habitat present. |
| *Fritillaria agrestis*<br>stinkbells | Federal none<br>State CEQA?<br>CNPS 4:1-2-3 | Chaparral, cismontane woodland, Valley/foothill grassland on clay or sometimes serpentinite. Fairly widespread fromSanta Barbara to Mendocino counties and east to the Sierra foothill counties. | Mar-April<br>Perennial herb (bulbiferous) | None: no suitable habitat present. |
| **Linaceae** | | | | |
| *Hesperolinon breweri*<br>Brewer's dwarf flax | Federal SC<br>State CEQA<br>CNPS 1B:2-2-3 | Chaparral, cismontane woodlands, Valley/foothill grassland, mostly on serpentinite. Found in Napa, Solano, and Contra Costa counties. | May-July<br>Annual herb | None: no suitable habitat present. |
| **Malvaceae** | | | | |
| *Hibiscus lasiocarpus*<br>rose-mallow | Federal none<br>State CEQA<br>CNPS 2:2-2-1 | Freshwater marshes. Restricted to the Sacramento-San Joaquin River Delta. | June-Sept<br>Perennial herb (rhizomatous) | None: suitable habitat present. Would have been detectable. Not known from vicinity. |

## TABLE 1 (continued)

| | | | | |
|---|---|---|---|---|
| **Potamogetonaceae** | | | | |
| *Potamogeton zosteriformis*<br>eel-grass pondweed | Federal none<br>State CEQA<br>CNPS 2:2-2-1 | Assorted freshwater marshes and swamps. Known from Contra Costa, Lake counties, Modoc, Lassen, and Shasta counties, and Washington and Oregon. | June-July<br>Annual herb<br>(aquatic) | Low: marginally suitable habitat present. Would have been detectable. |
| **Primulaceae** | | | | |
| *Androsace elongata* ssp. *acuta*<br>California androsace | Federal none<br>State CEQA?<br>CNPS 4:1-2-2 | Chaparral, cismontane woodland and coastal scrub. Known from the Bay Area and Central Coast to Siskyou and San Diego counties. | Mar-June<br>Annual herb | None: no suitable habitat present. |
| **Ranunculaceae** | | | | |
| *Delphinium californicum* ssp. *interius*<br>Hospital Canyon larkspur | Federal SC<br>State CEQA<br>CNPS 1B:3-2-3 | Cismontane woodland, possible on mesic sites. Recorded from Alameda, Contra Costa, Santa Clara, San Joaquin, and San Luis Obispo counties. | April-June<br>Perennial herb | None: no suitable habitat present. |
| *Delphinium recurvatum*<br>recurved larkspur | Federal SC<br>State CEQA<br>CNPS 1B:1-2-3 | Chenopod scrub, cismontane woodland and Valley/ foothill grassland, in alkaline places. Restricted to the Central Valley from Colusa to Kern counties, San Luis Obispo. | Mar-May<br>Perennial herb | None: no suitable habitat present. |
| *Ranunculus lobbii*<br>Lobb's aquatic buttercup | Federal none<br>State CEQA?<br>CNPS 4:1-2-3 | Mesic sites in cismontane woodland, Valley/foothill grassland, North Coast coniferous forest and vernal pools. Known from the San Francisco Bay Area to Mendocino and Napa counties. | March-May<br>Annual herb<br>(aquatic) | Low: marginally suitable habitat present. |
| **Scrophulariaceae** | | | | |
| *Cordylanthus maritimus* ssp. *palustris*<br>Pt. Reyes bird's-beak | Federal SC<br>State CEQA<br>CNPS 1B:2-2-2 | Coastal saltmarsh. Believed extant in Humboldt, Marin, and Sonoma counties; presumed extinct in Alameda, Santa Clara, and San Mateo counties. | May-Oct<br>Annual herb<br>(hemiparasite) | Low: suitable habitat present. Would have been detectable. |
| *Cordylanthus mollis* ssp. *hispidus*<br>hispid bird's-beak | Federal SC<br>State CEQA<br>CNPS 1B:2-3-3 | Meadows, playas, Valley/foothill grassland on alkaline sites. Recorded from Alameda, Kern, Merced, Placer and Solano counties. | June-Sept<br>Annual herb<br>(hemiparasite) | None: no suitable habitat present. |
| *Cordylanthus mollis* ssp. *mollis*<br>soft bird's-beak | Federal FPE<br>State CR<br>CNPS 1B:3-2-3 | Coastal saltmarsh. Known from fewer than 10 locations in Contra Costa, Napa, and Solano counties. Extirpated in Marin and Sonoma counties. | July-Sept<br>Annual herb<br>(hemiparasitic) | Moderate: suitable habitat present. Would have been detectable. Known from vicinity. |
| *Limosella subulata*<br>Delta mudwort | Federal none<br>State CEQA<br>CNPS 2:2-3-1 | Marshes and swamps, muddy or sandy intertidal flats in the Sacramento and San Joaquin river deltas. | May-Aug<br>Perennial herb<br>(stoloniferous) | Low: marginally suitable habitat present. Would have been detectable. |

## TABLE 1 (continued)

| | | | | |
|---|---|---|---|---|
| **Thymelaeaceae** | | | | |
| *Dirca occidentalis*<br>western leatherwood | Federal none<br>State CEQA<br>CNPS 1B:2-2-3 | Broadleaf upland forest, closed cone coniferous forest, chaparral, cismontane woodland, North Coast coniferous forest, riparian forest, and riparian woodland. Restricted to brushy slopes and mesic sites. Known from San Mateo to Sonoma counties. Recorded from near Jewel Lake in Tilden Regional Park. | Jan-April<br>Deciduous shrub | None: no suitable habitat present. |

[1] Explanation of sensitivity status codes provided in Appendix B.

## TABLE 2

## POTENTIALLY OCCURRING SPECIAL-STATUS WILDLIFE SPECIES IN THE CITY OF ALBANY WATERSHED STUDY AREA

| Scientific Name<br>Common Name | Satus[1] | Habitat Affinities and Reported Localities in the Project Area | Potential for Occurrence Onsite |
|---|---|---|---|
| **Invertebrates** | | | |
| *Danaus plexippus*<br>Monarch Butterfly | Federal none<br>State * | Roosts during winter migration in dense stands of large trees sucha as eucalyptus and Monterey pines that provide shelter from the wind. Roosts in groves close to nectar and water sources. Roosts from northern Mendocino County to Baja California, Mexico. Recorded from Albany Hill, at the UC Engineering Field Station in Richmond and the Point Pinole Regional Shoreline. | Moderate: suitable roosting habitat present throughout. Mass roosting unlikely. |
| *Helminthoglypta nickliniana bridgesi*<br>(no common name) | Federal SC<br>State none | Inhabits open hillsides of Alameda and Contra Costa counties. Tends to colonize under tall grasses and weeds. Prefers rock piles. Recorded from Kensington and in the vicinity of Thousand Oaks in the Berkeley Hills and in San Pablo Creek. | None: no suitable habitat present. |
| **Birds** | | | |
| *Egretta thula*<br>Snowy Egret<br>(rookery site only) | Federal MB<br>State *<br>Audubon none | Rookery sites situated close to foraging areas such as marshes, tidal flats, streams, wet meadows and borders of lakes. Nests colonially in protected beds of dens tules. Recorded on Brooks Island, just offshore from Point Potrero in SF Bay. | None: no suitable rookery habitat present. Foraging individuals common. |
| *Elanus leucurus*<br>White-tailed Kite<br>(nesting sites only) | Federal MB<br>State none<br>Audubon none | Inhabits low rolling foohills and valley margins with scattered oaks and river bottom-lands or marshes adjacent to deciduous woodlands. Prefers open grasslands, meadows and marshes for foraging close to isolated, dense-topped trees for nesting and perching. Recorded from Brooks Island, 0.7 mile southeast of Point Potrero. | Low: marginally suitable nesting habitat present near the UC Village and south of Creek-side Park. |
| *Laterallus jamaicensis coturniculus*<br>California Black Rail | Federal SC, MB<br>State CT<br>Audubon none | Mainly inhabits saltwater marshes bordering bays. Prefers tidal salt marsh habitat dominated by pickleweed. Also occurs at low elevations in freshwater and brackish marshes supporting sedges, saltgrass, bulrush or cattails. Known throughout the San Francisco Bay and Sacramento-San Joaquin River delta. Recorded from Pinole and nnw of San Pablo. | Low to none: marginally suitable habitat present at edge of SF Bay. High level of human activity precludes occupation by species. |
| *Nycticorax nycticorax*<br>Black-Crowned Night Heron<br>(rookery site only) | Federal MB<br>State *<br>Audubon none | Rookery sites usually located adjacent to foraging areas such as lake margins, mud bordered bays and marshy spots. Roosts colonially in trees or tule patches. Recorded from Brooks Island, just offshore from Point Potrero in SF Bay. | Low: marginally suitable roosting habitat present at downstream ends of Codornices and Cerrito creeks. |

| | | | |
|---|---|---|---|
| *Rallus longirostris obsoletus*<br>California Clapper Rail | Federal FE, MB<br>State CE<br>Audubon SC | Restricted to salt water marshes traversed by tidal sloughs in the vicinity of San San Francisco Bay. Associated with stands of pickleweed but forages on molluscs in tidal mud flats. Recorded from the inner Richmond Harbor, in scattered marshes between San Pablo Creek, Point Pinole and in Chevron Marsh at the mouth of Wildcat Creek. | Low to none: marginally suitable habitat along edge of SF Bay. High level of human activity precludes occupation by species. |
| *Sterna caspia*<br>Caspian Tern<br>(nesting colonies only) | Federal MB<br>State *<br>Audubon none | Nests in small colonies inland and along the coast. Inhabits inland fresh water lakes and marshes as well as brackish or salt water marshes of estuaries and bays. Recorded from Brooks Island, just offshore from Point Potrero. | None: no suitable nesting habitat present. High level of human activity precludes occupation by species. |
| **Fishes** | | | |
| *Archoplites interruptus*<br>Sacramento Perch | Federal SC<br>State SSC | This warm water, lacustrine species formerly inhabited sloughs, slow-moving rivers and lakes of the Central Valley. It is now mostly restricted to reservoirs and farm ponds. It is associated with submerged or emergent vegetation, which is essential for young. Adults can tolerate a wide range of physical and chemical water conditions. The species is native to the Sacramento, San Joaquin, Salinas and Pajaro rivers. Recorded from Anza Lake and Jewel Lake in Charles Lee Tilden Regional Park in the Berkeley Hills north of UC Berkeley. | None: no suitable habitat present. |
| *Hypomesus transpacificus*<br>Delta Smelt | Federal FT<br>State CT | Inhabits open brackish and fresh water of large channels. Spawns during spring in sloughs and channels in the upper Delta. Spawning has also been recorded in Montezuma Slough and Suisun Bay. Occurs from Isleton on the Sacramento River and Mossman on the San Joaquin River to Suisun Bay. | None: no suitable habitat present. Never recorded so close to the Golden Gate. |
| *Lampetra ayresi*<br>River Lamprey | Federal SC<br>State watch | Anadromous. Spawns during spring in clear gravel riffle pools in coastal streams. Young metamorphose upriver from salt water and enter the ocean in the following late spring. Restricted to coastal streams from Alaska to the San Francisco Bay. In Calif., the species is only recorded the Sacramento-San Joaquin rivers and the Russian River. | None: no suitable habitat present. Not recorded from project vicinity. |
| *Lampreta tridentata*<br>Pacific Lamprey | Federal SC<br>State none | Anadromou. Spawns during spring in clear, gravel riffle pools in clear, coastal streams. Adults feed in the ocean. Distributed from Alaska to the Santa Ana River. | Low: marginally suitable habitat present. |
| *Oncorhyncus mykiss irideus*<br>Steelhead (Rainbow) Trout<br>(Central Coast populations) | Federal FT<br>State CT | Anadromous. Inhabits cold headwaters, creeks, and small to large rivers and lakes with swift, shallow water and clean, loose gravel for spawning. Requires large pools during summer months. Spawns in spring. Populations inhabiting coastal streams from the Santa Maria River to the Russian River only. | Mod. to high; possibly detected. Marginally suitable habitat present. Unidentified species detected on Codornices Creek between Curtis and Santa Fe. Anecdotal siting by neighbors between Nielson and Peralta. |

| | | | |
|---|---|---|---|
| *Spirinchus thaleichthys*<br>Longfin Smelt | Federal SC<br>State CE | This native species inhabits estuaries and bays near to shore. It occurs along the Pacific coast from Alaska to the Monterey Bay. In the San Francisco Bay, its main populations are in San Pablo Bay. It ascends coastal streams from Oct. to Dec. to spawn. It is an important forage species. | Low: marginally suitable habitat present in Codornices Creek only. |
| **Reptiles** | | | |
| *Clemmys marmorata*<br>Wstern Pond Turtle | Federal SC<br>State SSC | This thoroughly aquatic turtle inhabits permanent, slow-moving creeks, streams, ponds, rivers, marshes and irrigation ditches a with mud or rocky bottom and densely vegetated shoreline. Needs safe and quiet upland sites for basking. Lays eggs on sandy banks and open grassy fields. Occurs from the Oregon border to the San Francisco Bay and inland throughout the Sacramento Valley. Recorded from three sites in the Richmond quad; location information suppressed to protect populations. | Detected: species observed on two separate occasions on Codornices Creek just upstream from the railroad tracks. Suitable habitat present throughout Codornices Creek. (see text) |
| **Amphibians** | | | |
| *Ambystoma tigrinum californiense*<br>California Tiger Salamander | Federal C<br>State SSC | Breeds in temporary or semi-permanent pools. Aestivates in ground squirrel burrows in grasslands and oak woodlands. Recorded from Santa Barbara to Sonoma counties along the coast and inland to Colusa, Yolo and Tulare counties | None: no suitable breeding habitat onsite or in vicinity. |
| *Rana aurora draytonii*<br>California Red-legged Frog | Federal FT<br>State SSC | Permanent stream pools, ponds and creeks with emergent and/or riparian vegetation. May estivate in rodent burrows or cracks in mud during dry periods. Restricted to coastal areas and coastal mountains from Humboldt to San Diego counties. | Low: marginally suitable habitat present. Never recorded from vicinity. |
| **Mammals** | | | |
| *Microtus californicus sanpabloensis*<br>San Pablo Vole | Federal SC<br>State SSC | Restricted to salt marshes of San Pablo Creek on the south shore of San Pablo Bay. Constructs burrows in soft soil. Feeds on grasses, sedges and herbs. Forms a network of runways leading away from each burrow. Recorded from Gian Salt Marsh, San Pablo Creek, Chevron Marsh at mouth of Wildcat Creek. | Low: suitable habitat present only at the shore of SF Bay. |
| *Sorex vagrans halicoetes*<br>Saltmarsh Wandering Shrew | Federal C<br>State SSC | Inhabitssalt marshes of the south arm of San Francisco Bay. Habitat consists of medium hig marsh 6-8 feet above sea level with abundant driftwood and scatteredpickleweed. Rec orded in the 1950 from Giant Marsh (Atlas Powder Company Marsh) and San Pablo Creek salt marsh. | Low: suitable habitat present only at the shore of SF Bay. |
| *Reithrodontomys raviventris*<br>Salt Marsh Harvest Mouse | Federal FE<br>State CE | Restricted to saline emergent wetlands of San Francisco Bay and its tributaries. Habitat consists primarily of pickleweed. Does not burrow; builds loose nests. Requires high to escape high tides and floods. Recorded from San Pablo Creek Marsh, Giant Marsh, Pt. Pinole Regional Shoreline. | Moderate: suitable habitat present only at the shore of SF Bay. |

[1] Explanation of sensitivity status codes provided in Appendix B.

# APPENDIX A

## Plant Species Detected at the City of Albany Watershed Study Area

| CLASS<br>Family<br>Scientific Name | Common Name | Creek** |
|---|---|---|
| **EQUISETAE** | | |
| Equisetaceae - Horsetail Family | | |
| *Equisetum arvense* | common horsetail | Cd, Cr, M, V |
| **FILICINAE** | | |
| Blechnaceae - Deer Fern Family | | |
| *Woodwardia fimbriata** | giant chain fern | Cr |
| Dennstaedtiaceae - Bracken Family | | |
| *Pteridium aquilinum* var. *pubescens* | western brackenfern | Cr, M |
| Dryopteridaceae - Fern Family | | |
| *Dryopteris arguta* | wood fern | Cr |
| *Polystichum munitum* | western sword fern | Cr |
| **CONIFERAE** | | |
| Cupressaceae - Cypress Family | | |
| *Calocedrus decurrens* | incense-cedar* | Cr, M |
| *Juniperus* sp. | ornamental juniper | Cd, Cr |
| Pinaceae - Pine Family | | |
| *Chamaecyparis lawsonii** | Lawson cypress | Cr |
| *Cryptomeria japonica** | cryptomeria | Cr |
| *Pinus jeffreyi* | Jeffrey pine | Cd |
| *Pinus radiata** | Monterey pine | Cd, Cr, V |
| *Pinus torreyana** | Torrey pine | V |
| Taxaceae - Yew Family | | |
| *Podocarpus macrophylla** | Buddhist pine | Cd |
| Taxodiaceae - Redwood Family | | |
| *Sequoia sempervirens** | coast redwood | Cd, Cr, V |
| *Sequoiadendron giganteum** | giant sequoia | V |
| **DICOTYLEDONAE** | | |
| Acanthaceae - Acanthus Family | | |
| *Acanthus mollis** | bears breech | Cd, Cr |
| Aceraceae - Maple Family | | |
| *Acer japonicum** | Japanese maple | Cr |
| *Acer macrophyllum* | big-leaf maple | Cr |
| *Acer negundo* ssp. *californicum* | box elder | Cd |

| | | |
|---|---|---|
| Aizoaceae - Carpetweed Family | | |
| *Carpobrotus edulis** | Hottentot fig | Cd, Cr |
| *Mesembryanthemum nodiflorum** | little ice plant | Cr |
| Amaranthaceae - Amaranth Family | | |
| *Amaranthus albus** | tumbleweed | Cr |
| Anacardiaceae - Sumac Family | | |
| *Rhus integrifolia** | lemonade-berry | Cr |
| *Schinus molle** | California pepper-tree | Cd |
| *Schinus terebinthifolius** | Brazilian pepper-tree | Cr |
| *Toxicodendron diversilobum* | poison oak | Cr |
| Apiaceae - Parsley Family | | |
| *Apium graveolens** | celery | Cd, Cr |
| *Conium maculatum** | poison hemlock | Cd, Cr, M, V |
| *Daucus pusillus* | rattlesnake weed | Cr |
| *Foeniculum vulgare** | sweet fennel | Cd, Cr, V |
| *Oenanthe sarmentosa* | Pacific oenanthe | Cd, Cr, V |
| Apocynaceae - Dogbane Family | | |
| *Nerium oleander** | common oleander | Cr |
| *Vinca major** | periwinkle | Cd, Cr, M |
| Aquifoliaceae - Holly Family | | |
| *Ilex aquifolium** | English holly | Cr |
| Araliaceae - Aralia Family | | |
| *Hedera helix** | English ivy | Cd, Cr, M, V |
| Asteraceae - Sunflower Family | | |
| *Artemisia douglasiana* | mugwort | Cd, Cr |
| *Baccharis pilularis* | coyote brush | Cd, Cr, V |
| *Carduus pycnocephalus** | Italian thistle | Cd, Cr |
| *Cirsium vulgare** | bull thistle | Cd, Cr, V |
| *Conyza bilboana** | horseweed | Cd, Cr |
| *Delairia odorata (=Senecio mikanioides)** | German ivy | Cd, Cr, M |
| *Gnaphalium luteo-album** | cudweed | Cd, Cr |
| *Grindelia stricta* var. *angustifolia*[1,2] | marsh gum-plant | Cd, Cr |
| *Helianthus annuus* * | western sunflower | Cd, Cr |
| *Jaumea carnosa* | jaumea | Cd, Cr |
| *Lactuca saligna** | willow lettuce | Cr |
| *Lactuca serriola** | prickly lettuce | Cd, Cr |
| *Picris echioides** | bristly ox-tongue | Cd, Cr, V |
| *Senecio vulgaris** | common groundsel | Cd, Cr |
| *Sonchus oleraceus** | common sow-thistle | Cd, Cr |
| *Taraxacum officinale** | common dandelion | Cr |
| Berberidaceae - Barberry Family | | |
| *Nandina domestica** | heavenly bamboo | Cr |
| Betulaceae - Birch Family | | |
| *Alnus rhombifolia* | white alder | Cd, Cr, V |
| *Betula pendula** | European white birch | Cr |

| | | |
|---|---|---|
| Brassicaceae - Mustard Family | | |
| *Brassica nigra** | black mustard | Cr |
| *Coronopus didymus** | lesser wart-cress | Cr |
| *Raphanus sativus** | wild radish | Cd, Cr, V |
| *Rorippa nasturtium-aquaticum** | water cress | Cd, Cr |
| Campanulaceae - Bellflower Family | | |
| *Campanula* sp.* | campanula | Cd, Cr |
| Caprifoliaceae - Honeysuckle Family | | |
| *Sambucus mexicana* | blue elderberry | Cd, Cr, M |
| Chenopodiaceae - Goosefoot Family | | |
| *Atriplex triangularis** | spearscale | Cd, Cr |
| *Salicornia virginica* | pickleweed | Cd, Cr |
| Convolvulaceae - Morning-glory Family | | |
| *Convolvulus arvensis** | field bindweed | Cd, Cr, V |
| *Convolvulus* sp.* | ornamental morning glory | Cd, V |
| *Dichondra* sp.* | ornamental dichondra | Cr |
| Dipsacaceae - Teasel Family | | |
| *Dipsacus fullonum** | wild teasel | Cd |
| Ebenaceae - Persimmon Family | | |
| *Diospyros virginiana** | common persimmon | Cr |
| Euphorbiaceae - Spurge Family | | |
| *Chamaesyce maculata** | spotted spurge | Cd, Cr |
| *Euphorbia lathyris** | caper spurge | Cd |
| *Euphorbia peplus** | petty spurge | Cd, Cr |
| *Ricinus communis** | castor bean | Cd, Cr |
| Fabaceae - Pea Family | | |
| *Acacia decurrens** | green wattle | Cd, V |
| *Acacia melanonxylon** | blackwood acacia | Cd, Cr, M, V |
| *Cytisus scoparius** | Scotch broom | Cr |
| *Genista monspessulana** | French broom | Cd, Cr, M, V |
| *Lotus corniculatus** | bird foot trefoil | Cr |
| *Medicago polymorpha** | bur-clover | Cd, Cr |
| *Melilotus albus** | white sweet-clover | Cd |
| *Robinia pseudo-acacia** | black locust | Cr |
| *Vicia sativa** | common vetch | Cr |
| *Vicia* sp. | vetch | Cd |
| Fagaceae - Oak Family | | |
| *Quercus agrifolia* | coast live oak | Cd, Cr, M |
| Frankeniaceae - Frankenia Family | | |
| *Frankenia salina* | alkali heath | Cr |
| Geraniaceae - Geranium Family | | |
| *Geranium dissectum** | cranesbill | Cd, Cr, M |
| *Pelargonium peltatum** | ivy geranium | Cr, V |
| Hamamelidaceae - Witch-hazel Family | | |
| *Liquidambar syraciflua** | sweet gum | Cr |

| | | |
|---|---|---|
| Hippocastanaceae - Buckeye Family | | |
| *Aesculus californica* | California buckeye | Cd, Cr |
| Juglandaceae - Walnut Family | | |
| *Juglans californica* var. *hindsii* * | California black walnut | Cd, Cr, M,V |
| *Juglans regia** | English walnut | Cd, Cr |
| Lamiaceae - Mint Family | | |
| *Mentha spicata* var. *spicata* | spearmint | Cd, Cr |
| *Stachys ajugoides* var. *rigida* | rigid hedge nettle | Cr |
| Lauraceae - Laurel Family | | |
| *Umbellularia californica* | California bay | Cd, V |
| Lemnaceae - Duckweed Family | | |
| *Lemma* sp. | duckweed | Cd |
| Malvaceae - Mallow Family | | |
| *Alcea rosea** | hollyhock | Cd, Cr |
| *Malva parviflora** | cheeseweed | Cd, Cr, V |
| Moraceae - Mulberry Family | | |
| *Ficus carica** | common fig | Cd, Cr |
| *Morus alba** | white mulberry | V |
| Myrtaceae - Myrtle Family | | |
| *Eucalyptus globulus** | Tasmanian blue gum | Cd, Cr, V |
| *Eucalyptus lehmannii** | Bald Island marlock | Cd |
| *Eucalyptus sideroxylon** | red ironbark | Cr |
| *Melaleuca deussata** | lilac melaleuca | Cr |
| *Syzygium uniflora** | Surinam-cherry | Cd, Cr |
| Myoporaceae - Myorporum Family | | |
| *Myoporum laetum** | myoporum | Cd, Cr |
| Oleaceae - Olive Family | | |
| *Fraxinus latifolia*[2] | Oregon ash | Cd |
| Onagraceae - Evening Primrose Family | | |
| *Epilobium brachycarpum* | fireweed | Cd |
| *Epilobium ciliatum* | northern willow herb | Cd, Cr |
| *Fuchsia* sp.* | fuchsia | Cd, Cr |
| Oxalidaceae - Oxalis Family | | |
| *Oxalis corniculata** | creeping wood sorrel | Cd, Cr |
| Papaveraceae - Poppy Family | | |
| *Eschscholzia californica* | California poppy | Cr |
| Passifloraceae - Passion-Flower Family | | |
| *Passiflora* sp.* | Passion-flower | Cr |
| Pittosporaceae - Pittosporum Family | | |
| *Pittosporum undulatum** | victorian box | Cr |
| Plantaginaceae - Plantain Family | | |
| *Plantago lanceolata** | English plantain | Cd, Cr, V |
| *Plantago major** | broadleaf plantain | Cd |
| Platanaceae - Sycamore Family | | |
| *Platanus racemosa* | California sycamore | Cr |

| | | |
|---|---|---|
| Plumbaginaceae - Thrift Family | | |
| *Limonium californicum* | sea-lavender | Cd, Cr |
| Polygonaceae - Buckwheat Family | | |
| *Polygonum arenastrum** | common knotweed | Cr |
| *Polygonum persicaria** | lady's thumb | Cd, Cr |
| *Rumex conglomeratus** | whorled dock | Cd |
| *Rumex crispus** | curly dock | Cd, Cr, V |
| *Rumex pulcher** | fiddle dock | Cd |
| Portulaceae - Purslane Family | | |
| *Portulaca oleracea** | purslane | Cr |
| Primulaceae - Primrose Family | | |
| *Anagallis arvensis** | scarlet pimpernel | Cd, Cr |
| Rosaceae - Rose Family | | |
| *Arbutus unedo** | strawberry-tree | Cr |
| *Cotoneaster pannosa** | cotoneaster | Cr, V |
| *Eriobotrya japonica** | loquat | Cd, Cr |
| *Heteromeles arbutifolia* | toyon | Cd, Cr |
| *Malus sylvestris** | apple | Cr, V |
| *Prunus cerasifera** | cherry plum | Cd, Cr |
| *Prunus dulcis** | almond | Cr |
| *Prunus ilicifolia** | holly-leaved cherry | Cr |
| *Prunus* sp.* | ornamental plum | Cd, Cr, M, V |
| *Pyracantha angustifolia** | common firethorn | Cd, Cr |
| *Rosa californica* | California rose | Cd, Cr |
| *Rubus discolor** | Himalayan blackberry | Cd, Cr, M, V |
| *Rubus ursinus* | California blackberry | Cd, Cr, M, V |
| *Rubus ulmifolius* var. *inermis* | thornless blackberry | Cd, Cr, M |
| Rubiaceae - Madder Family | | |
| *Galium porrigens* var. *porrigens* | climbing bedstraw | V |
| Salicaceae - Willow Family | | |
| *Populus fremontii* ssp. *fremontii* | Fremont cottonwood | Cd |
| *Salix babylonica** | weeping willow | Cr, M |
| *Salix laevigata* | red willow | Cd, Cr, M |
| *Salix lasiolepis* | arroyo willow | Cd, Cr, M, V |
| Sapindaceae - Soapberry Family | | |
| *Dodnaea viscosa** | purple-leaved dodonaea | Cd |
| Scrophulariaceae - Figwort Family | | |
| *Hebe speciosa** | showy hebe | |
| *Kickxia spuria** | fluellin | Cr |
| *Mimulus guttatus* | large monkey-flower | Cr |
| *Scrophularia californica* ssp. *californica* | California figwort, bee plant | Cd, Cr |
| *Veronica americana* | American brooklime | Cr |
| Solanaceae - Nightshade Family | | |
| *Solanum furcatum** | forked nightshade | Cd, V |
| *Lycopersicon esculentum** | tomato | Cd, Cr |

| | | |
|---|---|---|
| Theaceae - Tea Family | | |
| *Camellia japonica** | camellia | Cr |
| Tropaeolaceae - Nasturtium Family | | |
| *Tropaeolum majus** | garden nasturtium | Cd, Cr, V |
| Ulmaceae - Elm Family | | |
| *Ulmus pumila** | Siberian elm | Cd |
| Urticaceae - Nettle Family | | |
| *Helxine soleirolii** | baby's tears | Cr |
| *Parietaria judaica** | pellitory | Cd |
| Valerianaceae - Valerian Family | | |
| *Centranthus ruber** | red valerian | Cd, Cr |
| Zingiberaceae - Ginger Family | | |
| *Zingiber officinale** | common ginger | Cr |
| | | |
| **MONOCOTYLEDONAE** | | |
| Araceae - Arum Family | | |
| *Zantedeschia aethiopica** | calla lily | Cd, Cr |
| Arecaceae - Palm Family | | |
| *Phoenix canariensis** | Canary Island palm | V |
| *Washingtonia robusta** | Mexican fan palm | Cr |
| Cyperaceae - Sedge Family | | |
| *Cyperus eragrostis* | umbrella sedge | Cd, Cr, V |
| *Scirpus californicus* | California bulrush | Cd, Cr, V |
| *Scirpus maritimus* | saltmarsh bulrush | Cr |
| *Scirpus microcarpus* | small-fruited bulrush | Cd |
| Iridaceae - Iris Family | | |
| *Chasmanthe floribunda** | chasmanthe | Cd, Cr |
| Juncaceae - Rush Family | | |
| *Juncus patens* | spreading rush | |
| Liliaceae - Lily Family | | |
| *Agapanthus africanus** | lily-of-the-Nile | Cd, Cr |
| *Amaryllis belladona** | naked lady | Cd |
| *Cordyline stricta** | lily tree | Cr |
| Juncaceae - Rush Family | | |
| *Juncus balticus* | wire rush | V |
| *Juncus patens* | spreading rush | Cd, Cr |
| *Juncus phaeocephalus* | brown-headed rush | Cr |
| Poaceae - Grass Family | | |
| *Agrostis pallens* | leafy bentgrass | Cd, Cr |
| *Arundo donax** | giant reed | Cr, M |
| *Avena barbata** | slender wild oat | Cd, Cr, V |
| *Avena fatua** | wild oat | Cd |
| *Bromus carinatus* var. *carinatus* | California brome | Cd, Cr |
| *Bromus diandrus** | ripgut brome | Cd, Cr |
| *Bromus madritensis** | red brome | Cr |

| | | |
|---|---|---|
| *Cortaderia jubata** | pampas grass | Cd, Cr, V |
| *Cynodon dactylon** | Bermuda grass | V |
| *Distichlis spicata* | salt grass | Cr |
| *Echinochloa crus-galli** | barnyard grass | Cr, V |
| *Ehrharta erecta** | ehrharta grass | Cd, Cr, M, V |
| *Hordeum marinum* ssp. *gussoneanum** | Mediterranean barley | Cr |
| *Leymus triticoides* | creeping ryegrass | Cd, Cr, V |
| *Lolium multiflorum** | Italian ryegrass | Cd, Cr |
| *Lolium perenne** | perennial ryegrass | Cr |
| *Paspalum dilatatum** | Dallis grass | Cd, Cr |
| *Phalaris aquatica** | Harding grass | V |
| *Phyllostachys aurea** | golden bamboo | Cr |
| *Piptatherum miliaceum** | smilo grass | Cd |
| *Polypogon monspeliensis** | rabbitfoot grass | Cr |
| *Setaria pumila** | bristlegrass | Cr |
| *Spartina foliosa* | California cordgrass | Cd, Cr |
| *Vulpia bromoides** | six-weeks fescue | Cr |
| Typhaceae - Cattail Family | | |
| *Typha angustifolia* | narrow-leaved cattail | Cd |
| *Typha latifolia* | broadleaf cattail | Cr, V |

**** Creek Location Codes: Cr = Cerrito, M = Middle, V = Village, Cd = Codornices**
*** denotes nonnative species or species not naturally occurring onsite**
**? indicates uncertain identification due to condition of plant material**
**[1] indicates sensitive taxon**
**[2] indicates unusual or significant taxon in Contra Costa County (Lake 1995)**

# APPENDIX B

## Wildlife Species Detected and Potentially Occurring in the City of Albany Watershed Study Area

| Scientific Name | Common Name | Creek** | P/O* |
|---|---|---|---|
| **Mammals** | | | |
| *Canis latrans* | Coyote | Cd, Cr | P |
| *Didelphus virginiana* | Virginia Opossum | Cd, Cr, M, V | P |
| *Mephitis mephitis* | Striped Skunk | Cd, Cr | P |
| *Procyon lotor* | Raccoon | Cr | O |
| *Reithrodontomys raviventris*[1] | Saltmarsh Harvest Mouse | Cd, Cr | P |
| *Sciurus niger* | fox squirrel | Cr | O |
| *Spermopholis beecheyi* | California Ground Squirrel | Cd, Cr | P |
| *Sylvilagus bachmani* | Brush Rabbit | Cr | P |
| *Vulpes fulva* | Red Fox | Cr, M | O |
| **Amphibians** | | | |
| *Batrachoseps attenuatus* | Calif. Slender Salamander | Cd, Cr, V | P |
| *Bufo boreas halophilus* | California Toad | Cd, Cr | P |
| *Ensatina eschscholtzii* | Ensatina | Cd, Cr, M | P |
| *Hyla regilla* | Pacific Treefrog | Cd, Cr, M | O |
| *Rana aurora draytonii*[1] | California red-legged frog | Cd, Cr | P |
| *Rana catesbeiana* | Bullfrog | Cd, Cr, V | P |
| **Reptiles** | | | |
| *Clemmys marmorata*[1] | Western Pond Turtle | Cr | O |
| *Gerrhonotus coeruleus principis* | Northern Alligator Lizard | Cd, Cr | P |
| *Lampropeltus getulus* | Common Kingsnake | Cd, Cr, M | P |
| *Pituophis malanoleucus catenifer* | Pacific Gopher Snake | Cd, Cr, V | P |
| *Sceloporus occidentalis* | Western Fence Lizard | Cd, Cr, V | O |
| *Thamnophis sirtalis* | Common Garter Snake | Cd, Cr | P |
| **Birds** | | | |
| *Agelaius phoeniceus* | Red-winged Blackbird | Cd, Cr | O |
| *Anas platyrhynchos* | Mallard | Cd, Cr | O |
| *Aphelocoma coerulescens* | Scrub Jay | Cd, Cr | O |
| *Ardea herodias* | Great Blue Heron | Cd, Cr | P |
| *Bubo virginianus* | Great Horned Owl | Cd, Cr, V | P |
| *Buteo jamaicensis* | Red-tailed Hawk | Cd, Cr, V | P |
| *Calypte anna* | Anna's Hummingbird | Cd, Cr | P |
| *Carpodacus mexicanus* | House Finch | Cr | O |
| *Casmerodius albus* | Great Egret | Cd | O |
| *Cathartes aura* | Turkey Vulture | Cd, Cr | P |
| *Ceryle alcyon* | Belted Kingfisher | Cd, Cr | P |

| | | | |
|---|---|---|---|
| *Charadrius vociferus* | Killdeer | Cd, Cr | O |
| *Corvus brachyrhynchos* | American Crow | Cd, Cr | P |
| *Egretta thula* | Snowy Egret | Cd, Cr | P |
| *Elanus caeruleus* | Black-shouldered Kite | Cd, Cr | P |
| *Euphagus cyanocephalus* | Brewer's Blackbird | Cd | O |
| *Fulica americana* | American Coot | Cr | P |
| *Junco hyemalis* | Dark-eyed Junco | Cd, Cr | P |
| *Mimus polyglottos* | Northern Mockingbird | Cd, Cr | O |
| *Nycticorax nycticorax* | Black-crowned Night Heron | Cd, Cr | P |
| *Passer domesticus* | House Sparrow | Cd, Cr, V | P |
| *Picoides nuttallii* | Nuttall's Woodpecker | Cd, Cr | P |
| *Sturnus vulgaris* | European Starling | Cd, Cr, V | O |
| *Turdus migratorius* | American Robin | Cd, Cr, V | P |
| *Zenaida macroura* | Mourning Dove | Cd, Cr, V | O |
| *Zonotrichia leucophrys* | White-crowned Sparrow | Cd, Cr, V | P |
| **Fish** | | | |
| *Gambusia affinis* | Mosquito Fish | Cd, Cr | O |
| *Lampreta tridentata*[1] | Pacific Lamprey | Cd, Cr | P |
| *Oncorhyncus mykiss irideus*[1] | Steelhead (Rainbow) Trout | Cd | P |

**** Creek Codes: Cr = Cerrito, M = Middle, V = Village, Cd = Codornices**
*** O = sign or individual observed, P = potential**
**[1] indicates sensitive taxon**

# APPENDIX C
# EXPLANATION OF SENSITIVITY STATUS CODES

## AGENCIES

USFWS = U.S. Fish and Wildlife Service
CDFG = California Department of Fish and Game
CNPS = California Native Plant Society
BLM = Bureau of Land Management
USFS = U.S. Forest Service

## CALIFORNIA NATIVE PLANT SOCIETY DESIGNATIONS

List 1: Plants of highest priority
List 1A: Plants presumed extinct in California
List 1B: Plants rare and endangered in California and elsewhere
List 2: Plants rare and endangered in California but more common elsewhere
List 3: Plants about which additional data are needed
List 4: Plants of limited distribution

**CNPS R-E-D Codes**

R (Rarity)
1 = Rare, but found in sufficient numbers and distributed widely enough that the potential for extinction or extirpation is low at this time.
2 = Occurrence confined to several populations or to one extended population.
3 = Occurrence limited to one or a few highly restricted populations, or present in such low numbers that it is seldom reported.
? = More data are needed

E (Endangerment)
1 = Not endangered
2 = Endangered in a portion of its range
3 = Endangered throughout its range
? = More data are needed

D (Distribution)
1 = More or less widespread outside California
2 = Rare outside California
3 = Endemic to California
? = More data are needed

## FEDERAL DESIGNATIONS

FE = listed as Endangered by the Federal Government
FT = listed as Threatened by the Federal Government
FPE = proposed as Endangered by the Federal Government
FTE = proposed as Threatened by the Federal Government
FSS = federal sensitive species, as listed by BLM and USFS
C[1] = Candidate; taxa for which USFWS has sufficient biological information to support a proposal to list as Endangered orThreatened).
SC[1] = Species of Concern
MB = migratory non-game birds of management concern to the USFWS; protected under the Migratory Bird Treaty Act.

[1]As of Feb. 28, 1996, all Category 1 candidate taxa are now regarded merely as Candidates. The USFWS ceased to maintains lists of Category 2 and Category 3 candidate taxa; Category 2 taxa are now regarded as Species of Concern.

## CALIFORNIA DEPT. OF FISH AND GAME DESIGNATIONS

CE = Listed as Endangered by the State of California
CR = Listed as Rare by the State of California
CT = Listed as Threatened by the State of California
CPE = Proposed for listing as Endangered
SSC = California Species of Special Concern
* = taxa that are restricted in distribution, declining throughout their range, or associated with habitats that are declining in California.
CEQA = taxa which are considered to meet the criteria for listing as Endangered, Threatened or Rare by the CDFG; impacts to such taxa must be addressed in CEQA documents.
CEQA? = Taxa that might be locally significant; should be evaluated for consideration during preparation of CEQA documents, as recommended by the CDFG.

*note: currently, all CNPS list 1B and 2 taxa are considered "Special Plants" by the CDFG.*

# APPENDIX H

# COMPONENTS OF CREEK RESTORATION & CASE STUDIES

## COMPONENTS OF CREEK RESTORATION

Creek restoration is more than just landscaping an engineered channel. Water is one of nature's most powerful elements and must be treated with respect. In general, working with creeks starts with science: hydrology, geomorphology, biology and ecology. Then, the functional requirements of flood control and storm water management are assessed. In addition to the functional aspect of carrying storm flows, creek restoration can provide additional benefits to the community, including enhanced riparian vegetation and wildlife habitat, recreational and greenway opportunities, community building and education, and water as a visual and auditory pleasure.

Restoration is an alternative to conventional construction of engineered drainage systems. It is a term that can be used to describe a broad range of creek alteration projects. In general, restoration means making the creek more like its former natural state: a channel able to transport water, sediment and woody debris while providing habitat for aquatic organisms (benthic invertebrates, fish, mammals), birds and terrestrial flora and fauna.

Restoration can take several forms. Channels that are now too narrow can be widened by sculpting banks to form a stepped channel system. Banks can be stabilized with biotechnical methods to reduce erosion from storm runoff or to control meanders where there is limited room. Exotic and invasive plant material can be removed and revegetated with material suitable to its regional habitat. Restoration can reintroduce meanders to straightened reaches, remove fish migration barriers and place substrate that is sized for desired species of aquatic organisms. It can also add significant amenities to rural and urban areas through trail and bike path connections to other existing city amenities such as regional trails, city wide bike path systems, parks and shopping areas.

### Basic Components

Basic components of creek restoration to be considered during detailed planning and design of specific projects include channel geometry, channel profile, bank stabilization, and revegetation.

### Channel Geometry

Channel geometry considers the areas of a creek channel section through which water moves as flows increase. These can be identified as the low flow channel, which is where water is carried during non-storm periods; bankfull channel, which carries the average storm event (1 to 2.5 years) without overflowing, and the floodplain, the area above the bankfull channel where larger storms overflow. In addition, the toe of the bank (at the intersection of the bank with the channel) is considered in the channel geometry to ensure proper anchorage that will limit erosion from the banks.

Creeks are an ecological system which is constantly moving and changing. The goal of channel geometry is to design for the optimal width and depth of the bankfull channel and floodplain to provide for a stable channel that will not excessively deposit or erode under average or non-catastrophic conditions. The restoration design should always be based on the magnitude of storm flows in the watershed. It should also reflect historic creek data typical to the creeks prior to urbanization. In most of the creeks in this area, urbanization has encroached into the historic floodplain of the creeks. This poses constraints that may likely require a variety of channel design techniques to achieve a stable channel. Many restored channels are designed too deep, allowing higher flow velocities that cause scour and erosion. Natural creeks overflow during major floods, which relieves pressure on the channel and allows lower velocities. Channels designed to hold maximum flows are much more likely to experience failure.

**Creek Profile**
Creek profile considers a cross section of the creek parallel to its flow. Establishing a stable creek profile requires a floodplain width that allows for the creek's sinuosity - meander length, radius of meander and amplitude. Pools, riffles and point bars characterize the meanders and create the basic form of the stream channel. Many of these features are lost in urbanized creeks such as those located in Albany. "Channelized streams are straighter, lack vegetative cover, have poorly sorted stream gravels, lack pools and riffles, and flow slower in the smaller to moderate storms and have very high velocities in large flows." - Urban Waterways Restoration Training Manual for Youth and Conservation Corps, A.L.Riley and Moira McDonald, 1995.

**Bank Stabilization**
The bank is the sloping side of the channel, which is susceptible to erosion from stream flow and surface runoff from above. It is essential that the banks remain stable to maintain appropriate channel geometry and minimize erosion or sediment deposition. Techniques to stabilize banks vary greatly from hard bank armoring solutions (concrete, rip rap, gabions, etc.) to softer low-tech bioengineering options (utilizing vegetation, wood and smaller stone).

The usual correction for bank erosion problems has been to build concrete or rubble walls, or place rock on the eroded area. This may create more problems because the cause of erosion has not been removed but rather "bandaged", and it may cause more erosion upstream, downstream, and on the opposite stream bank from the correction area. Hard armoring such as walls and rock create currents which can undercut adjacent areas and perpetuate erosion problems. Less impactive protective measures can be grouped into three categories: vegetative plantings, soil bioengineering systems and structural measures for an extremely difficult site.

Vegetative plantings are appropriate for slopes with marginal erosion problems or can be used in conjunction with structural measures. Local native species are preferred, and non-invasive introduced species are a possible alternative. Problems related to vegetative plantings include the period required to establish the plantings, during which time little erosion protection is available; maintenance is required to ensure the material is established and remains healthy; and planting in coarse gravely material can be difficult.

Soil bioengineering systems utilize live plant material as a structural component. Suitable species of woody trees and shrubs are installed to provide immediate soil protection and reinforcement by developing root or fibrous inclusions. Soil bioengineering can work well with some structural methods for more permanent protection and enhance aesthetics. Sunny or partly sunny sites are more suitable for soil bioengineering, and most sites require some earthwork prior to installation. The following methods can be used with this technique: live stakes, live fascines, branchpacking, vegetative geogrids, joint plantings, and brushmattresses.

Structural measures for difficult sites include cribwalls; tree revetments; log, rootwad and boulder revetments; dormant post plantings; piling revetments with wire or geotextile fencing; piling revetments with slotted fencing; jacks or jack fields; rock riprap; stream jetties; stream barbs; and gabions.

Biotechnical solutions are advantageous because of their cost effectiveness, durability and environmental compatibility compared to structural methods. The engineering and aesthetic aspects of these methods improve over time in contrast to "hardened" concrete solutions which deteriorate over time. Biotechnical techniques combine live native vegetation such as Willow and Ninebark with indigenous natural structural materials such as wood, stone or brush to stabilize banks and anchor the stream meander. This technique is quick, efficient and cost-effective. It is usually less disruptive to the site than concrete solutions and it also provides quick native vegetative cover.

**Revegetation**
The goal of revegetation is to remove existing exotic and invasive vegetation and to re-establish the banks with native plant material appropriate to that particular riparian plant community. Revegetation can occur as vegetative plantings or soil bioengineering as discussed under bank stabilization.

**Additional Components**
In addition to the basic components of creek restoration, additional components that may provide amenities to the community include "daylighting" buried culverts, removing road culverts, and recreation opportunities.

**"Daylight" Buried Culverts**
Daylighting is the removal of stormwater pipes and regrading to re-establish an open channel that functions like the historical channel as closely as possible and is based upon the stormwater flow needs of the creek. This enhancement, along with bridging the road at creek crossings, is a much larger and more expensive undertaking than other creek restoration methods. "Daylighting" generally improves flood water conveyance because the regraded channel is designed to handle larger storms than a typical culvert.

**Remove Road Culverts**
Replacing existing culverts at road crossings with bridges or removing crossings entirely is often desirable because culverts usually provide a restriction to flow. The entrance of culverts can also collect debris that may block the opening. Bridges also allow a more continuous natural habitat to be established, with sand and gravel creek bed material instead of concrete, and easier passage for wildlife through the area.
Bridging could be done whenever a culvert needs to be replaced, or specifically as a restoration

improvement.

Fords can also be used at creek crossings by grading the road down to the level of the low flow channel. Fords are best suited for streets with little traffic or emergency traffic only, and where high flows will not interfere with required travel.

In Albany, removal of culverts and replacement with pedestrian bridges or creek access points could be done at selected residential streets along Codornices Creek and Cerrito Creek. This would create cul-de-sac streets, with no through traffic, and allow creek restoration and access on the available public right-of-way. Replacement of culverts is also being considered for UC Village at 5th Street, 6th Street, and 8th Street, which have been closed to normal traffic across Codornices Creek.

**Recreation Opportunities**
Recreation opportunities provided with creek restoration projects allow people to appreciate, interact and learn from creeks. These opportunities can include trails and bikepaths along the creek with connections to other areas of the city, overlooks for passive recreational use, and interpretive signs to educate and inform the community about the creek system.

**Alternatives and Opportunities**

Criteria for determining alternatives and opportunities are based upon the following criteria: Function, Location, Opportunities and Ecosystem. Alternatives and opportunities are divided into two categories: Functional Repairs and Restoration Enhancement Opportunities. Opportunities for each of the creek reaches are shown in Table 8.

**Functional Repairs** describes repairs that would be desirable for a creek to improve its basic function of carrying storm drainage flow.

Debris Cleanup/Maintenance: fallen trees, significant overgrown vegetation in channel or on low flow channel banks, or man made debris (shopping carts, illegal dumping, etc.) in the channel significantly restrict water flow.

Bank Erosion Repair: areas of the creek bank are highly eroded and could potentially fail and contribute to additional sediment in the creek or endanger nearby structures or facilities.

**Restoration Enhancement Opportunities** describes possible alternatives available to recreate or enhance a creek system beyond the basic function of carrying drainage flows.

Debris Cleanup: overgrown vegetation, fallen trees or man made debris not a currently posing a flow problem but removal would enhance the creek's aesthetic and access value, control potential environmental (pollution) hazards or eliminate future flow capacity problems. The amount of vegetation and trees to be removed would need to be evaluated for its contribution to the creek's wildlife habitat.

Remove Exotics: remove exotic vegetation that are crowding out desirable riparian species. Removals could mean one Acacia tree or entire banks of ivy.

Revegetation of Native Species: provide new native plantings based upon identified beneficial vegetation communities. Revegetation could be one or two native trees or extensive new bank plantings.

Vegetation Management: the creek reach has the opportunity to support human and wildlife activity if a general maintenance strategy was implemented. Existing vegetation is not suitable for a desirable habitat or conflicts with the use of the creek as a drainage channel.

Stabilize Banks Fabric / Biotechnical: repair creek bank with a natural method of bank stabilization (erosion fabric, gabions, wattling, etc.). The repair could be a small or large area within the reach.

Restore Channel: restore the natural creek profile (channel dimensions, dynamics or meander) or section (width, terraces) for aesthetic, recreational and drainage capacity value and wildlife habitat.

Trail / Bike path/ Overlook: the creek reach has the potential for a trail and/or bikepath or rest stop. It would provide trail linkages to existing or proposed open space or urban development (shopping or services) or add on to a reach that has previously been developed with a trail or open space.

Wildlife Habitat: enhancement of the creek reach would contribute to the natural system acting as a wildlife corridor. Field observation has determined that particular creatures exist in the creeks and further vegetative restoration would contribute to the existence and reproduction of those species.

Education: education of residents about Albany's Watershed Management program could occur through signage in public areas or mailings to creekside residents and owners. The purpose of the mailings would be to provide a comprehensive guide to effective creek management techniques, inform residents of policies regarding building adjacent to a creek corridor, suggest maintenance tasks with appropriate cleanup seasons and offer techniques and resources for implementing new or repair work along or within the reach.

Daylight Creek: a potential opportunity exists to re-open a culverted reach of creek and return it to its natural condition.

Bridge Downstream: replacing culverts with bridges over the creek or widening culverts under roadways on the downstream portion of the reach to remove impediments to stormwater flow.

Purchase Easement: if maintenance or restoration needs to occur along a reach that is privately owned, the City should consider purchasing an easement to maintain control over that portion of the site where creek restoration can occur.

Purchase Land: land is currently vacant and available in reaches where purchase would greatly enhance the restoration potential or parcels of land with structures that straddle the creek or have been continually damaged by flooding.

The defined criteria was used to describe and identify the areas in need of repair and the potential creek restoration enhancement opportunities. The creeks were also evaluated on their overall impact within the regional urban and ecological and system of Albany, El Cerrito and Berkeley as well as the character zones imposed upon the creeks by adjacent urban development and zoning. These three creek zones are defined as: East of San Pablo (residential and commercial); West of San Pablo to I-80 and 580 (residential, commercial, public facilities, light industrial and open space); and the San Francisco Bay Waterfront. Methods used to determine priorities of creek restoration projects are described in chapter 5.

## CREEK MAINTENANCE

Creek maintenance is desirable to protect the health and safety of citizens by preventing flood damage, and to preserve and enhance the natural resources of the creeks riparian ecosystem. Proactive maintenance including inspections, debris clean-up and education can greatly reduce costly emergency work. Proactive planning to limit construction within the floodplain also reduces maintenance and costly repairs. " Engineers in local flood control or water management districts ... profess that the most economical and effective flood damage prevention program or project is that which regulates land use within the flood plain." - A. L. Riley, Report to Assemblyman Tom Bates, January 10, 1984.

Maintenance includes monitoring, clean-up, repair and enhancement in the following areas:

storm water conveyance
pollution control (both point and non-point source)
channel stabilization, grade control, and bank stabilization and erosion control
riparian and aquatic habitat restoration.

### Maintenance Tasks

**Storm water conveyance** requires annual inspection and removal of large fallen limbs or other debris that can clog the channel or culvert openings before the beginning of the rainy season. However, natural material should only be removed if it poses a safety hazard since it can provide excellent wildlife habitat and erosion control, and is an important part of a well functioning natural creek system.

**Pollution control** requires identification and monitoring of direct discharges of contaminants into the stream from point source pollution sources (sewer breaks or manufacturing discharges) and non-point sources (runoff from roads and parking lots or household cleaners poured into inlets). Periodic die testing of the sanitary sewer is recommended to identify possible leaks into the storm drainage system.

**Channel stabilization, grade control and bank stabilization and erosion control** requires identifying unstable channel sections and regrading where space permits or stabilizing with biotechnical techniques to achieve dynamic equilibrium. As discussed earlier under channel geometry, a creek channel is stabilized when water flow does not cause excessive downcutting of the streambed or erosion of the channel banks. In general, the goal is to provide adequate channel width and slope to hold the water flow without increasing velocity which causes downcutting of the stream bed.

**Riparian and aquatic habitat restoration** requires identifying and retaining existing native vegetative cover, identifying and removing invasive exotic species that can overrun the system, and re-planting with native plant species to improve terrestrial wildlife habitat and to lower water temperatures which improves aquatic habitat. In addition, restoring the natural pool-riffle-run sequences as described earlier under creek profile is needed to provide habitats for feeding, breeding and cover for aquatic life.

**Maintenance Responsibilities**
While the open stream channels serve to carry stormwater flows from all areas of the city, these channels are located on both private and public areas, creating a potential conflict in maintenance responsibilities. In many cases, cities have left maintenance of creeks on private property to individual owners, unless emergency action is required to prevent damage. In addition, other public agencies including the United States Army Corps of Engineers, United States Fish & Wildlife Service, California State Department of Fish & Game, and Regional Water Quality Control Board have regulatory control over what changes can be made to these water courses.

In general, Albany performs bi-annual inspections of creeks for overall maintenance and improvements, and acts as the lead agency in cooperation with the regulatory agencies on projects within the stream corridor.

City Maintenance staff does inspection for possible problems, notification of the need for repairs, provides emergency response to flooding or spills. If periodic inspections determine that debris removal is necessary, private property owners are notified and are required to perform this work. Also, they contract out some tasks such as tree or limb clearance.

City Environmental Resources staff does community outreach and education and is a liaison between volunteer groups and other agencies.

City Planning staff reviews development plans and verifies that construction meets the requirements of the Zoning Ordinance. The ordinance identifies a Watercourse Combining (WC) Zoning District which applies to areas within 75 feet of the centerline of each creek, and areas designated on the Flood Insurance Rate Map as a Special Flood Hazard Zone. The ordinance requires that no structures be built within 20 feet of the natural creek bank. However, this setback requirement may be decreased with a Conditional Use Permit. The ordinance also requires the Planning Commission to consider creek preservation and restoration when reviewing proposed development adjacent to the creeks. Any change to the land must follow flood damage prevention requirements and special geotechnical, drainage and erosion control measures as outlined by the Planning Department.

Albany has an active citizen volunteer group called the "Friends of Five Creeks". They do weekly water quality testing and hold regular creek clean-up days in conjunction with the City. Also, since enforcement is the weak link in protecting stream corridors, citizen education and vigilance can be effective tools.

Codornices Creek is the southern boundary separating Albany from the City of Berkeley. Maintenance responsibilities are shared by the two cities. Codornices Creek is inspected by the City of Albany from San Pablo Avenue west to the Bay; and by the City of Berkeley for that portion of the creek east of San Pablo Avenue.

Cerrito Creek is the northern boundary separating Albany from the Cities of El Cerrito and Richmond. Albany is responsible for the inspection of Cerrito Creek from San Pablo Avenue west to the Bay; the City of El Cerrito is responsible for inspecting areas lying east of San Pablo Avenue.

**Maintenance Policy**
Maintenance of the entire length of the creek channels is needed regardless of ownership. Water does not adhere to political boundaries and flows across and through various jurisdictions. The right to cross property lines to maintain creek channels for public health and safety has been granted by the State Lands Commission. Even though cities have the right to maintain the entire stream corridor, most do not claim responsibility or authority for maintenance of the watershed except for those areas actually in public ownership. City attorneys feel that they accept liability if they accept the responsibility while others feel that they are legally vulnerable if they know of a problem and do not respond. But, this is not the case as court cases over the last 15 years have upheld the cities "sovereign immunity" if they attempt to provide proactive maintenance. (A. L. Riley; Personal communication. Report to Assemblyman Tom Bates on Legislation for Watershed Maintenance, January 10, 1984 and Legal and Regulatory Framework: Constitutional Authority for Regulation of Flood Plains, November, 1984.)

**Maintenance Recommendations**
1. Institute an annual pro-active program to clean debris from the mouths of culverts prior to the beginning of the rainy season. This would be similar to the program for storm drain inlets and could utilize City maintenance workers, court workers and/or volunteers.

2. Develop a City Stream Corridor Management Program. This plan would be an operations manual for City staff and private homeowners that states maintenance procedures for all existing conditions and future implemented projects. The goal of the document would be to provide pro-active best management practices (BMPs) for the open creek channels and those troublesome spots where the creeks enter and exit culverts. One methodology to start

developing this manual would be to meet with adjacent cities to coordinate practical strategies for maintaining the creeks, develop specific operations for creek maintenance, and possibly coordinate maintenance through shared equipment and training. Planning and implementation steps to maintain the creeks can also be shared in the diverse environment of four cities, a University and a many private landowners.

The program should incorporate working methods learned from this coordination into a manual (with text and maps) which outlines who, what, when and where in an organized manner.

3. Pursue funds from the FEMA Hazard Mitigation Grant Program which requires that 15% of all emergency funds be spent on proactive programs. This is one of the few programs that funds proactive programs.

## OTHER PLANNED PROJECTS

There are a number of projects currently in the planning stage that may involve aspects of the watershed management plan. These projects may influence choices made for the watersheds, by providing opportunity windows which would make projects easier and less costly to implement.

### University Village

The University of California is planning improvements to the University Village graduate student housing complex in Albany. As part of this process, changes may be made to Codornices Creek as one alternative for keeping planned buildings above the 100-year flood level. In addition, locations for a future restored Village Creek are being planned.

### Berkeley Sewer Project

The City of Berkeley is planning improvements to their sanitary sewer outfall, which will parallel an existing sewer line on the south side of Cerrito Creek between Adams Street and Pierce Street. As part of this project, mitigation for disturbances to the area near the creek will be required. Construction of this project is scheduled for summer of 1998.

### El Cerrito Plaza Development

The El Cerrito Plaza Shopping Center, located in El Cerrito between San Pablo Avenue and BART just north of Albany, is in the process of being redeveloped. The project will redevelop an existing mall-type shopping center, located adjacent to the BART rapid transit station. The proposal would create a transit-oriented, mixed use development including housing, retail and office space. The plan includes a parking garage, central public plaza and a restored creek with pedestrian/bicycle trails. The creek restoration elements requested by the City of El Cerrito includes daylighting about 500 lineal feet of creek (BART to Talbot) and restoring about 660 lineal feet of existing creek (Talbot to Kains). A draft environmental impact report and conceptual design of the creek restoration have been completed. The project has been temporarily postponed until a new developer is found.

### Richmond Pacific East Mall

This project consists of the redevelopment of a shopping center located east of Pierce Street just north of Cerrito Creek in the City of Richmond. As part of the conditional use permit for the site, a stream remediation and flood control plan is required for creeks adjoining the property, including Cerrito Creek, with revegetation of the banks and channel.

### Codornices Creek between San Pablo Avenue and Interstate-80

A conceptual design for the restoration of Codornices Creek between San Pablo Avenue and Interstate-80 was prepared by the Waterways Restoration Institute for the City of Berkeley in July 1997.

# CASE STUDIES OF RECENT RESTORATION PROJECTS

## Blackberry Creek at Thousand Oaks Grade School, Berkeley, CA

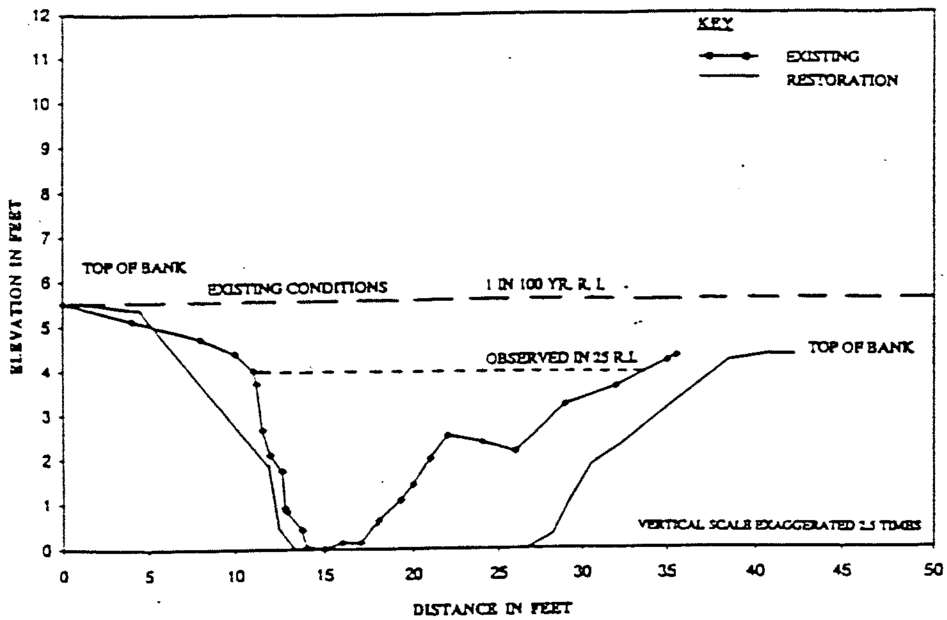
Type: Daylighting buried culvert
Year (from design to final implementation): 1991-1995
Lineal Feet of Creek Restored: 250+
Creek Channel/Top of Bank Width: 8 feet/ 20 feet
Basic Enhancements (minimal enhancements required to restore its natural function and appearance):
Additional Enhancements:
Implementation Cost including Design and Engineering: $300,000
Funding Source: State Department of Water Resources Stream Restoration Grant, Berkeley Unified School District Seismic Fund for the Thousand Oaks Grade School, City of Berkeley Park Grant and In-kind Staff Help, Volunteers
Approximate Cost per Linear Feet based upon Contractor Installation: $1,000 per linear foot.

## San Leandro Creek at Root Park, San Leandro, CA

Type: Revegetation and stabilizing slopes; trail access and overlooks
Year (from design to final implementation): 1991-1995
Lineal Feet of Creek Restored: 200+
Creek Channel/Top of Bank Width: 20 feet/60 feet
Basic Enhancements (minimal enhancements required to restore its natural function and appearance):
Additional Enhancements:
Implementation Cost including Design and Engineering: $40,000 for stabilization and revegetation; $150,000 for access paths, stairs and paths
Funding Source: City of San Leandro Capital Improvement Fund, State Department of Water Resources Stream Restoration Grant
Cost per Square Feet based upon Contractor Installation: $10 for restoration

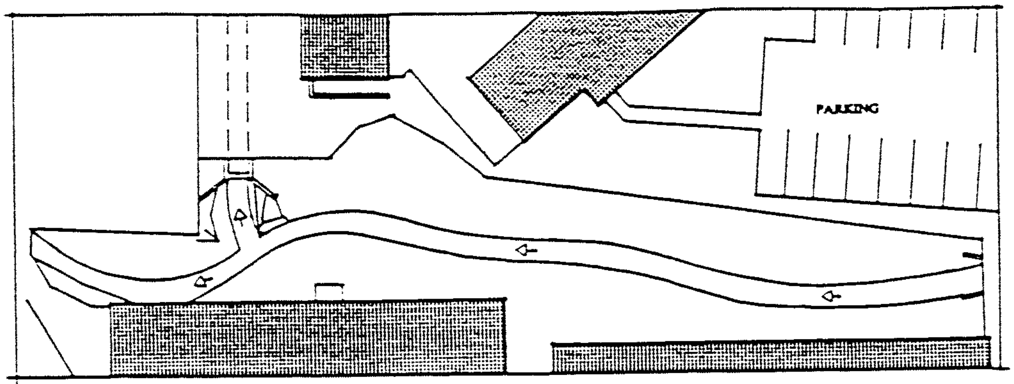
## Codornices Creek between 8th and 9th Street, Berkeley/Albany, CA

Type: Daylighting buried culvert
Year (from design to final implementation): 1992-1996
Lineal Feet of Creek Restored: 400+
Creek Channel/Top of Bank Width: 12 feet/ 30 feet
Basic Enhancements (minimal enhancements required to restore its natural function and appearance):
Additional Enhancements:
Implementation Cost including Design and Engineering: $100,000+
Funding Source: State Department of Water Resources Stream Restoration Grant, Volunteers, Private developer for the Body Time Building
Cost per Linear Feet: $400



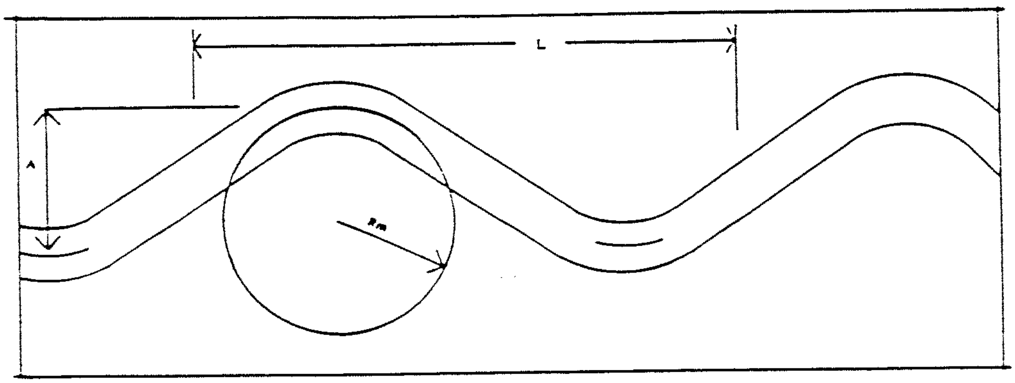

CODORNICES CREEK TYPICAL CROSS SECTION
WATERWAYS RESTORATION INSTITUTE

CREEK Geometry

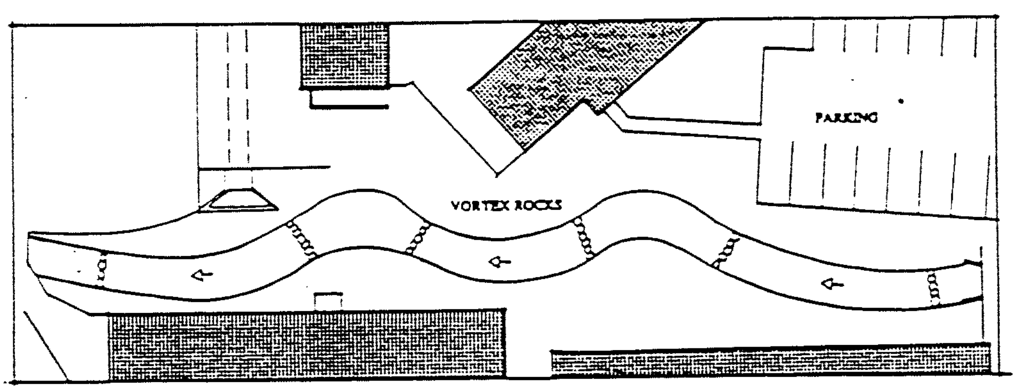



EXISTING CONDITIONS

SCALE: 1" = 60'




CALCULATED MEANDER

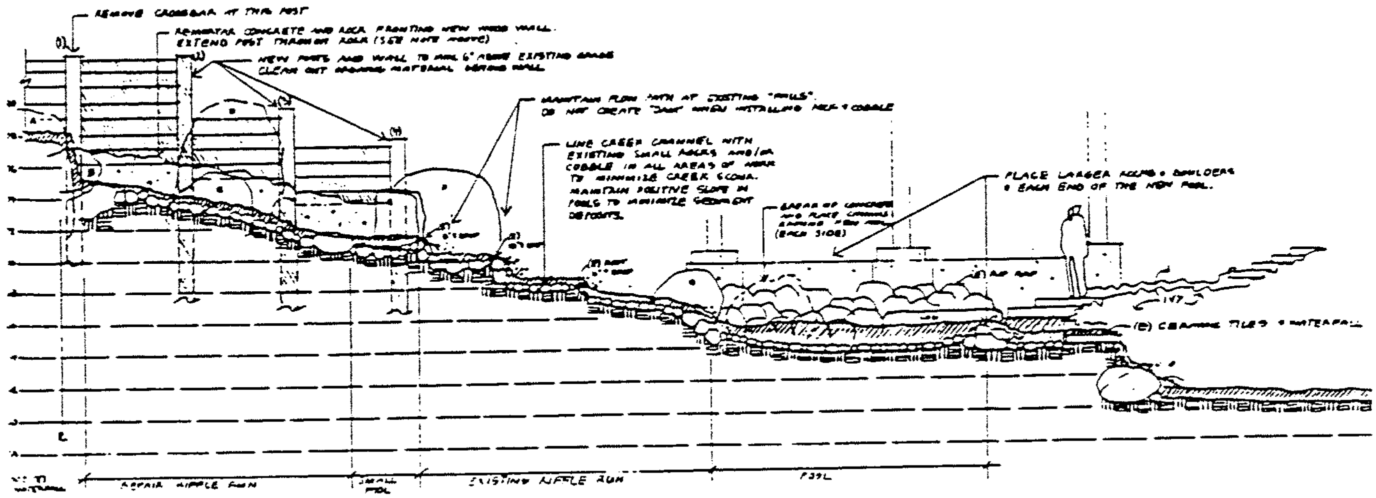



RESTORATION DESIGN PLAN

SCALE: 1" = 60'

CODORNICES CREEK. BERKELEY, CA

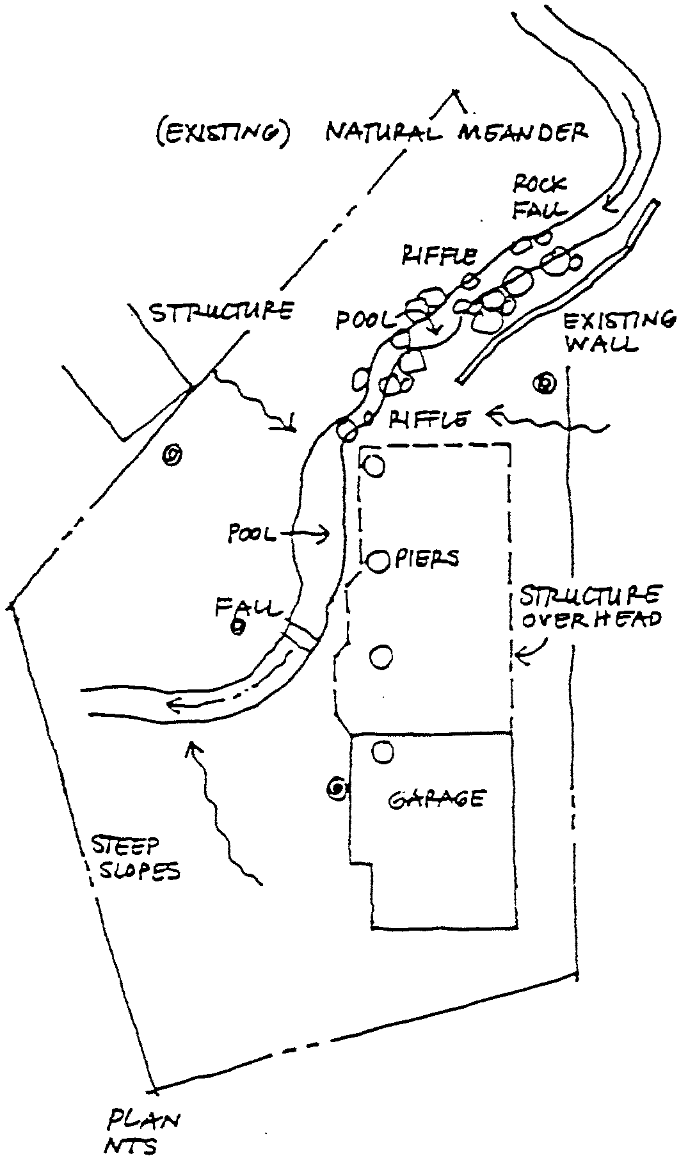
CREEK GEOMETRY




PROFILE:

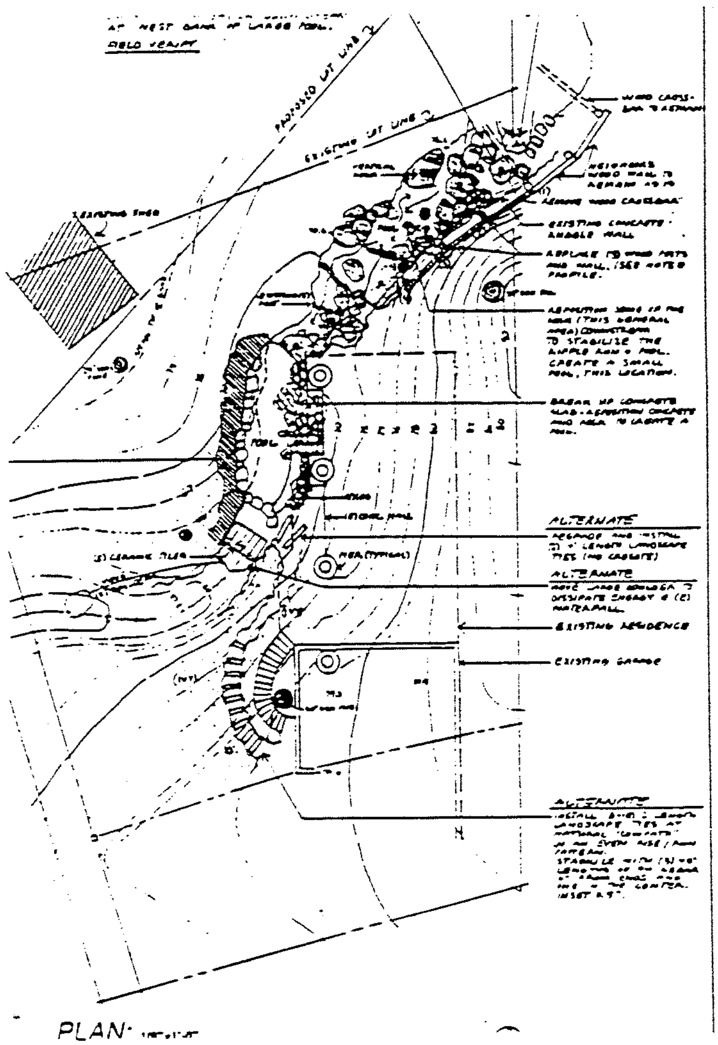
31 KENSINGTON ROAD, WMA 1996

CREEK PROFILE




31 Kensington Diagram of
existing meander and modifications
to meander character (falls, pools, riffles) WMA 1996

CREEK PROFILE




31 Kensington

SOIL BIOENGINERING - 6 SHTS



*(i)* ***Live stakes***—Live staking involves the insertion and tamping of live, rootable vegetative cuttings into the ground (figs. 16–4 and 16–5). If correctly prepared, handled, and placed, the live stake will root and grow (fig. 16–6).

A system of stakes creates a living root mat that stabilizes the soil by reinforcing and binding soil particles together and by extracting excess soil moisture. Most willow species root rapidly and begin to dry out a bank soon after installation.

*Applications and effectiveness*

- Effective streambank protection technique where site conditions are uncomplicated, construction time is limited, and an inexpensive method is needed.
- Appropriate technique for repair of small earth slips and slumps that frequently are wet.
- Can be used to peg down and enhance the performance of surface erosion control materials.
- Enhance conditions for natural colonization of vegetation from the surrounding plant community.
- Stabilize intervening areas between other soil bioengineering techniques, such as live fascines.
- Produce streamside habitat.

**Figure 16–4** Live stake details

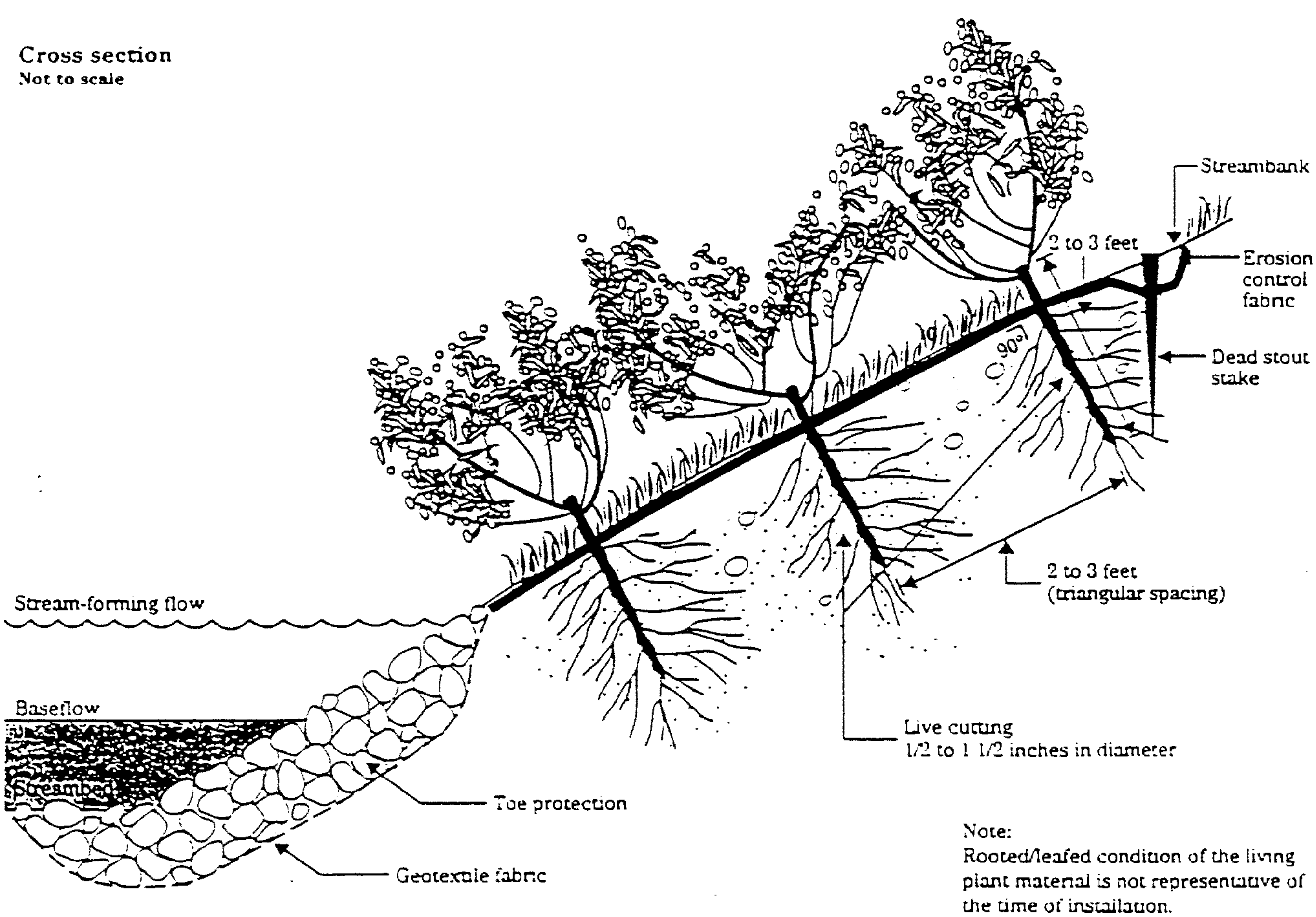


**Figure 16–7** Live fascine details

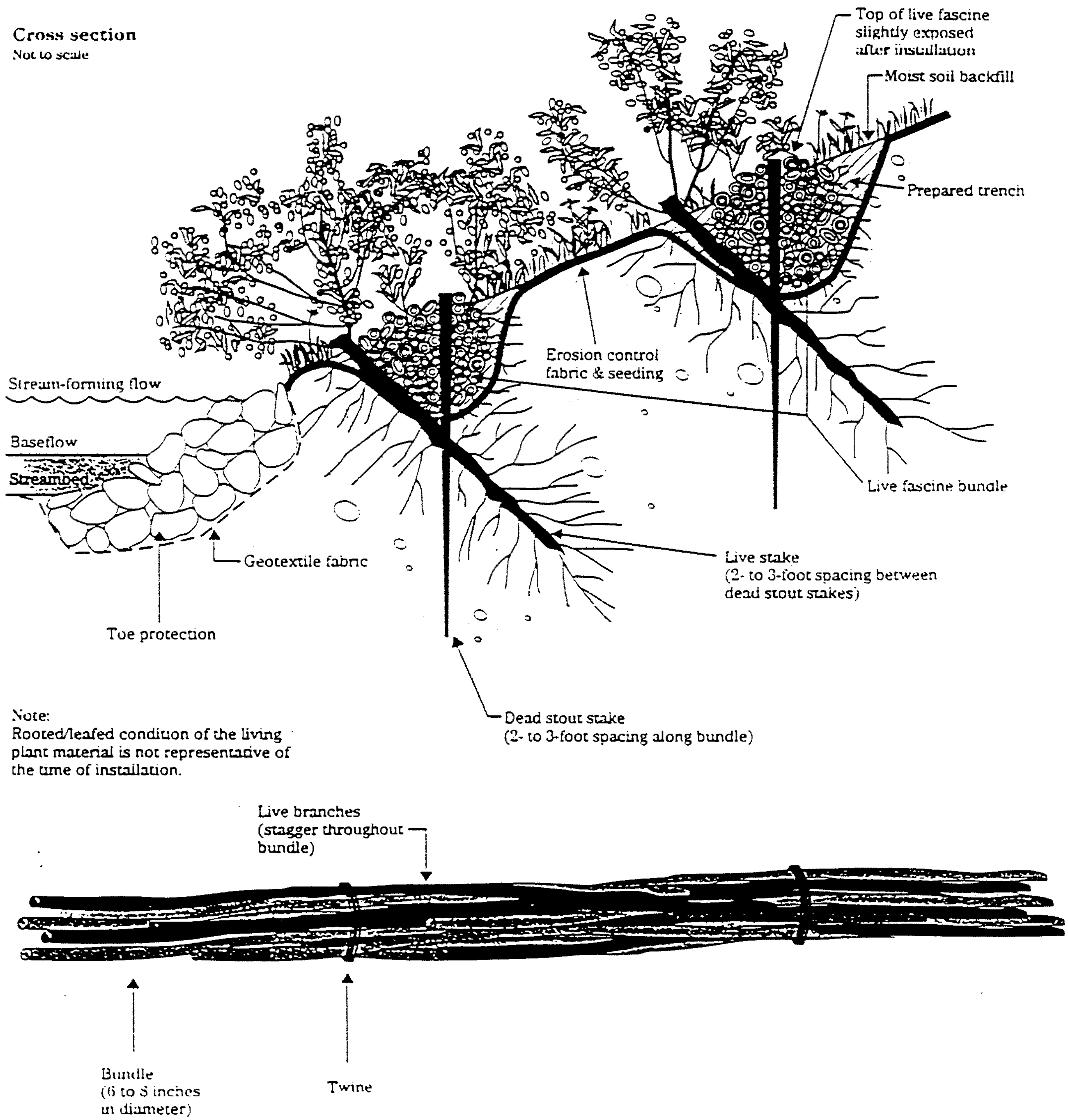
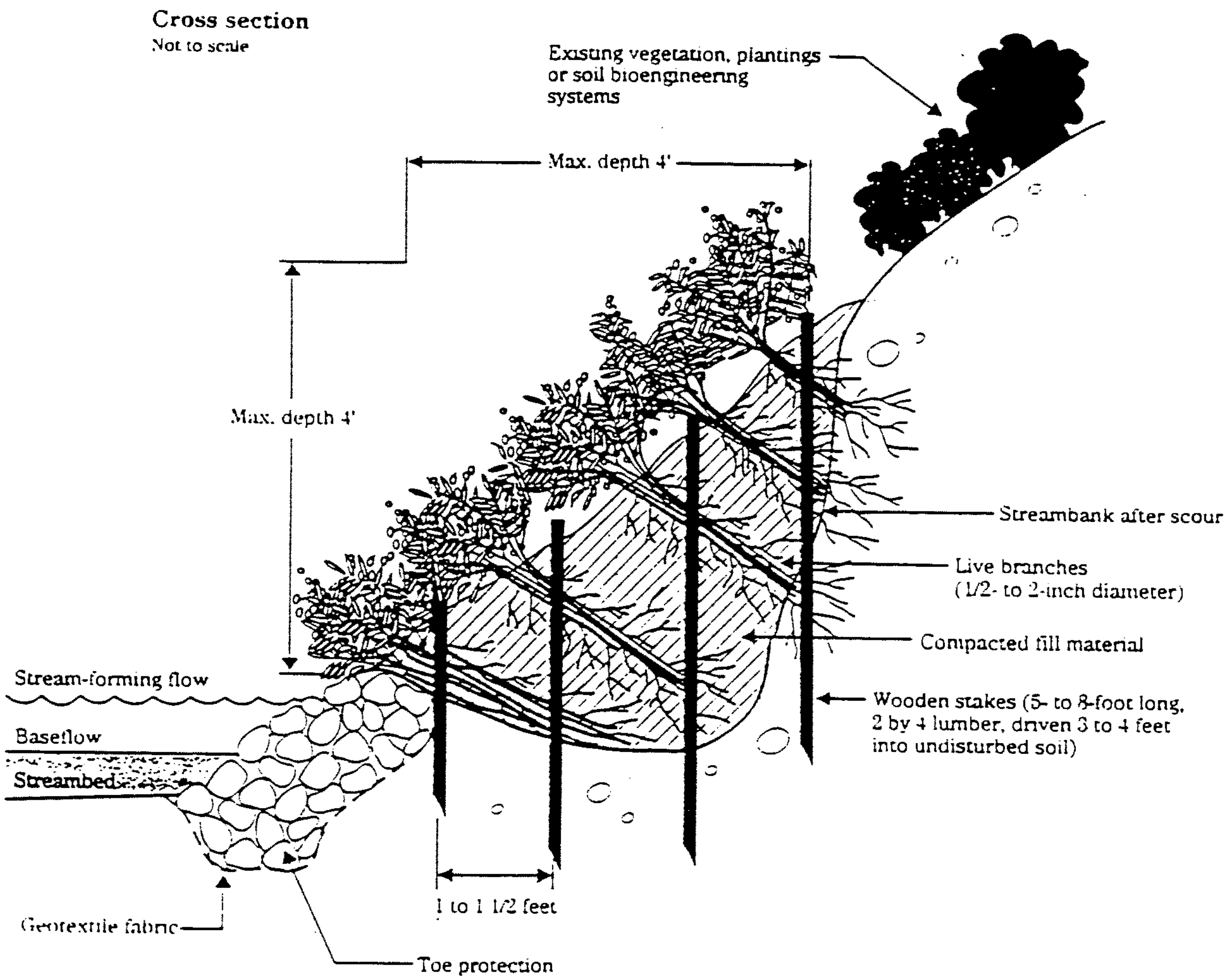
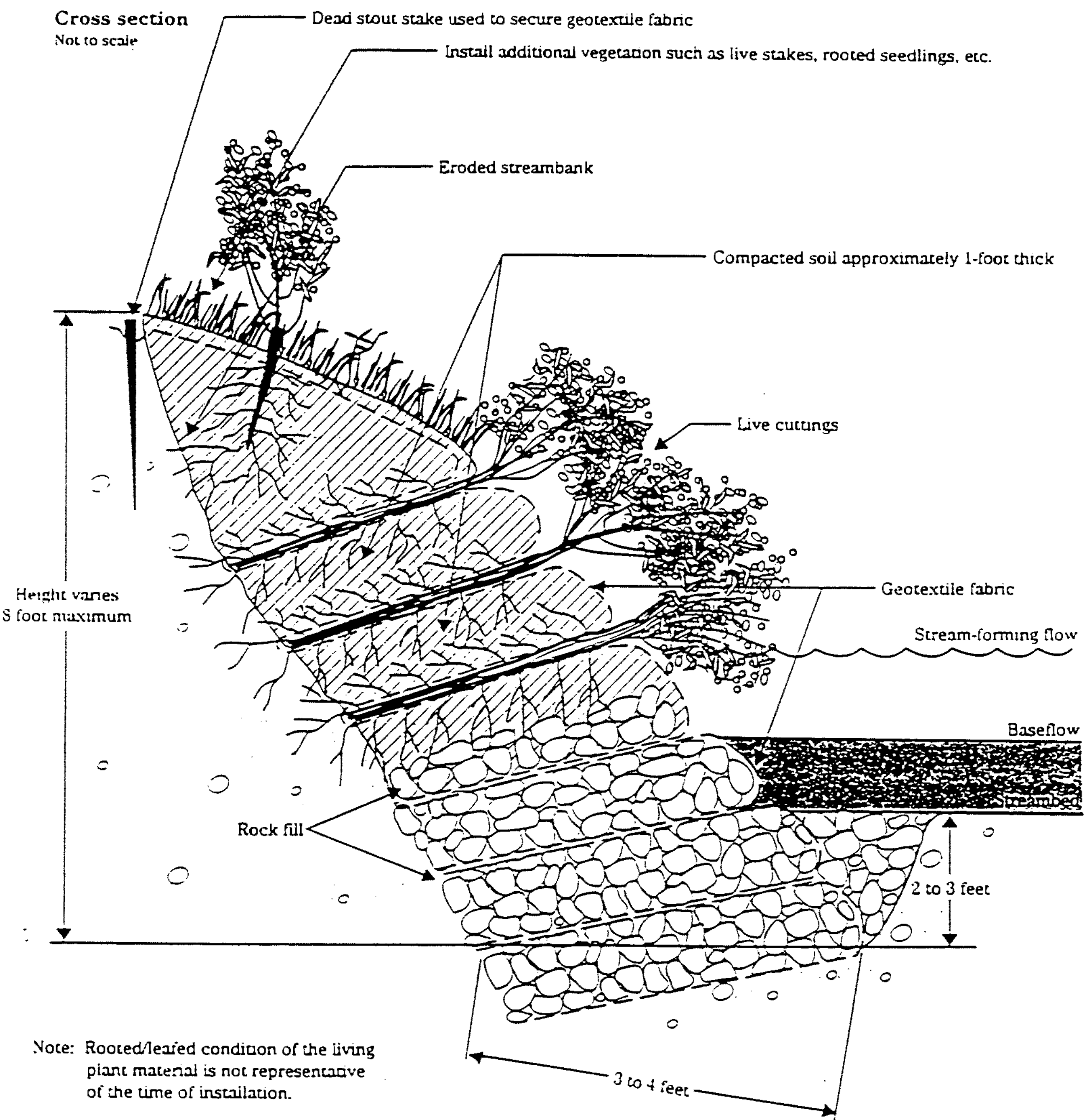


**Figure 16–10** Branchpacking details




Note:
Root/leafed condition of the living plant material is not representative of the time of installation

**Figure 16–12** Vegetated geogrid details




Note: Rooted/leafed condition of the living plant material is not representative of the time of installation.

*(vi)* ***Joint planting***—Joint planting or vegetated riprap involves tamping live stakes into joints or open spaces in rocks that have been previously placed on a slope (fig 16–16). Alternatively, the stakes can be tamped into place at the same time that rock is being placed on the slope face.

*Applications and effectiveness*

- Useful where rock riprap is required or already in place.
- Roots improve drainage by removing soil moisture.
- Over time, joint plantings create a living root mat in the soil base upon which the rock has been placed. These root systems bind or reinforce the soil and prevent washout of fines between and below the rock.
- Provides immediate protection and is effective in reducing erosion on actively eroding banks.
- Dissipates some of the energy along the streambank.

*Construction guidelines*

Live material sizes—The stakes must have side branches removed and bark intact. They should be 1.5 inches or larger in diameter and sufficiently long to extend well into soil below the rock surface.

*Installation*

- Tamp live stakes into the openings of the rock during or after placement of riprap. The basal ends of the material must extend into the backfill or undisturbed soil behind the riprap. A steel rod or hydraulic probe may be used to prepare a hole through the riprap.
- Orient the live stakes perpendicular to the slope with growing tips protruding slightly from the finished face of the rock (figs. 16–17a, 16–17b, and 16–17c).
- Place the stakes in a random configuration.

**Figure 16–16** Joint planting details

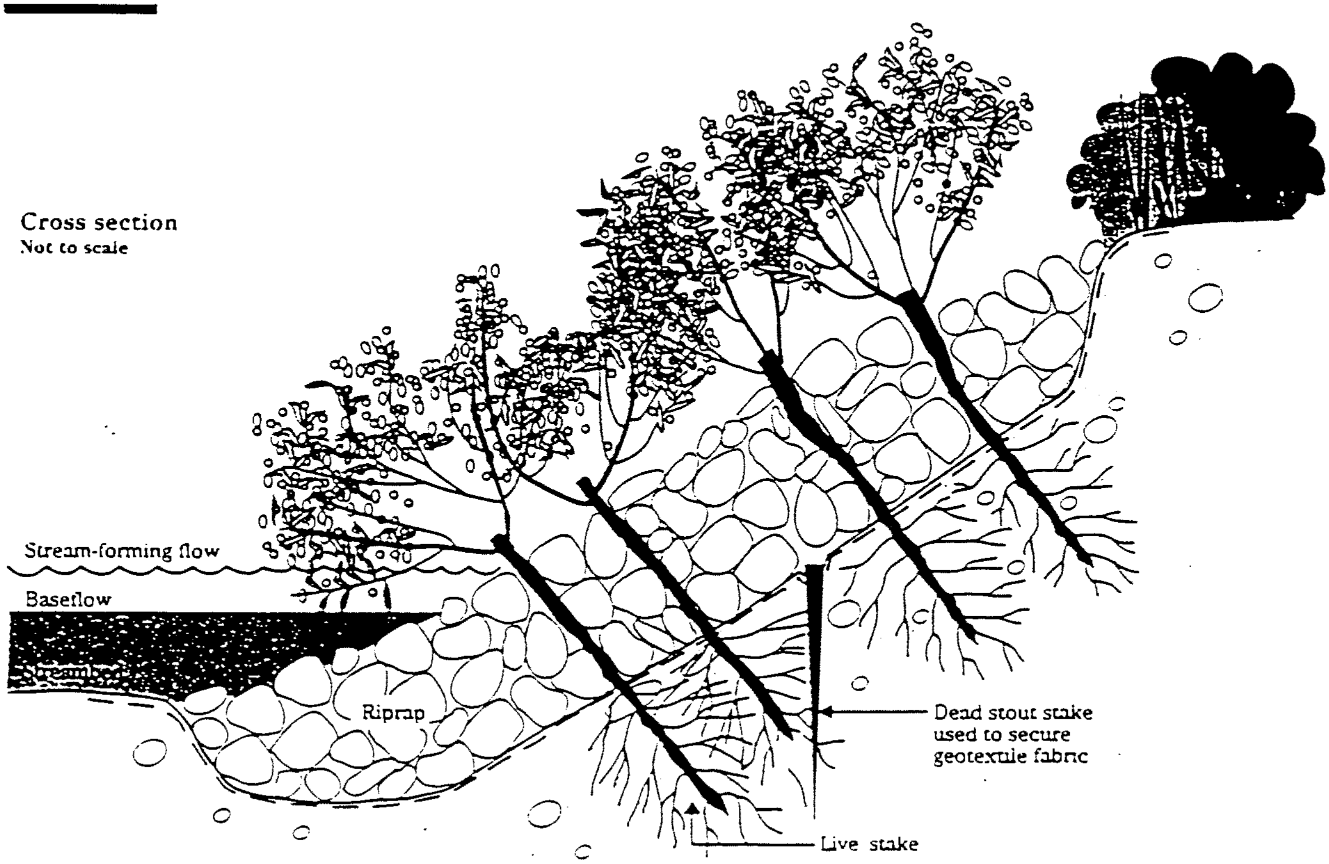
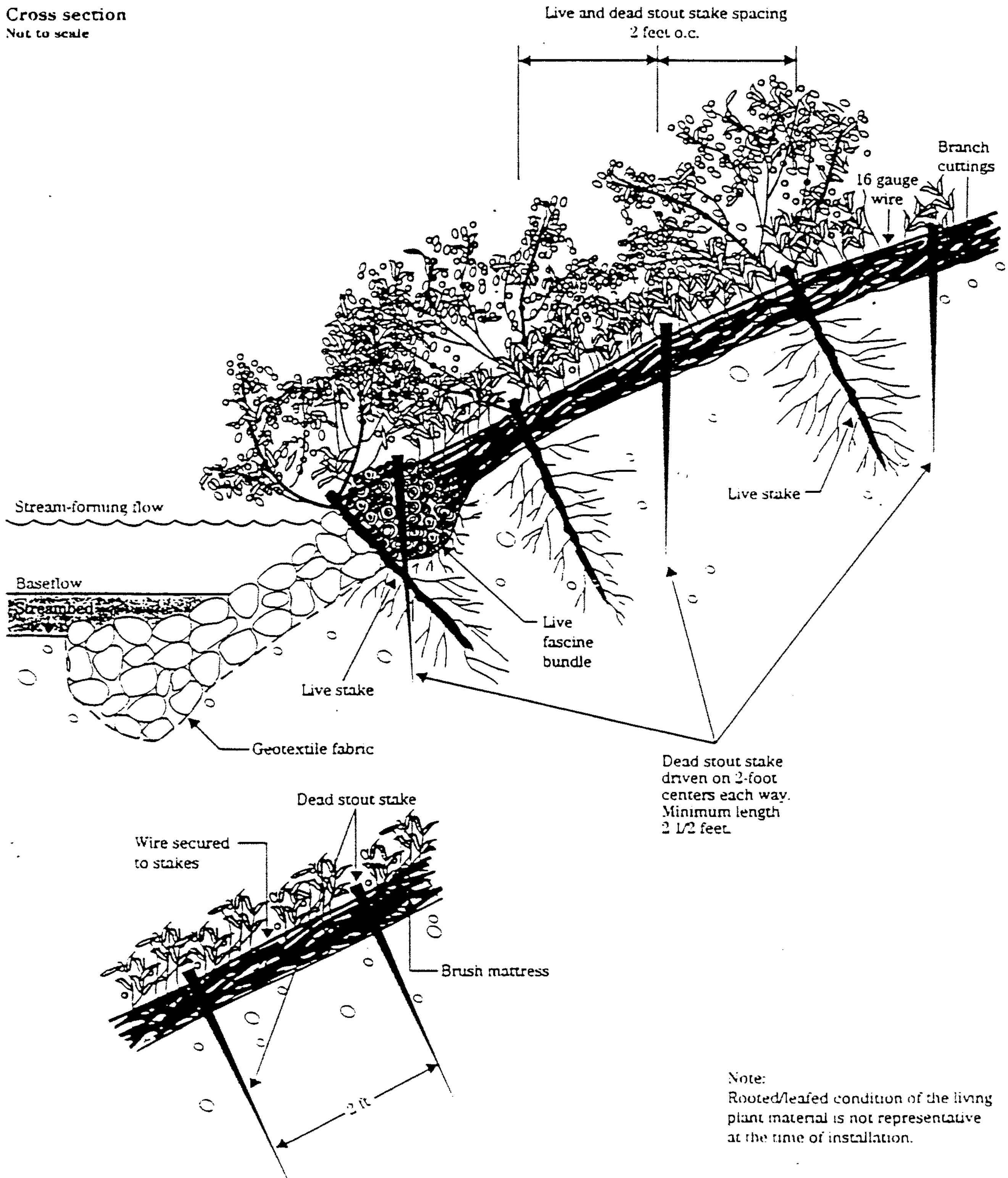
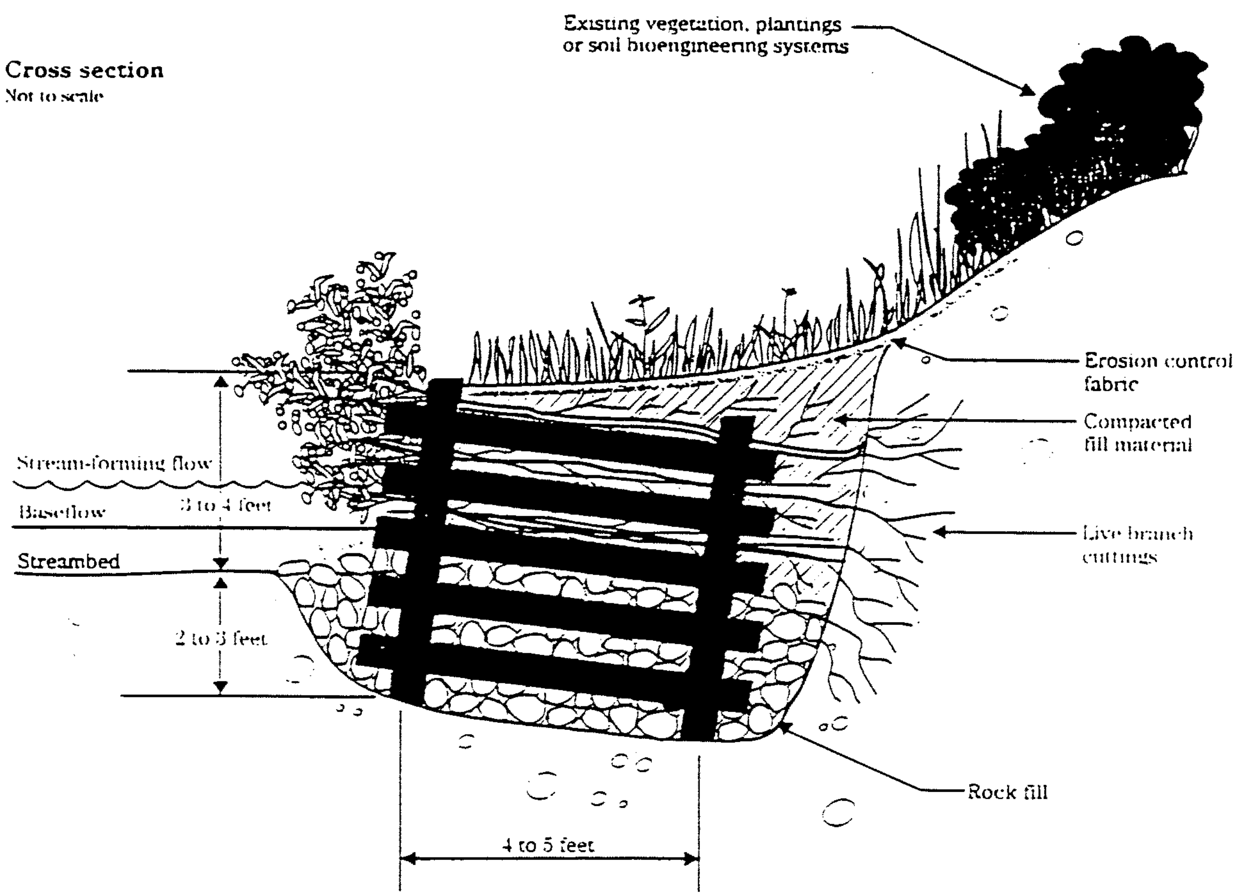


**Figure 16–18** Brushmattress details



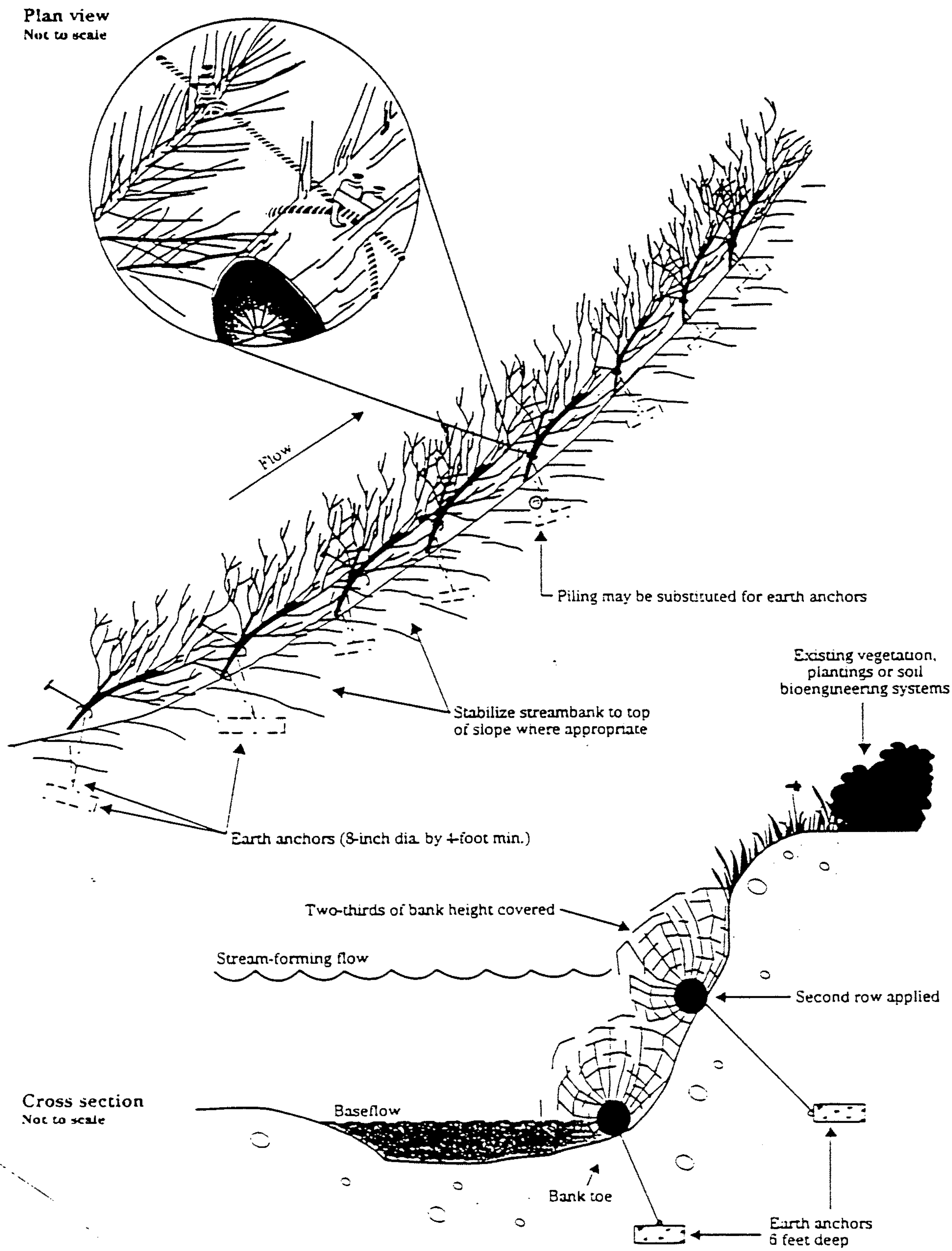

Note:
Rooted/leafed condition of the living plant material is not representative at the time of installation.

**Figure 16–14** Live cribwall details




Note:
Rooted/leafed condition of the living plant material is not representative of the time of installation.

**Figure 16–20** Tree revetment details

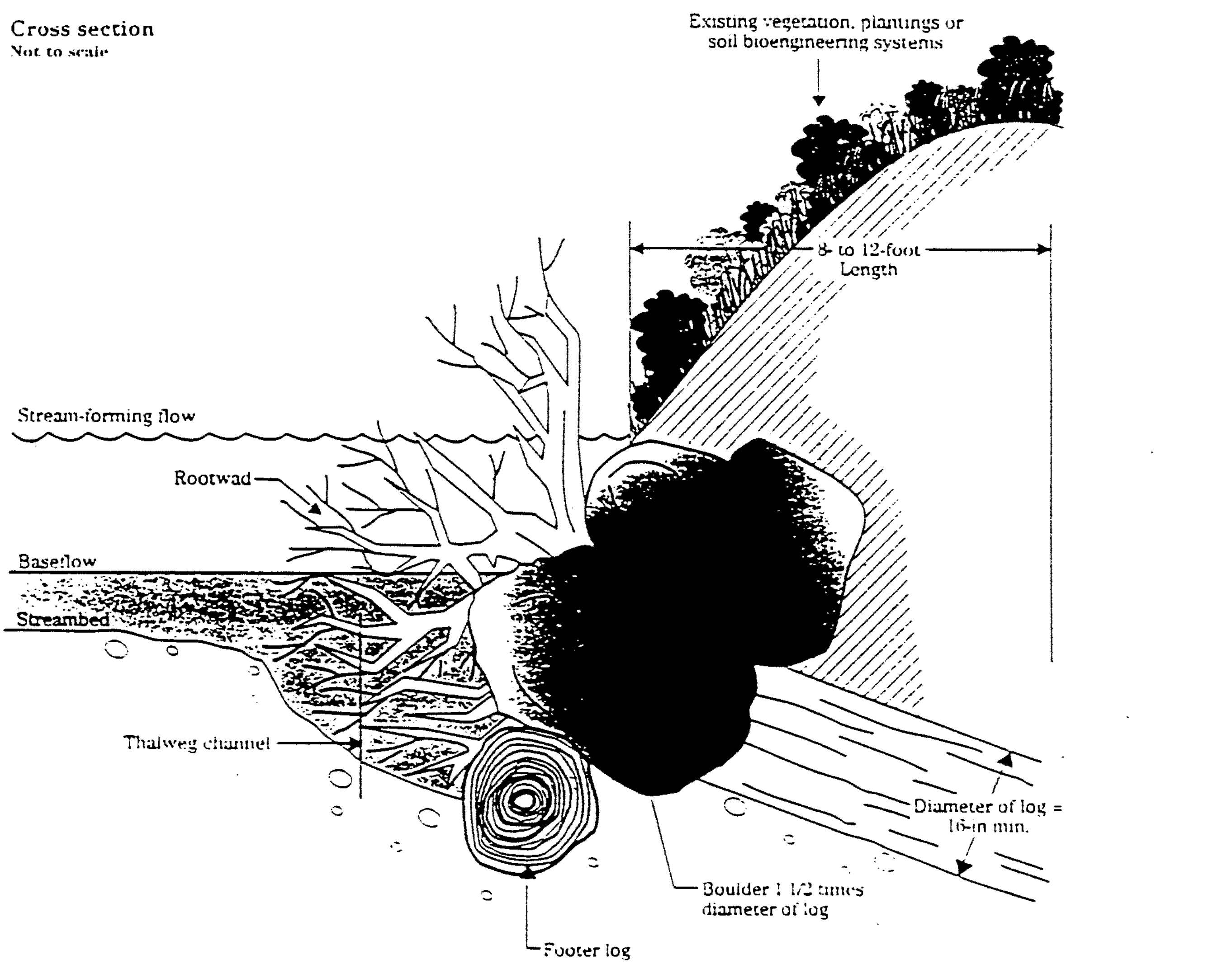


*(ii) Log, rootwad and boulder revetments*—These revetments are systems composed of logs, rootwads, and boulders selectively placed in and on streambanks (figs. 16–22 and 16–23). These revetments can provide excellent overhead cover, resting areas, shelters for insects and other fish food organisms, substrate for aquatic organisms, and increased stream velocity that results in sediment flushing and deeper scour pools. Several of these combinations are described in Flosi and Reynolds (1991), Rosgen (1992) and Berger (1991).

*Applications and effectiveness*

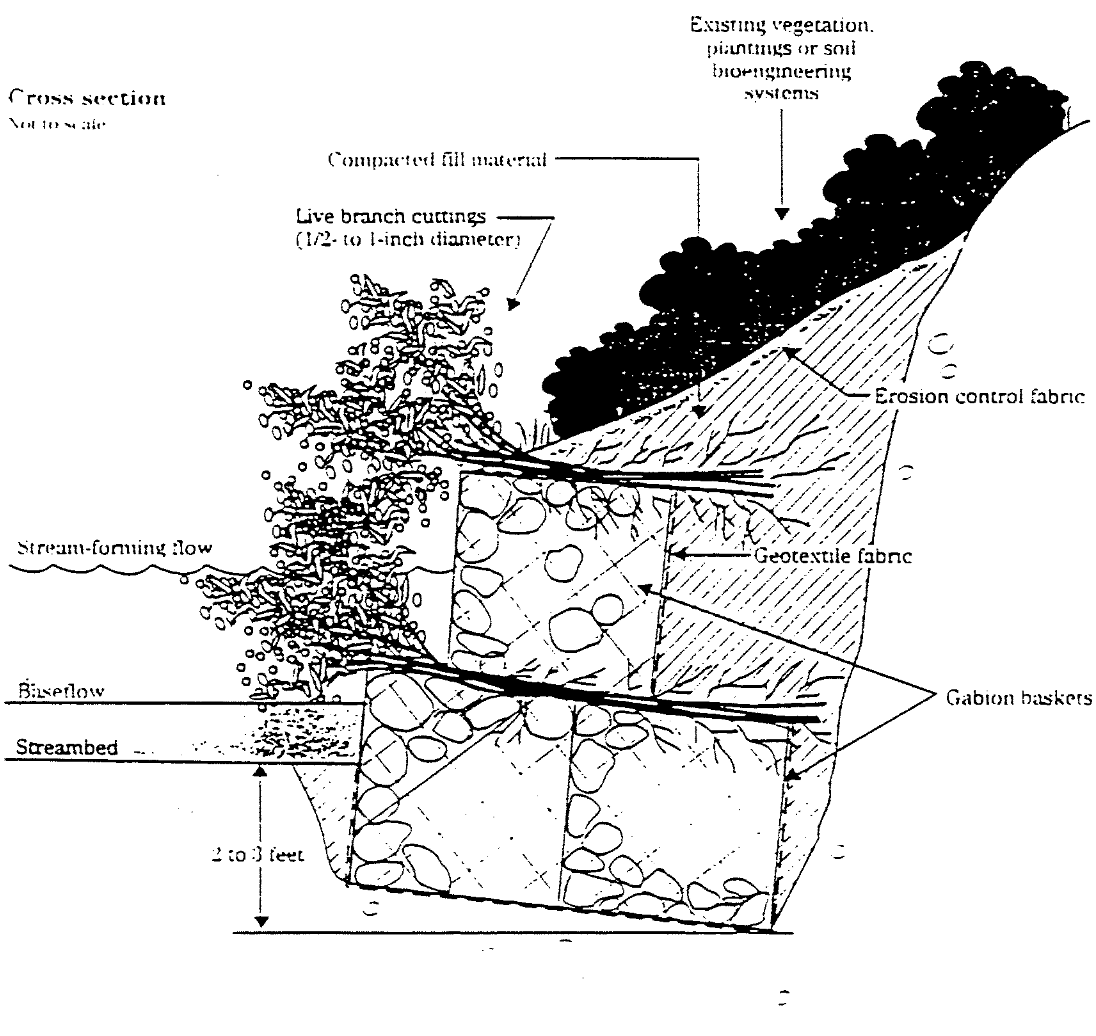
- Used for stabilization and to create instream structures for improved fish rearing and spawning habitat
- Effective on meandering streams with out-of-bank flow conditions.
- Will tolerate high boundary shear stress if logs and rootwads are well anchored.
- Suited to streams where fish habitat deficiencies exist.
- Should be used in combination with soil bioengineering systems or vegetative plantings to stabi-

**Figure 16–22** Log, rootwad, and boulder revetment details (adapted from Rosgen 1993—Applied fluvial geomorphology short course)

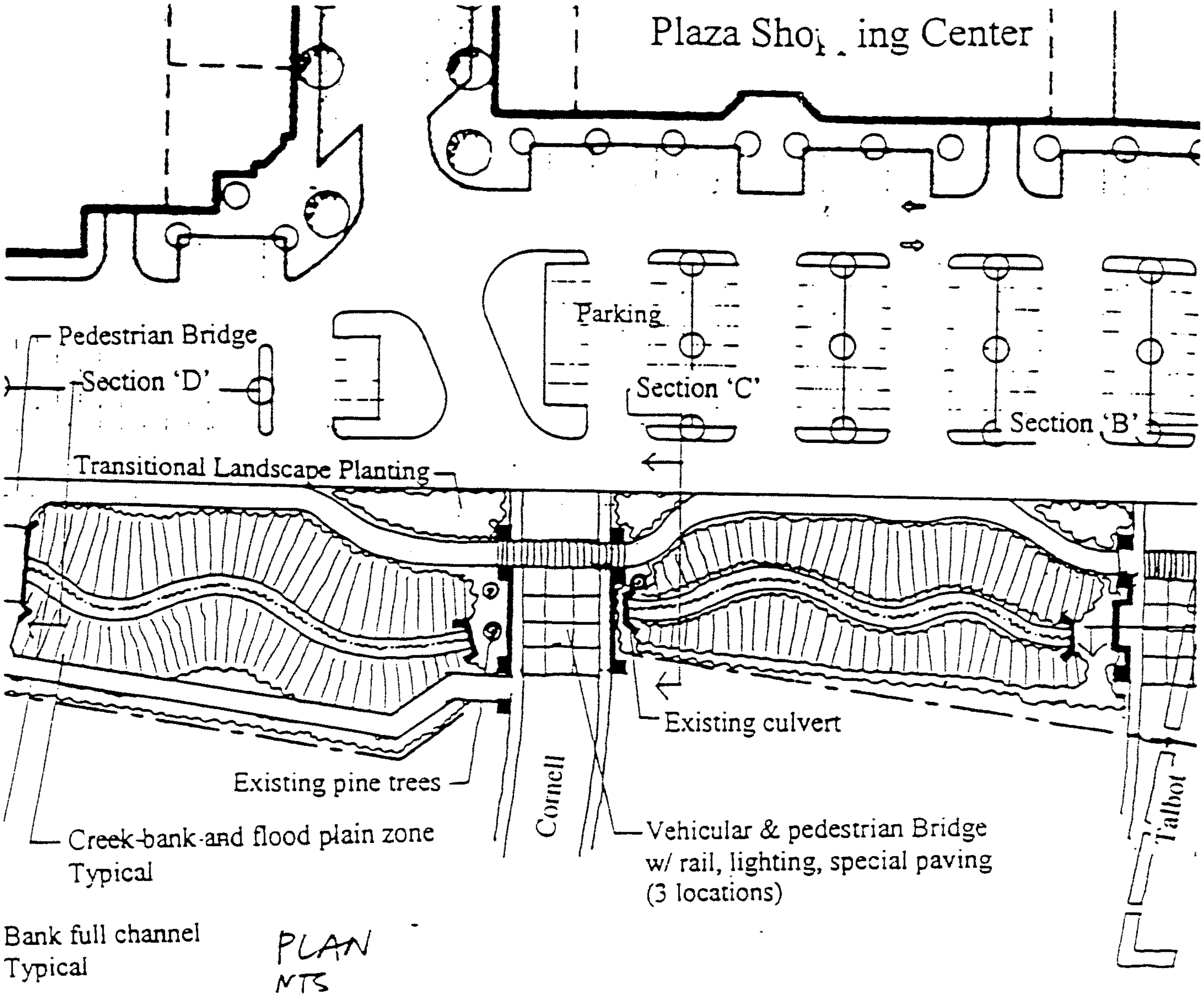


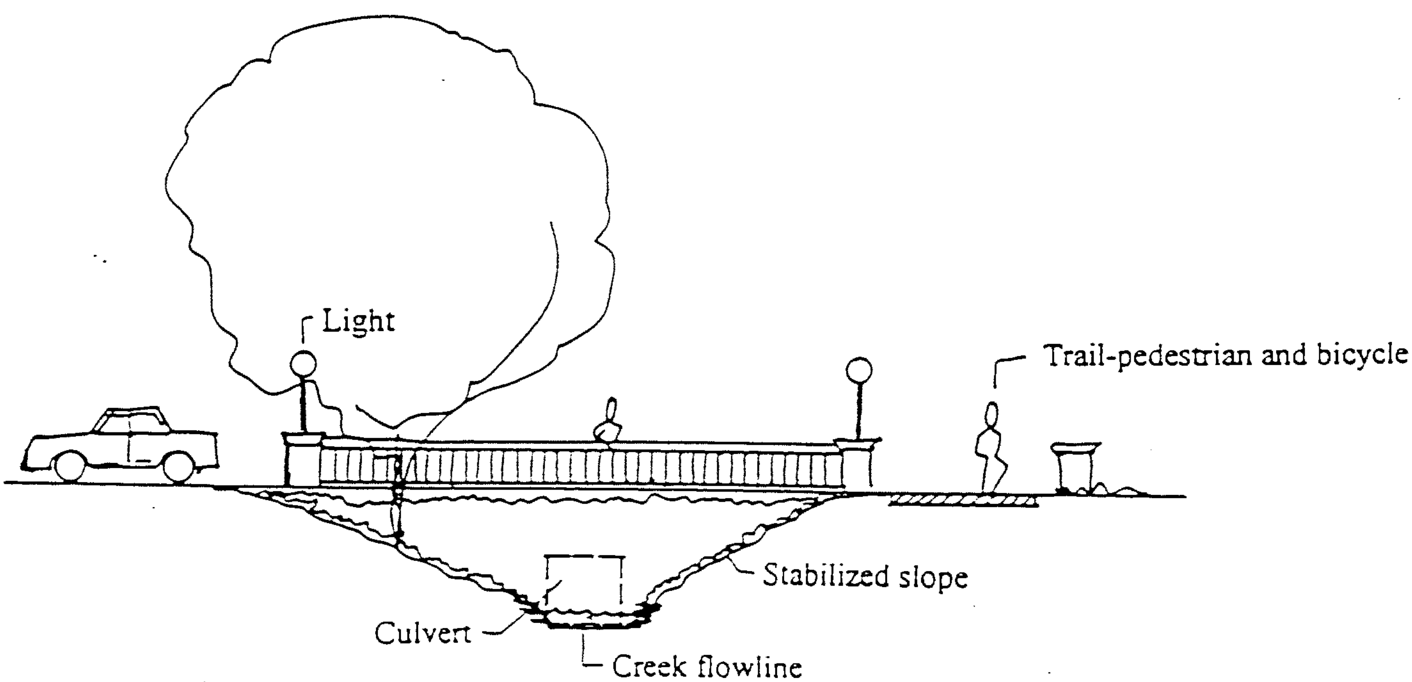
- Where abrasive bedloads or debris can snag or tear the gabion wire, a concrete cap should be used to protect those surfaces subject to attack. A concrete cap 6 inches thick with 3 inches penetration into the basket is usually sufficient. The concrete for the cap should be placed after initial settlement has occurred.
- A filter is nearly always needed between the gabions and the foundation or backfill to prevent soil movement through the baskets. Geosynthetics can be used in lieu of granular filters for many applications, however, when drainage is critical, the fabric must maintain intimate contact with the foundation soils. A 3-inch layer of sand-gravel between the gabions and the filter material assures that contact is maintained.
- At the toe and up and downstream ends of gabion revetments, a tieback into the bank and bed should be provided to protect the revetment from undermining or scour.

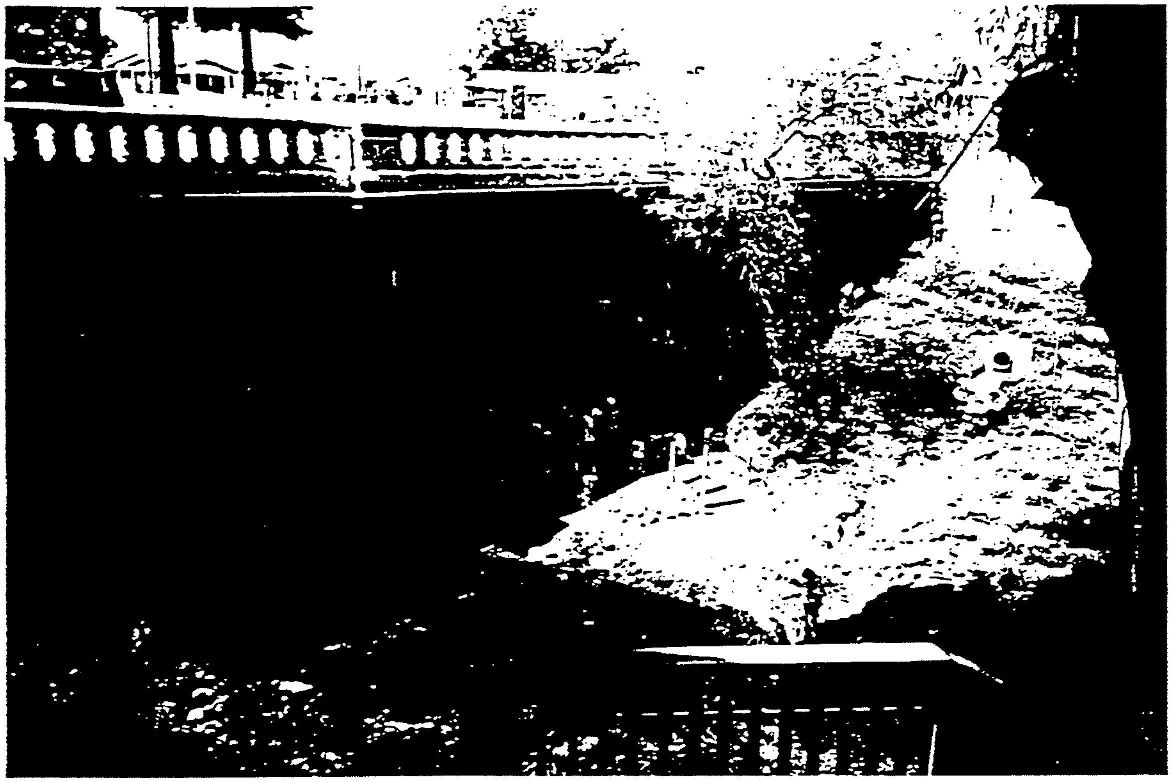
**Figure 16–42** Vegetated rock gabion details



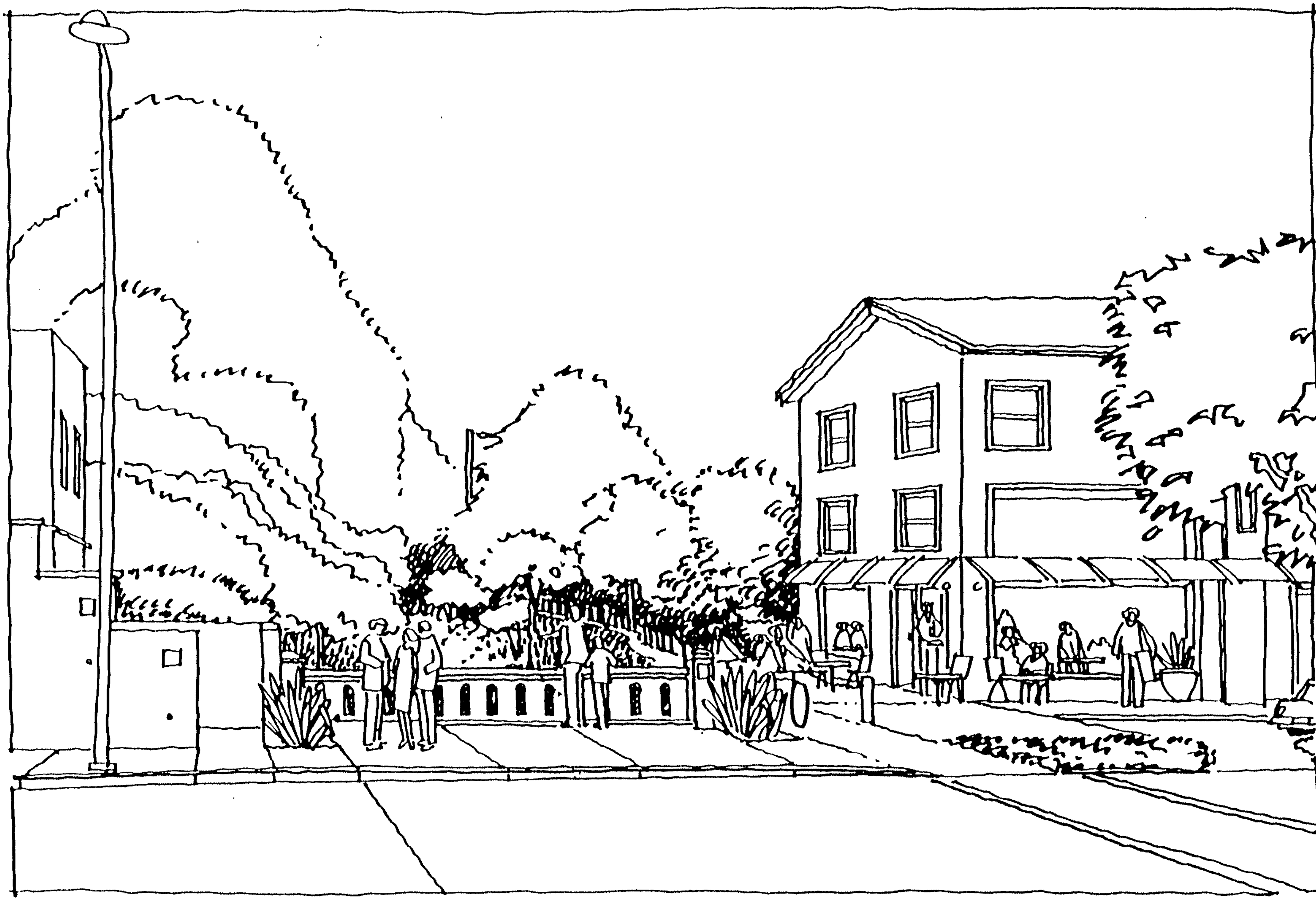

Note:
Rooted/leafed condition of the living plant material is not representative of the time of installation.


Plaza Sho_ing Center
Parking
Pedestrian Bridge
Section 'D'
Section 'C'
Section 'B'
Transitional Landscape Planting
Existing culvert
Existing pine trees
Cornell
Talbot
Creek-bank-and flood plain zone
Typical
Vehicular & pedestrian Bridge
w/ rail, lighting, special paving
(3 locations)
Bank full channel
Typical
PLAN
NTS

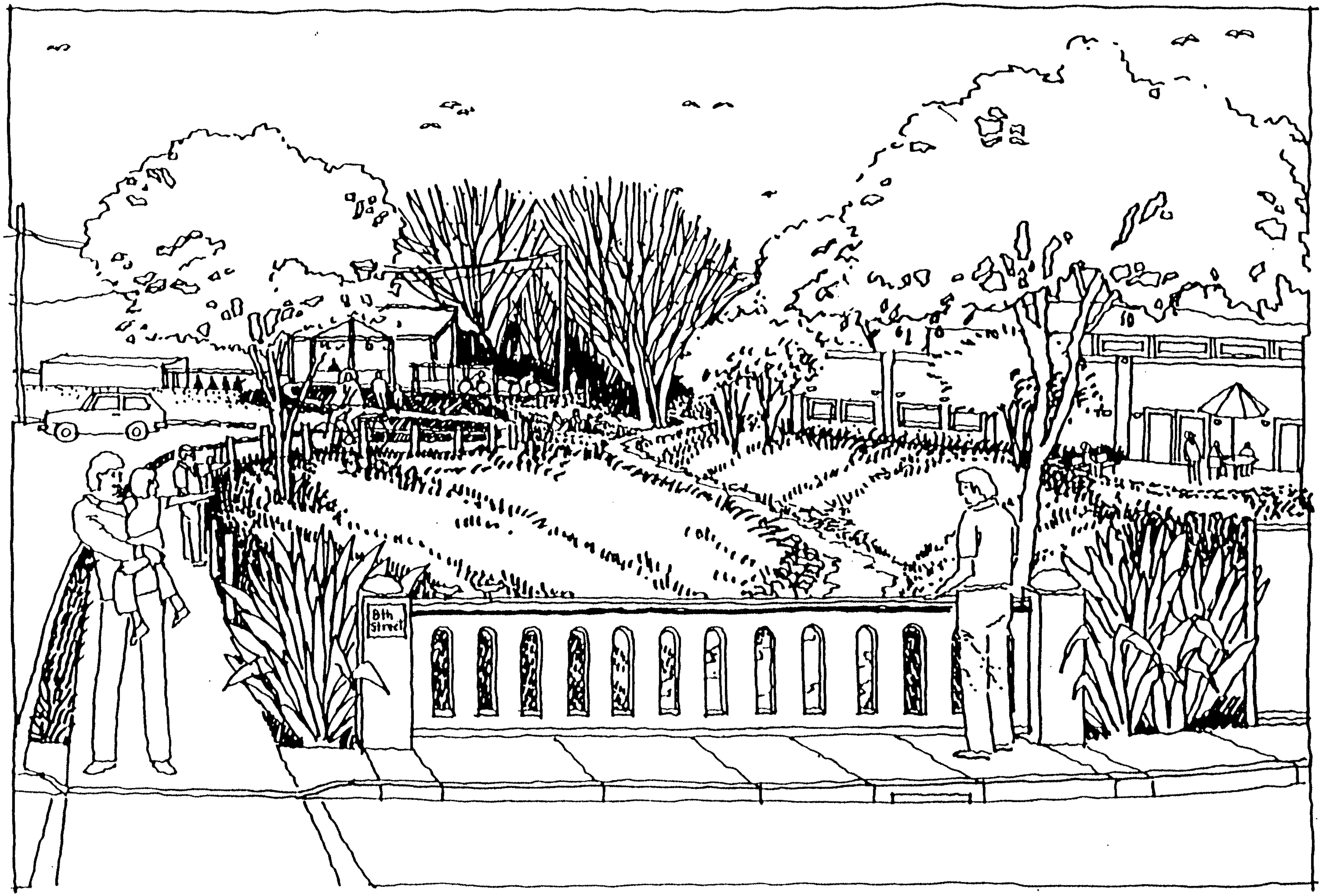

Light
Trail-pedestrian and bicycle
Stabilized slope
Culvert
Creek flowline

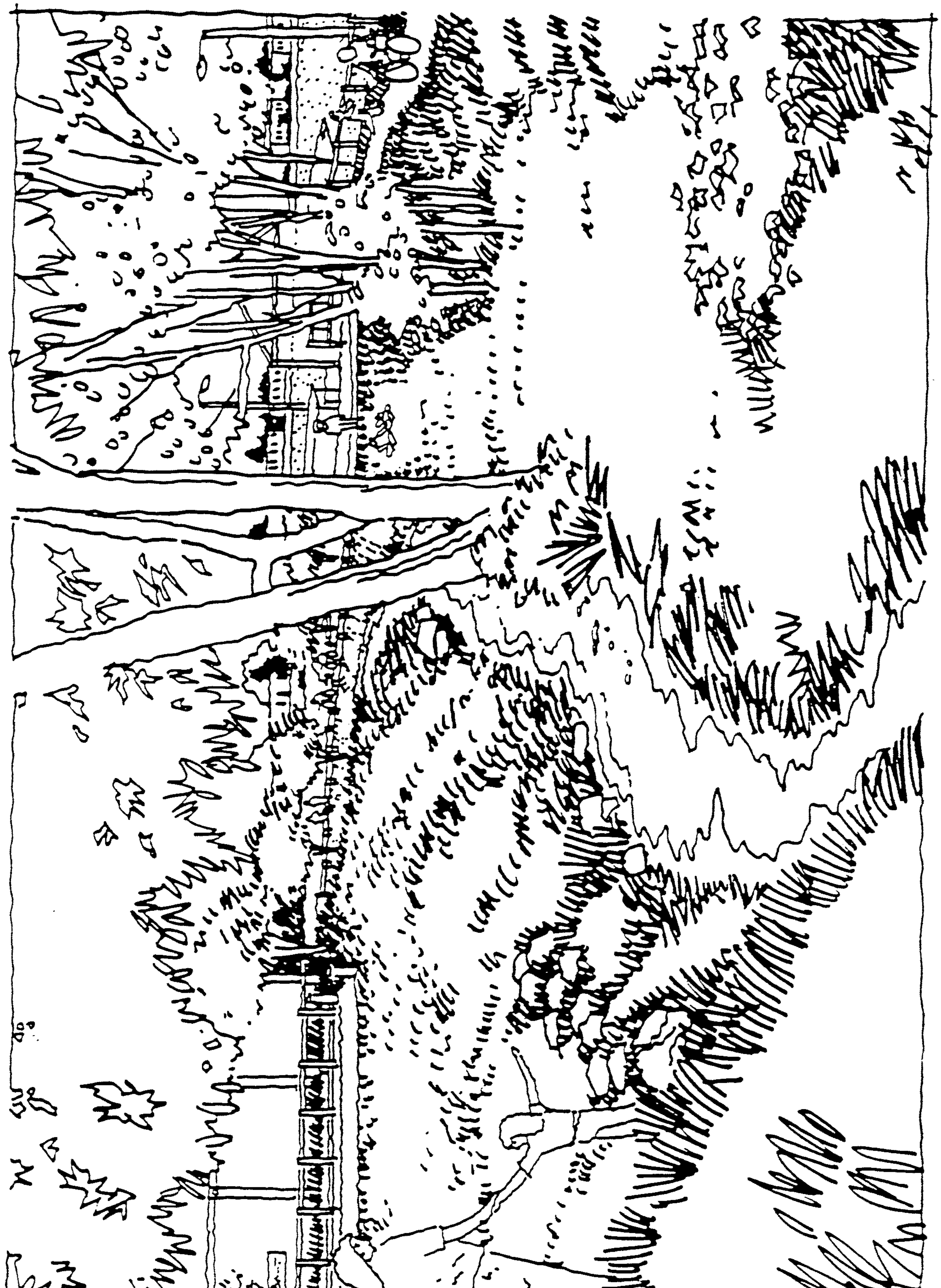


Bridging (Root Park)



San Pablo looking west on Codornices or Cerrito Creek


8th Street



# APPENDIX I

# PERMITTING PROCEDURES

## PERMITTING PROCEDURES

Waters of the U.S. are defined as 1) waters used in interstate or foreign commerce, 2) waters subject to the ebb and flow of tide, 3) all interstate waters including interstate wetlands, intrastate lakes, rivers, streams, mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, natural ponds, the use, degradation, or destruction of which could affect interstate or foreign commerce, and 4) areas that are or could be used for recreation by interstate or foreign travellers, fish or shellfish that is sold in interstate or foreign commerce, or industrial purposes in interstate commerce (§328.3(a). The Environmental Protection Agency (EPA) has expanded the definition of "waters" to include "waters" used to irrigate crops sold in interstate commerce, and habitats that are used by birds protected by treaty or birds that cross state lines, and habitat for endangered species (51 FR 41217), as well as impoundments of "waters", tributaries of "waters", and territorial seas (§328.3(a)(4),(5),(6).

The width of "other waters" is defined as that portion of an unvegetated creek or drainage which falls within the limits of ordinary high water. Field indicators of ordinary high water include clear and natural lines on opposite sides of the banks, scouring, sedimentary deposits, drift lines, exposed roots, shelving, destruction of terrestrial vegetation, and the presence of litter or debris. Typically, the width of "waters" corresponds to the two-year flood event.

Wetlands are defined as "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" (§404 Clean Water Act). Indicators of all three wetlands parameters (hydric soils, hydrophytic vegetation, wetlands hydrology) must be present for a site to be classified as a wetland (Environmental Laboratory 1987). Vegetation dominated by wetland indicator species within the creek channel was assumed to meet all three wetlands parameters.

Waters of the U.S. including wetlands are considered sensitive biological resources and fall under the jurisdiction of several regulatory agencies. Impacts to waters of the U.S. including wetlands might require federal, state, and/or local permits or agreements. Avoiding impacts to waters of the U.S. or wetlands would negate the need for agency involvement. Prior to the issuance of any development permit for actions that would result in unavoidable impacts to jurisdictional "waters" or wetlands, the following agencies should be notified:

- U.S. Army Corps of Engineers (San Francisco District)
- California Department of Fish and Game (Region 3)
- San Francisco Regional Water Quality Control Board
- San Francisco Bay Conservation and Development Commission

U.S. Army Corps of Engineers

Section 404 of the Clean Water Act (CWA) of 1972 regulates activities that result in the discharge of dredged or fill material into waters of the U.S., including wetlands. The primary intent of the CWA is to authorize the Environmental Protection Agency (EPA) to regulate water quality through the restriction of pollution discharges. The ACOE is the principal authority to regulate discharges of dredged or fill material into waters of the U.S., although the EPA has a specific oversight role over the ACOE authority.

Projects that include potential dredge or fill impacts to waters of the U.S. including wetlands must, under most circumstances, be reviewed by the ACOE pursuant to Section 404 of the CWA. Aggregate wetland impacts (defined as direct fill or indirect effects of fill) over three acres require a standard Individual Permit. Projects impacting one to three acres of wetlands are subject to a Preconstruction Notification (PCN), which includes coordination with federal and state agencies. Projects impacting between _ and one acre will require notification and review by the ACOE. All permitees who utilize the Nationwide Permit 26 for impacts to less than _ of an acre are required to report the location and acreage of impacts to the ACOE. A PCN and Individual Permit are also required for any project that would result in cumulative impacts to more than 500 linear feet of a stream or for projects that run parallel to a stream. Additional regional requirements for maintaining upland buffer areas between authorized projects and open waters or streams may be conditions for granting any ACOE permit. Activities authorized under either a Nationwide or Individual Permit require compliance with ACOE Section 404 regulations, EPA Section 404(b)(1) Guidelines, NEPA, the Endangered Species Act, Section 106 of the National Historic Preservation Act, Section 401 of the Clean Water Act and the Coastal Zone Management Act.

In order for any authorization by a Nationwide Permit to be valid, certain general conditions must be met, including 1) appropriate erosion and siltation controls must be used and maintained during construction, 2) the project must not substantially disrupt the movement of those species of aquatic life indigenous to the water body, 3) the activity must comply with any regional conditions which may have been added by the District Engineer, 4) and individual state water quality certification must be obtained or waived, 5) the activity must not jeopardize the continued existence of a threatened or endangered species or a species proposed for such designation; the project proponent must notify the District Engineer if any listed species or critical habitat might be affected or is in the vicinity of the project, and 6) the project proponent must notify the District Engineer of the proposed discharge (see below).

Individual permits require the submission of an individual application and compliance with the ACOE's formal review process. This process provides opportunities for public notice and comment, requires the preparation of an alternatives analysis pursuant to EPA Section 404 (b)(1) and requires compliance with the National Environment Policy Act (NEPA) environmental review process. The average time necessary for the ACOE to process an Individual Permit is 120 days, although controversial projects can take up to two years or more. The application fee is $10 for non-commercial projects and $100 for commercial projects.

There are two simple methods for the verification of ACOE jurisdiction. One method is to attend one of the ACOE's monthly interagency preapplication consultations. At these meetings, it would be determined if the project proponent must apply for a permit or if the project falls under ACOE jurisdiction and what type of permit may be required. During the interagency meeting, it would also be determined what course of action would be required to meet other federal, state and local regulations.

It is recommended that during the planning stage for any creek modifications, the City make a request for verification of jurisdiction to the ACOE San Francisco district office. The following information should be provided to the ACOE: 1) name, address, and phone number of the general permittee; 2) location of planned work; 3) brief description of the proposed work, it purpose, and the approximate size of the waters, including wetlands, which would be lost or substantially adversely modified as a result of the work; 4) any specific information on the resources, such as a copy of this report, and 5) a formal wetlands delineation map. The ACOE will typically respond within 30 days, notifying the project proponent as to what jurisdiction, if any, the ACOE may exert. If the ACOE does not respond within 30 calendar days, the activity may proceed. It is nonetheless recommended that the district office be contacted before engaging in the activity even if it has not responded in the 30-day period.

No matter what type of permit the ACOE determines is required for the proposed program, the regulatory guidelines require a permit applicant to justify project-related impacts to waters of the U.S. including wetlands and to provide mitigation for unavoidable impacts. In order of preference, these include avoidance, minimization and compensation. There are three types of compensatory mitigation. These include wetland enhancement, wetland restoration, and wetland creation.

With the incorporation of sensitive project design and sensitive construction practices, impacts to "waters" or wetlands can frequently be avoided or minimized.

California Department of Fish and Game

The CDFG has jurisdictional authority over wetland resources associated with rivers, streams, and lakes under California Fish and Game Code Sections 1600 to 1607. The CDFG has the authority to regulate work that will substantially divert, obstruct, or change the natural flow of a river, stream, or lake; substantially change the bed, channel, or bank of a river, stream, or lake; or use material from a streambed. Typical activities regulated by CDFG under Sections 1600-1607 authority include rechanneling and diverting streams, stabilizing banks, implementing flood control projects, river and stream crossings, diverting water, damming streams, gravel mining, and logging operations.

The CDFG encourages completion of a Streambed Alteration Agreement, which is not a permit, but rather a mutual agreement between the CDFG and the project proponent. The CDFG generally evaluates the information gathered during preparation of the environmental assessment document and attempts to satisfy their resource concerns during the permitting process. In accordance with their policy of "no net loss" of wetland habitat, the Streambed Alteration Agreement can impose conditions on the proposed activity to ensure no net loss of wetlands values or acreage. Typically, a Streambed Alteration Agreement will also include a mitigation program for impacts to all wetlands, regardless of acreage. The CDFG also typically requires the establishment of a buffer zone immediately adjacent to creeks and wetlands. The buffer zone, measured from the upland edge of riparian vegetation might be as little as ten feet wide or as much as 100 feet wide.

The applicant is required to contact the CDFG prior to the initiation of any construction, either during the preapplication interagency consultation or through separate consultation. The CDFG will then stipulate what its permitting concerns are and should give the applicant an idea of what type of conditions on project approval he/she can expect. Because the CDFG has a policy of no net loss of wetlands, complete mitigation for all impacts to wetlands may be required as a condition of approval. As part of a Streambed Alteration Agreement with the CDFG, for projects resulting in unavoidable impacts to wetlands, mitigation measures in the form of replacement of lost wetlands values and functions may be required to minimize adverse environmental effects. One of three acceptable types of mitigation are typically required. These include, in order of decreasing preference, onsite in-kind replacement, offsite in-kind replacement, and mitigation banking.

San Francisco Regional Water Quality Control Board

Pursuant to Section 401 of the Clean Water Act and EPA 404(b)(1) Guidelines, any applicant for a federal permit to conduct any activity which may result in any discharge into navigable waters must provide a certification from the California Regional Water Quality Control Board (RWQCB) that such discharge will comply with the state water quality standards (Title 23, California Administrative Code, Section 3830 *et. seq.*). The RWQCB has a policy of no-net-loss of wetlands in effect and typically requires mitigation for all impacts to wetlands before it will issue a water quality certification.

Projects that would result in discharges into waters of the U.S. but qualify for certain Nationwide Permits may also require state water quality certification or waiver thereof. Upon receipt of notification from the permittee, the ACOE issues a public notice for review by the RWQCB. If the RWQCB fails or refuses to act on certification requirements within a reasonable time (*e.g.*, 60 days after receipt of the ACOE notice), the certification requirement is waived (RWQCB 1988). If a RWQCB issues a water quality certification which includes special conditions, the district engineer will add these conditions as conditions of the Nationwide Permit.

San Francisco Bay Conservation and Development Commission

The San Francisco Bay Plan, in recognizing that the San Francisco Bay must be protected from "needless and gradual destruction", provides policies to guide the future uses of the Bay and shoreline (BCDC 1969). The Bay Plan identifies open water, mudflats and marshes as significant habitats providing benefits to fish and wildlife as well as humans by providing "food, economic gain, recreation, scientific research, education and an environment for living." It is a policy of the Bay Plan that marshes and mudflats be maintained to the fullest possible extent and that mitigation for unavoidable impacts to these natural resources be considered by the San Francisco Bay Conservation and Development Commission (BCDC). Areas under BCDC jurisdiction include a) all areas subject to tidal action with the San

Francisco Bay between mean high tide and five feet above mean sea level, tidelands and submerged lands, b) a shoreline band extending 100 feet landward of all areas subject to tidal action, c) diked saltponds reclaimed from the Bay that have been used since 1966, d) managed wetlands diked off from the Bay since 1966, and e) specified waterways.

Permit procedures for filling and dredging (including placement of piers, pilings, and floating structures moored in the Bay for extended periods of time) are controlled through the permit system established by the McAteer-Petris Act of 1969. The BCDC is authorized to issue or deny permits for any filling and dredging in the Bay. Any public agency or owner of privately-held lands is required to obtain a permit before proceeding with fill or dredging. The BCDC can be expected to require that the project proponent demonstrate that, as part of proposed project, there are no practicable alternatives to the placement of fill into Bay waters. A BCDC permit will require that use of best management practices to minimize impacts on water quality. Such practices might include the conduct of excavation only during low tide and during the dry season. The McAteer-Petris Act requires the Commission to take action on a permit matter within 90 days after notification. A proposed project should be approved if the filling is the minimum necessary to achieve its purpose, and if it is in accordance with the Bay Plan.

# APPENDIX J

# LITERATURE CITED

## LITERATURE CITED

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# JOINT WATERSHED GOALS STATEMENT

The cities of Albany, Berkeley, El Cerrito, and Richmond, and the East Bay Regional Park District, and the University of California, Berkeley, agree to join in partnership to restore the watershed of our joint jurisdiction to a healthy condition. We will cooperate closely to accomplish the following goals:

- Restoring our creeks by removing culverts, underground pipes, and obstructions to fish and animal migration, putting creeks in restored channels up in the sunshine where they can be enjoyed by people and wildlife.

- Restoring creek corridors as natural transportation routes with pedestrian and bicycle paths along creekside greenways; wherever possible using creekside greenways to connect neighborhoods and commercial districts east of the Interstate 80 freeway to the shoreline of San Francisco Bay and the San Francisco Bay Trail.

- Restoring a healthy freshwater supply to creeks and the bay by eliminating conditions that pollute rainwater as it flows overland to creeks and eliminating conditions that prevent a healthy amount of rainwater from soaking into the ground and replenishing the underground water supplies that nourish creeks.

- Instilling widespread public awareness of the value of developing infrastructure along lines that promote healthier watersheds and watershed oriented open spaces where nature and community life can flourish.

In addition to ongoing general cooperation in the furtherance of these goals, the watershed partners agree to seek out opportunities to jointly apply for grants and jointly undertake planning, construction, educational, and watershed management projects which will be approved on a case by case basis by the respective governing bodies.

The Joint Watershed Goals Statement
was passed by the following cities on the following dates:

| | |
|---|---|
| City of Albany | July 17, 1995 |
| City of Berkeley | July 25, 1995 |
| City of El Cerrito | September 5, 1995 |
| City of Richmond | July 31, 1995 |