

# **TOWN OF ATHERTON TOWNWIDE DRAINAGE STUDY UPDATE**



**April 2015**

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BEYOND ENGINEERING

# TOWN OF ATHERTON TOWNWIDE DRAINAGE STUDY UPDATE



**April 2015**

Prepared for:

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## CHAPTER 1 - INTRODUCTION

Background information and the drainage study scope of services are presented in this chapter.

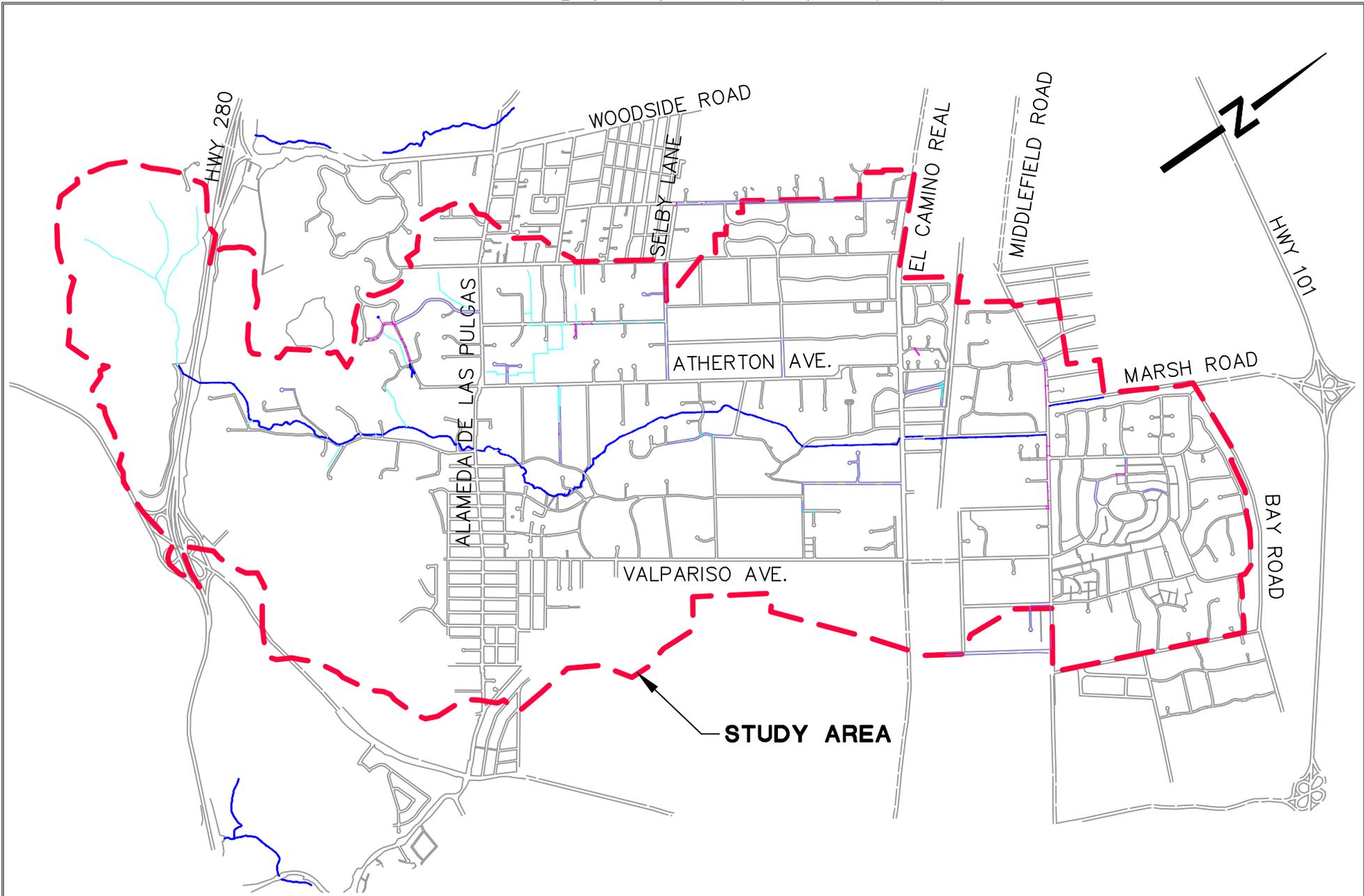
### BACKGROUND

The Town of Atherton (Town) is served by a mixture of drainage facilities ranging from traditional storm drains and developed channels to dry pits that percolate storm flows. These facilities have been installed progressively as the Town has developed. Developers that originally subdivided the land from large estates installed many of the facilities. The Town and the Flood Control District that owns and operates Atherton Channel have constructed other portions of the existing system.

During the recent past, significant storm events have caused flooding within the Town. Although the flooding did not cause damage to the interiors of residences, flooding created significant safety problems, particularly at intersections. In 2001, Nolte Associates, Inc. (now NV5) prepared the *Town Wide Drainage Study* (2001 Drainage Study). Figure 1-1 depicts the limits of the area studied. Upland areas that are tributary to the study area were analyzed to assess problems and impacts within the study area. The 2001 Drainage Study objectives were:

1. Development of an inventory of the existing drainage system for incorporation into the Town Geographic Information System (GIS) database.
2. Assessment of the weaknesses of the drainage system with input from the community.
3. Development of estimated costs and a prioritized plan for improvements to the drainage system.

The locations of drainage issues identified from Town records and community input during preparation of the 2001 Drainage Study are depicted in Figure 1-2. Since 2001, the Town has implemented 26 of the 55 improvement projects identified in the 2001 Drainage Study. The locations of the 26 projects are also depicted in Figure 1-2.



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TOWN WIDE DRAINAGE STUDY UPDATE

FIGURE 1-1  
STUDY AREA

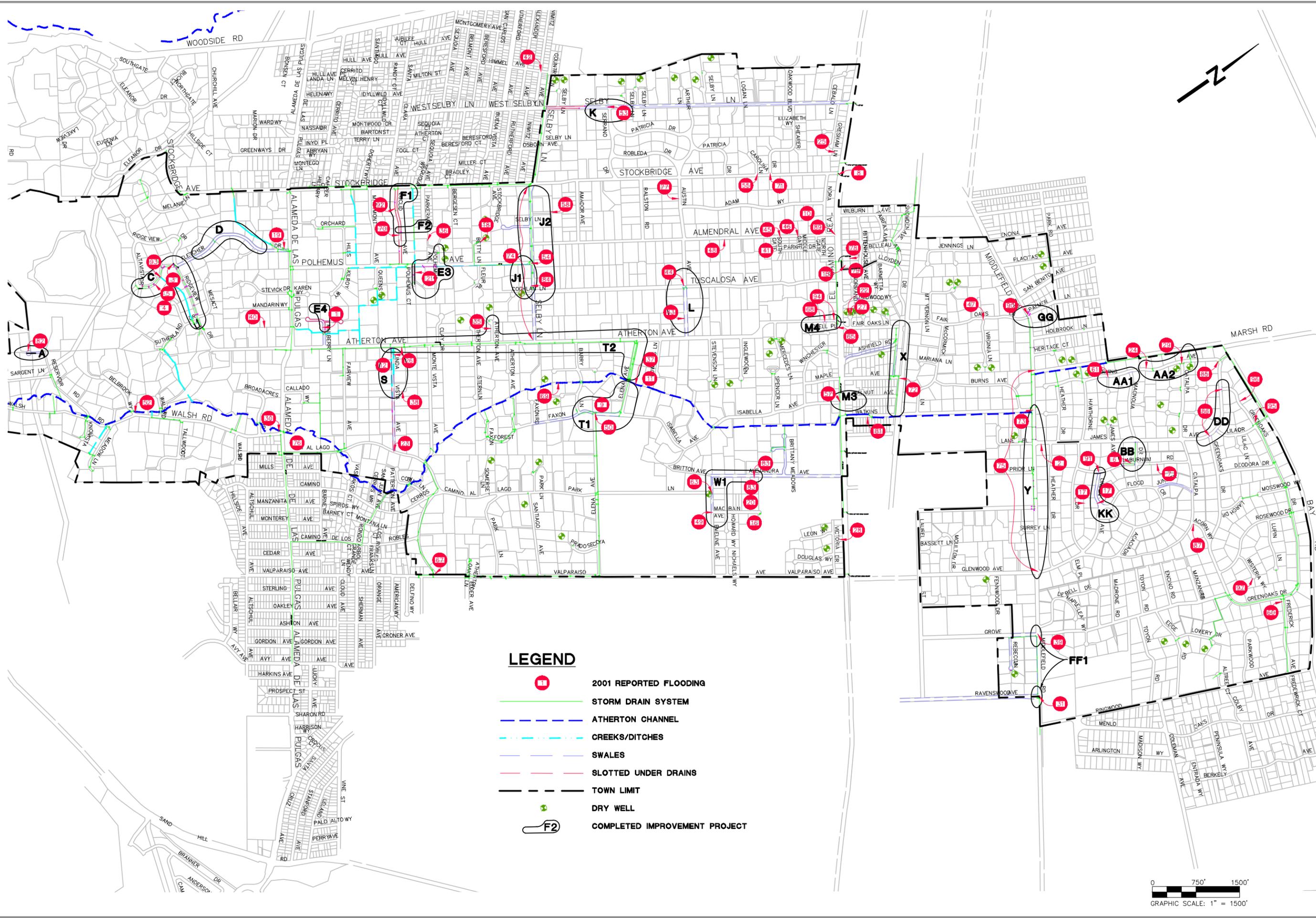
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**LEGEND**

- 2001 REPORTED FLOODING
- STORM DRAIN SYSTEM
- ATHERTON CHANNEL
- CREEKS/DITCHES
- SWALES
- SLOTTED UNDER DRAINS
- TOWN LIMIT
- DRY WELL
- COMPLETED IMPROVEMENT PROJECT



**TOWN WIDE DRAINAGE STUDY UPDATE**  
**FIGURE 1-2**  
2001 REPORTED FLOODING AND COMPLETED IMPROVEMENT PROJECTS  
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## **SCOPE OF SERVICES**

In 2014, an update to the 2001 Drainage Study was requested. Recent residential development may have impacted previously identified drainage issues. Drainage improvements are now required to comply with the Municipal Regional Stormwater Permit (R2-2009-0074) adopted in 2009. In addition, the Town adopted drainage design criteria in January 2013 aimed to reduce peak stormwater flows and improve water quality. The goals of the desired drainage study update are to:

1. Update the inventory of the existing drainage system.
2. Assess current system weaknesses with input from the community.
3. Develop a prioritized plan for improvements to the drainage system, with itemized cost estimates.
4. Review stormwater management policies for compliance with the 2009 Municipal Stormwater Permit.
5. Describe opportunities for regional stormwater detention.

## CHAPTER 2 - SUMMARY

In 2001, Nolte Associates, Inc. (now NV5) prepared the *Town Wide Drainage Study* (2001 Drainage Study) for the Town. In 2014, an update to the 2001 Drainage Study was requested. The goals of the drainage study update were to:

1. Update the inventory of the existing drainage system.
2. Assess current system weaknesses with input from the community.
3. Develop a prioritized plan for improvements to the drainage system, with itemized cost estimates.
4. Review stormwater management policies for compliance with the 2009 Municipal Stormwater Permit.
5. Describe opportunities for regional stormwater detention.

An update of the previous drainage system mapping was completed based on feedback from Town staff and a revised map of the system was prepared. In addition, community input was gathered regarding recent flooding issues. Community input was solicited at a public meeting where attendees were encouraged to share anecdotal information regarding flooding events. The information was noted by Town staff and the study team. A total of 16 flooding complaints were reported. In three instances, the location of the flooding coincided with flooding complaints identified in the 2001 Drainage Study. These locations include Mandarin Way, Austin Avenue, and Alameda de las Pulgas. Los Lomitas School on Alameda de las Pulgas also experienced flooding of classrooms during a December 2012 storm event.

At the Marsh Road box culvert, the existing capacity of the Atherton Channel is limited to less than estimated 10-year storm event flows. Providing 100-year flood protection for the Atherton Channel is not currently feasible due to the existing downstream Atherton Channel constraints beyond the Town limits. Therefore, a regional approach is recommended to reduce storm flows conveyed by the Atherton Channel for the 10-year storm event (and mitigate associated flooding) by providing upstream detention basins. Hydrologic modeling was conducted for Atherton Channel and peak storm flows during the 10-year, 25-year, 50-year, and 100-year storm events were estimated. For each storm event modeled, the detention basin storage volume required to mitigate overtopping of Atherton Channel at the existing Marsh Road box culvert was estimated. Based on available topographic and land use information, feasible detention basin site locations were selected for consideration by the Town. As part of the analysis, a conceptual design layout of detention basin(s) for the 10-year storm event was prepared. Ultimately, detention basin construction is recommended at Los Lomitas School and Holbrook-Palmer Park. Probable construction costs are approximately \$4.1 million.

Recommended improvements to address known drainage problems were prioritized using a tier system as follows:

- Tier 1 – Improvements mitigate flooding problems that can create significant life and safety issues
- Tier 2 – Improvements are intended to avoid damage to private property caused by storm runoff from public areas

- Tier 3 – Projects are located on public property and are not influenced by downstream drainage system
- Tier 4 – Projects are located on public property and are influenced by under capacity downstream drainage system
- Tier 5 – Projects were recommended in the 2001 Drainage Study but drainage issues in these areas have not been observed recently

The estimated cost for each tier is provided below.

**TABLE 2-1  
TOWN OF ATHERTON DRAINAGE STUDY  
SUMMARY OF ESTIMATED DRAINAGE IMPROVEMENT COSTS BY TIER**

<b>Tier</b>	<b>Description</b>	<b>Estimated Cost, \$</b>
1	Life and safety issues	6,140,000
2	Avoid damage to private property	8,620,000
3	Public improvements not influenced by downstream drainage system	3,120,000
4	Public improvements influenced by under capacity downstream drainage system	23,630,000
5	Recommended 2001 Drainage Study projects with no current observed drainage issues	3,590,000
<b>Total</b>		<b>45,100,000</b>

## CHAPTER 3 - EXISTING DRAINAGE SYSTEMS AND IDENTIFIED PROBLEMS

The purpose of this chapter is to describe the existing drainage systems within the Town and any flooding issues and damage that have been documented historically. This discussion will provide a framework for the subsequent analysis of potential solutions to drainage problems that are known to exist. The natural drainage boundaries created by the topography of the Town will be described (see Figure 3-1), along with the downstream drainage systems that convey flow away from the Town. Upstream drainage systems that contribute flows to drainage facilities located within the Town limits will also be identified.

### NATURAL TOPOGRAPHY

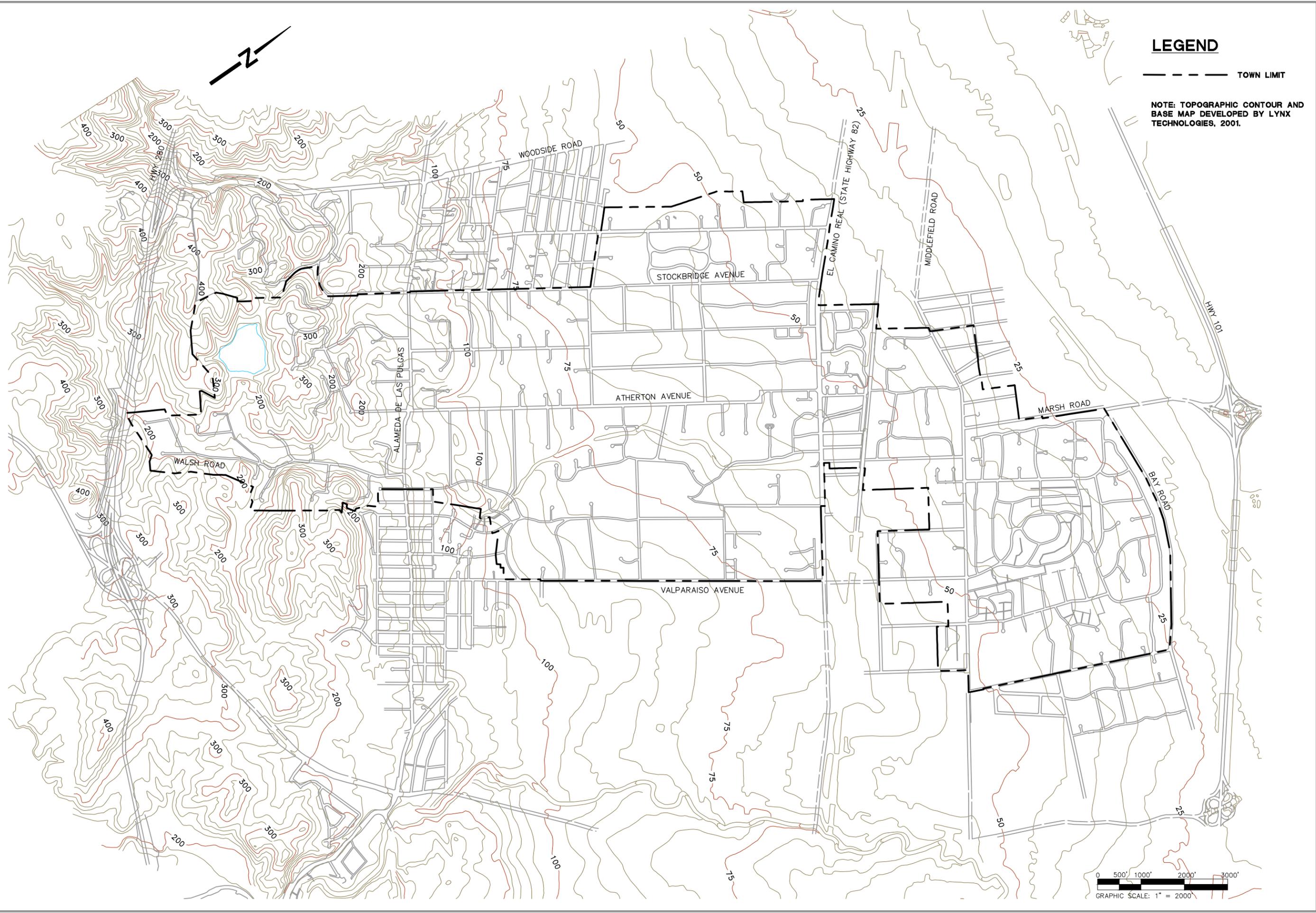
The overall runoff pattern through the study area is from the hills near Interstate 280 (I-280) northeast toward San Francisco Bay. The Atherton Channel is the most significant drainage system component in the study area and extends northeast from I-280 to a box culvert along Marsh Road (east of intersection with Middlefield Road). The topographic contour and base map used in the 2001 Drainage Study were developed by Lynx Technologies, a contractor for San Mateo County.

The drainage boundaries defined by the existing contour lines and surface terrain features are presented in Table 3-1. The drainage areas summarized in Table 3-1 are designated by their point of discharge and include: Selby Lane, El Camino Real, Atherton Channel, and Bay Road.

**TABLE 3-1  
TOWN OF ATHERTON DRAINAGE STUDY  
DRAINAGE AREA SUMMARY**

<b>Watershed Designation</b>	<b>Drainage Area (ac)</b>
Selby Lane	455
El Camino Real	544
Atherton Channel	3,348
Bay Road	377

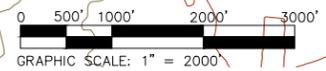
Each drainage area is further discussed below.



### LEGEND

--- TOWN LIMIT

NOTE: TOPOGRAPHIC CONTOUR AND  
BASE MAP DEVELOPED BY LYNX  
TECHNOLOGIES, 2001.



TOWN WIDE DRAINAGE STUDY UPDATE  
 FIGURE 3-1  
 STUDY AREA TOPOGRAPHY

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### **Selby Lane Drainage Area**

The drainage area designated as Selby Lane is located roughly southwest of the intersection of Atherton Avenue and Selby Lane as depicted on Figure 3-2. An existing ditch between residence backyards along the west side of Atherton Avenue, continuing south of Parker Avenue, collects flow from the foothills and adjacent areas and discharges runoff into a County of San Mateo (County) 48-inch storm drain facility located near the intersection of Stockbridge Avenue and Selby Lane. The pipe extends along Selby Lane to Woodside Road, then travels north along Woodside Road and ultimately connects to Redwood Creek. Failure of the existing storm drain system or flows in excess of the system design capacity would flow along Selby Lane and sheet flow north away from the study area.

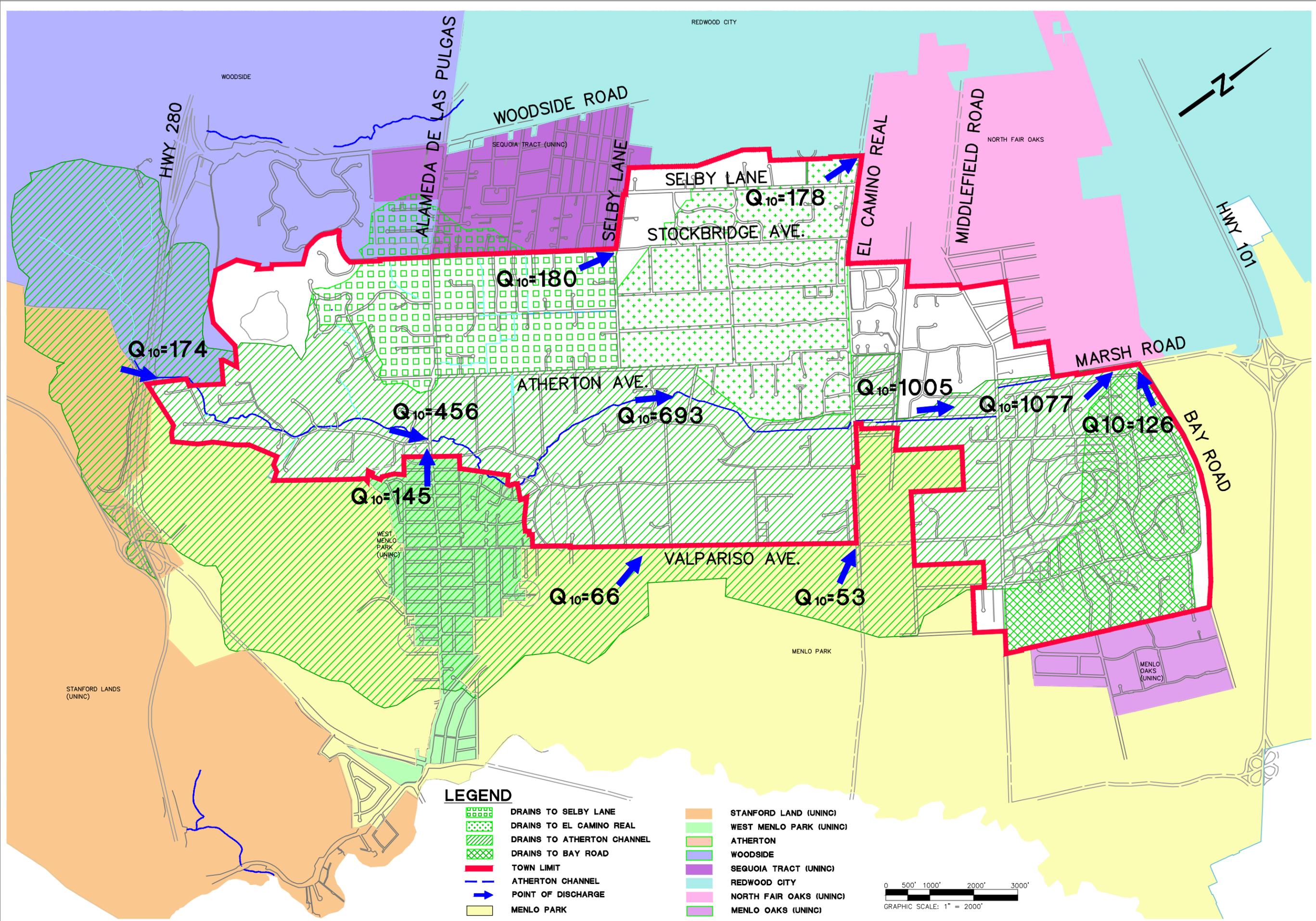
### **El Camino Real Drainage Area**

The drainage area designated as El Camino Real is located north of the Selby Lane drainage area as depicted in Figure 3-2. This area drains to a Caltrans storm drain that has minimal capacity. The storm drain was constructed in El Camino Real (State Highway 82) by Caltrans in the mid-1940s. This storm drain continues along El Camino Real turning north onto Markham Avenue and ultimately connects to Redwood Creek. The drainage system upstream of the storm drain consists primarily of ditches and culverts. The most upstream point is at the northeast corner of Atherton Avenue and the El Camino Real. Runoff will likely be conveyed to the storm drain from this area along existing terrain features through overland release because there is not an existing ditch or drainage system to convey flows.

### **Atherton Channel Drainage Area**

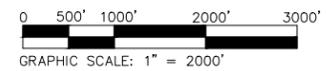
Figure 3-2 depicts Atherton town limits (approximately 3,224 acres) and drainage influences by neighboring areas such as unincorporated Stanford Lands, Woodside, and Menlo Park. As shown in Figure 3-2, neighboring lands outside the Town limits also discharge to Atherton Channel. Woodside and unincorporated Stanford Lands discharge to Atherton Channel at its upstream limit (I-280). In addition, some parts of Menlo Park (including unincorporated areas) contribute runoff to Atherton Channel. For the watershed contributing runoff to Atherton Channel, Table 3-2 summarizes how much of the Atherton Channel watershed is located within the Town versus neighboring communities. As shown in Table 3-2, the Town comprises approximately 51 percent of the Atherton Channel watershed. Because a significant percentage of the watershed extends beyond the Town limits, drainage system improvements within the Town cannot mitigate all flooding issues associated with the Atherton Channel.

SYLVESTER  
XREFS:



**LEGEND**

- |  |                            |  |                         |
|--|----------------------------|--|-------------------------|
|  | DRAINS TO SELBY LANE       |  | STANFORD LAND (UNINC)   |
|  | DRAINS TO EL CAMINO REAL   |  | WEST MENLO PARK (UNINC) |
|  | DRAINS TO ATHERTON CHANNEL |  | ATHERTON                |
|  | DRAINS TO BAY ROAD         |  | WOODSIDE                |
|  | TOWN LIMIT                 |  | SEQUOIA TRACT (UNINC)   |
|  | ATHERTON CHANNEL           |  | REDWOOD CITY            |
|  | POINT OF DISCHARGE         |  | NORTH FAIR OAKS (UNINC) |
|  | MENLO PARK                 |  | MENLO OAKS (UNINC)      |



TOWN WIDE DRAINAGE STUDY UPDATE  
 FIGURE 3-2  
 TOWN OF ATHERTON DRAINAGE SYSTEM BOUNDARIES  
 AND REGIONAL DRAINAGE IMPACTS

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**TABLE 3-2  
TOWN OF ATHERTON DRAINAGE STUDY  
REGIONAL CONTRIBUTIONS TO ATHERTON CHANNEL WATERSHED**

<b>Communities</b>	<b>Percent of Watershed Contributing to Atherton Channel</b>
Woodside/Stanford Lands (Unincorporated)	13%
City of Menlo Park/Unincorporated	36%
Town of Atherton	51%

### **Bay Road Drainage Area**

The Bay Road drainage area is located roughly southeast of the intersection of Marsh Road and Bay Road as depicted on Figure 3-2. This drainage area discharges to the downstream end of Atherton Channel, the box culvert east of the intersection of Marsh Road and Middlefield Road.

### **DRAINAGE SYSTEM COMPONENTS**

This discussion will review the interactions of the various drainage components, the location of the key storm drains, and most importantly the paths that the water will take across the Town during extreme events. The specific criteria for the design of these systems will be discussed in Chapter 4 - Design Criteria and Regional Stormwater Detention Evaluation of this report.

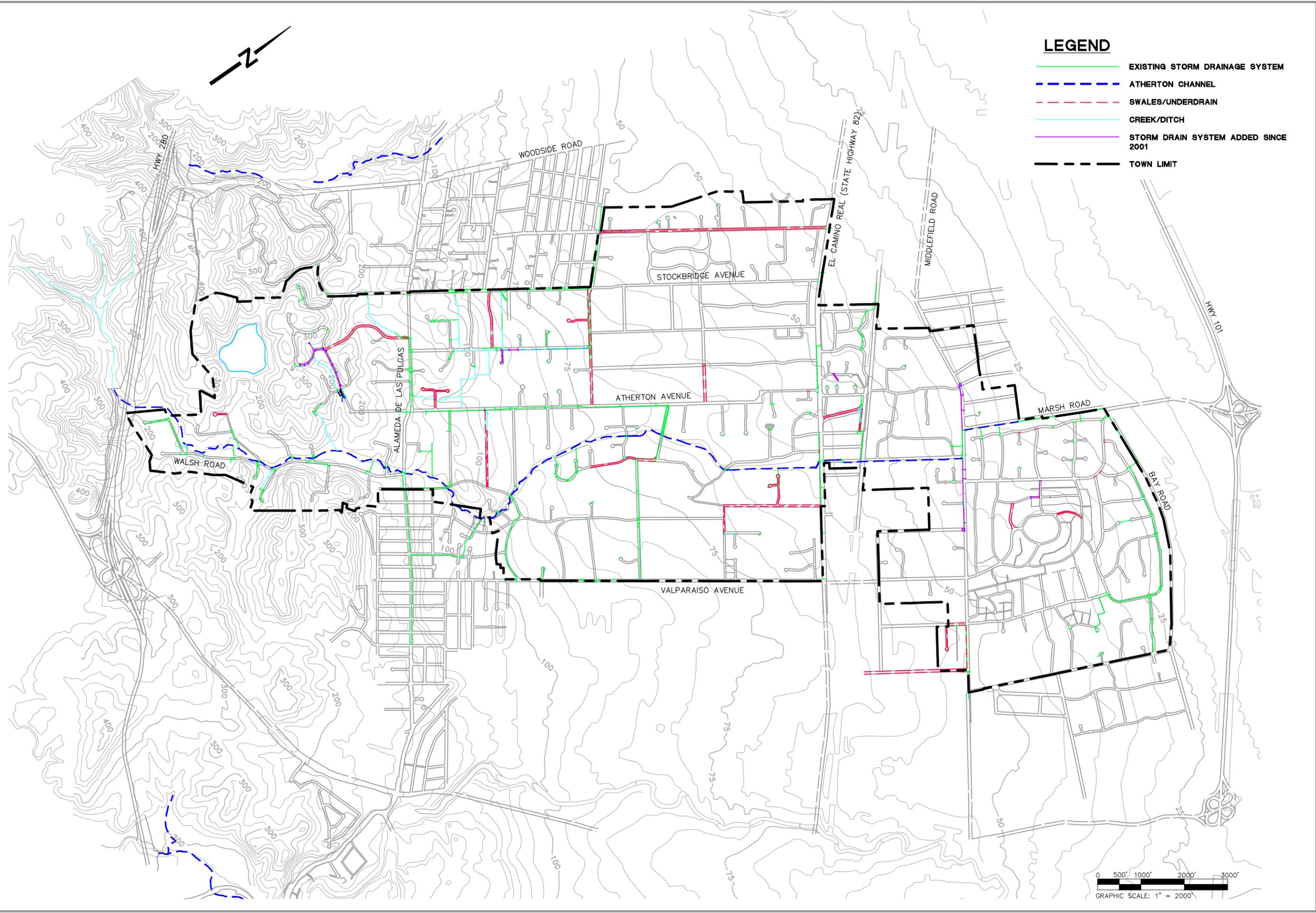
There are several systems for conveying water across the Town including:

1. Piped system defined as storm drain inlets, pipes, channels and ditches.
2. Overland flow system.
3. Detention basins that help mitigate increases in runoff associated with development.
4. “Dry wells” defined as specialized components of the piped drainage system for disposal of storm water.

Each is discussed below.

### **Piped System**

The piped storm drainage system is illustrated in Figure 3-3. These storm drains range in size from 6-inch diameter up to 72-inch diameter. The purpose of Figure 3-3 is to illustrate the general coverage of the storm drain system and not the specific pipe sizes, inlet locations, and connections. This system is typically intended to provide local drainage, enhance public convenience and safety, as well as eliminate standing water. The piped storm drainage system was inventoried as part of this drainage study update. The updated inventory is included in Appendix A. Based on available records, Figure 3-3 depicts new storm drain pipe systems, swales, and underdrains constructed since 2001.



**LEGEND**

- EXISTING STORM DRAINAGE SYSTEM
- - - ATHERTON CHANNEL
- - - SWALES/UNDERDRAIN
- CREEK/DITCH
- STORM DRAIN SYSTEM ADDED SINCE 2001
- - - TOWN LIMIT

**TOWN WIDE DRAINAGE STUDY UPDATE  
FIGURE 3-3  
PIPED STORM DRAINAGE SYSTEM**

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## **Overland Flow System**

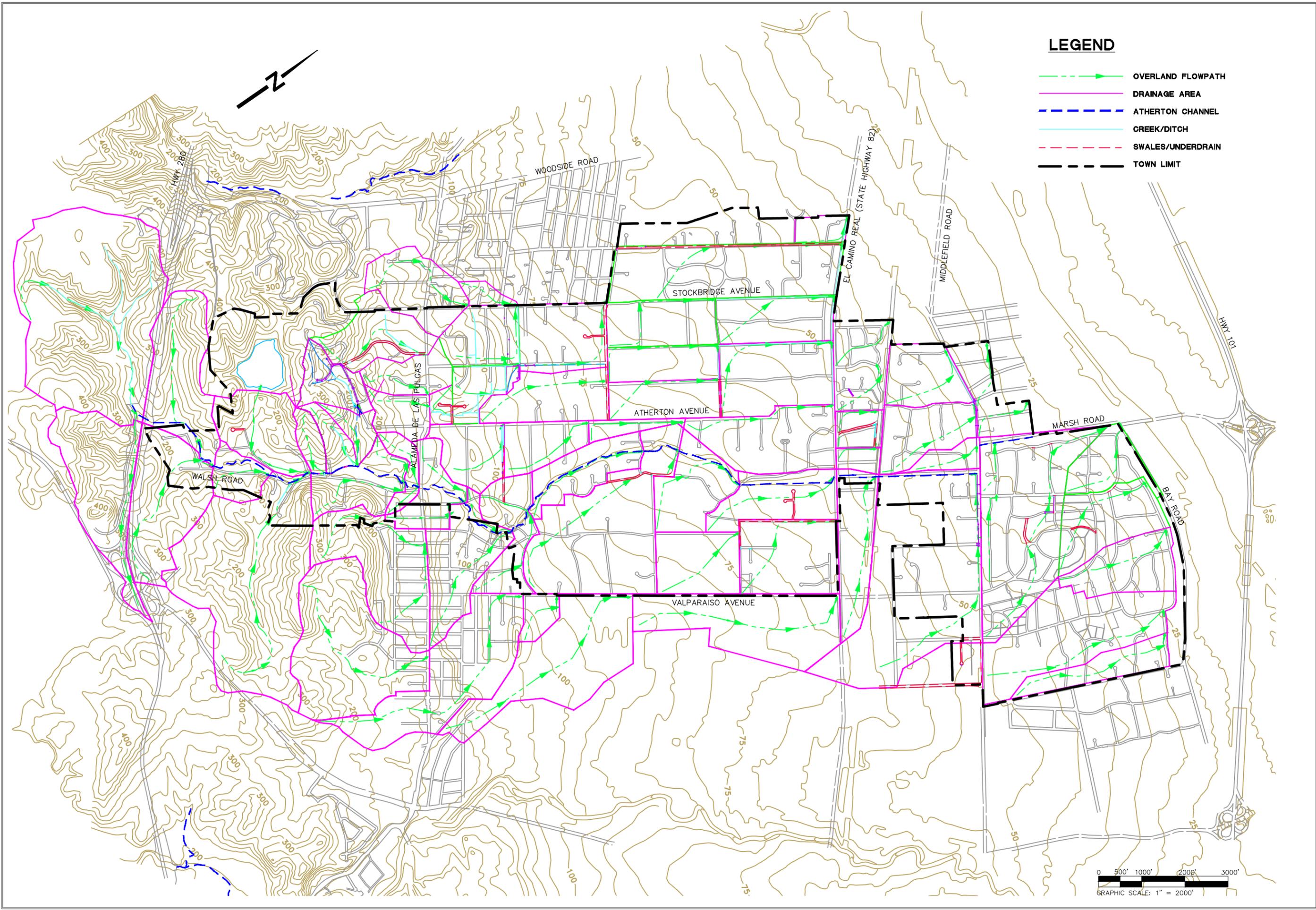
Overland flow is defined as the surface flow of runoff that exceeds the capacity of the drainage system; i.e., the point when water no longer is contained by pipes and proceeds over the land. The paths of overland flow are most often determined by the natural or graded contour of the land and consist of both natural and manmade features.

The flow paths are illustrated in Figure 3-4. These paths are the first place the water will flow as the piped drainage system capacity is exceeded. The illustrated paths were identified from an interpretation of the contour maps and visual inspection of conditions in the field. These paths are assumed to be the paths that existed in the winters of 1992 and 1998 and remain largely unchanged since the 2001 Drainage Study. These existing primary flow paths include gaps at driveways or streets and can only carry flow as deep as adjacent ground, curbs, or other controlling terrain feature. Overland flow paths therefore have a limited capacity due to physical constraints.

## **Detention Basins**

The Town enacted a requirement that new development provide detention volume to attenuate any increase in stormwater runoff caused by increased imperviousness created by the proposed development. The current Town Drainage Criteria (dated January 2, 2013) requires stormwater detention for projects that create or replace greater than 5,000 square feet (SF) impervious surface. The detention basins constructed to meet this requirement are typically excavations that are filled with drain rock, underground piped storage, or underground storage tanks. The Town Drainage Criteria provide three options for sizing detention storage:

1. Detain two inches of rainfall over the impervious area. Storage volume reduction for stormwater discharged from the detention basin is not allowable.
2. Detain three inches of rainfall over the impervious area less the runoff volume associated with stormwater discharged from the detention basin.
3. Detain runoff such that the post-project site runoff flow rate is equal to or less than the pre-project site runoff rate during the 6 hour peak rainfall event during a 24-hour storm event.



**LEGEND**

- ▶— OVERLAND FLOWPATH
- DRAINAGE AREA
- - - ATHERTON CHANNEL
- CREEK/DITCH
- - - SWALES/UNDERDRAIN
- - - TOWN LIMIT

**TOWN WIDE DRAINAGE STUDY UPDATE**  
**FIGURE 3-4**  
**OVERLAND FLOW PATHS**

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## Dry Wells

Dry wells are excavations that are made to receive surface runoff from a defined area. Dry wells are typically a circular excavation filled with drain rock. Dry wells range in depth from a few feet to 50 feet. The excavation may be covered with a grated inlet to allow water to enter directly. Alternatively, the excavation may have one or more storm drain inlet connections.

The 2001 Drainage Study summarized the following regarding dry well use in the Town:

1. The Town has approximately 48 dry wells in service. These are generally located at the end of cul-de-sacs and other locations that are relatively inaccessible to major drainage features.
2. Five complaints were recorded during the course of the 2001 Drainage Study associated with the failure or ineffectiveness of dry wells.
3. The predominate form of failure for dry wells is the contribution of flows from overland release paths that should be collected and routed to more appropriate drainage systems. A less significant cause of failure is the introduction of yard waste into the dry wells by poorly informed maintenance staff of nearby private residences.

Dry wells function as a storm water treatment and disposal system. Dry wells prevent runoff from reaching surface waterways by collecting the runoff and allowing it to percolate into the ground. The pollutants associated with the storm water are trapped and removed from the surface waters. The recharge of groundwater systems by runoff is enhanced through the use of dry wells.

Despite these apparent benefits, drywells can introduce polluted surface runoff into the groundwater system. This is an area that is controlled by the San Francisco Regional Water Quality Control Board (Regional Board) through permits issued under the National Pollution Discharge Elimination System (NPDES). The Basin Plan for the San Francisco Bay Basin specifically includes the following goal:

*The goal of the Shallow Drainage Program is to eliminate the unregulated construction and use of shallow drainage wells in areas where municipal, domestic, agricultural, and industrial groundwater supplies are threatened.*

*This goal is to be attained by a coordinated effort on the part of U.S. EPA, the Regional Board, DWR, and local government agencies to implement a shallow drainage well control program.*

The full text from the Basin Plan regarding shallow drainage wells is included in Appendix B.

## REPORTED FLOODING COMPLAINTS

Flooding complaints from: 1) the 2001 Drainage Study and 2) recent public input are reviewed below.

## 2001 Drainage Study

When runoff exceeds the capacity of the storm drain system and proceeds along flow paths that are not prepared to carry excess flow, damage to both public and private property can result. During the preparation of the 2001 Drainage Study, Town records were reviewed and the community was invited to assist in identifying potential drainage problems. A total of 97 flooding complaints were identified. A description of the each reported flooding problem is included in Appendix C along with the reported damage when available. These areas were classified by type of problem such as building floods, saturated or clogged drywell, channel or ditch overflow, driveway and intersection floods, and storm system overflow or clog. Many of these problem areas were addressed with improvement projects implemented since 2001 or with maintenance activities. The drainage improvement projects completed since 2001 are summarized in Table 3-3.

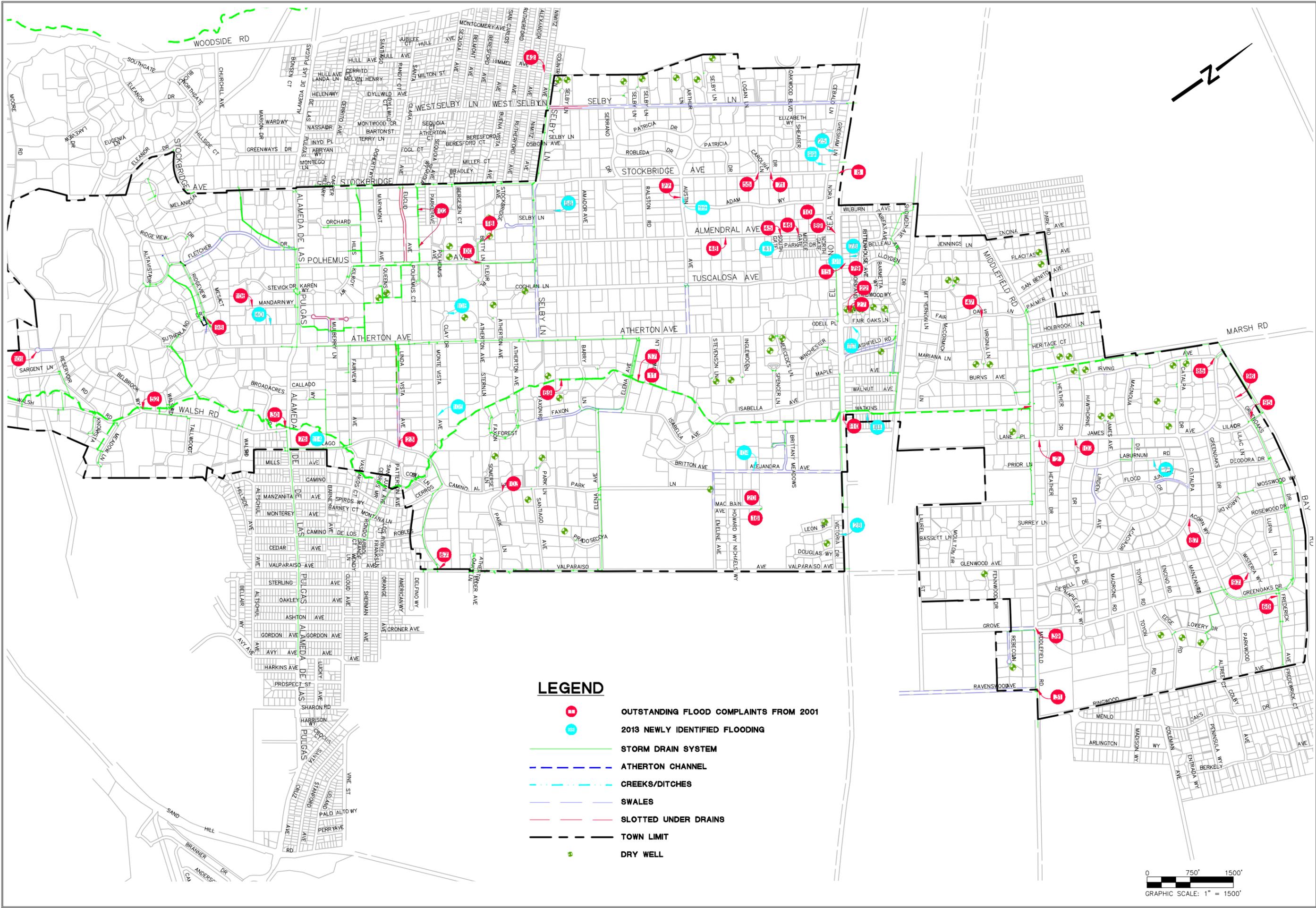
**TABLE 3-3  
TOWN OF ATHERTON DRAINAGE STUDY  
DRAINAGE SYSTEM IMPROVEMENT PROJECTS COMPLETED SINCE 2001**

<b>ID No.</b>	<b>Improvement Project Description</b>	<b>ID No.</b>	<b>Improvement Project Description</b>
A	Reservoir Road Regrade & Crown	J1	Selby East Swale
AA1	Irving Swale	J2	Selby East Upgrade SD System
AA2	Irving SD System and Upgrade	K	Serrano/Selby Regrade Intersection
BB	Laburnum/Magnolia Barrier	KK	Linden/Laburnum Swale
C	Fletcher/Ridgeview SD System	L	Austin/Tuscaloosa Concrete Swale and Regrade
D	Fletcher Barrier	M3	El Camino/Isabella Concrete Swale and Regrade
DD	Greenoak/James Regrade Intersections	M4	El Camino Real Swale
E3	Polhemus SD System	S	Linda Vista Concrete Swale
E4	Mulberry Slotted Drain	T1	Elena/Faxon Barrier/Curb
F1	Euclid Swale	T2	Atherton/Elena Upgrade Ex. SD System
F2	Euclid SD System	W1	Mac Bain/Alejandra/Brittany Swale
FF1	Middlefield East Swales	X	El Camino/Station Upgrade Ex. SD System
GG	Middlefield/Palmer Regrade Intersections	Y	Middlefield West SD System

## Current Reported Flooding Complaints

In conjunction with this drainage study update, community input was gathered regarding recent flooding issues. A total of 17 flooding complaints were reported. In three instances, the location of the flooding coincided with flooding complaints from the 2001 Drainage Study. These locations include Mandarin Way, Austin Avenue, and Alameda de las Pulgas. Los Lomitas School on Alameda de las Pulgas experienced flooding of classrooms during a December 2012 storm event.

Appendix C includes a table of recently reported flooding complaints. Figure 3-5 depicts the locations and associated complaint number for new flooding complaints. “Outstanding” flooding complaints refer to complaints from the 2001 Drainage Study that have not been addressed by implementing improvement projects. This information is also shown in Figure 3-5. Figure 3-6 illustrates the current and outstanding flooding complaint locations by problem category such as building floods, saturated or clogged drywell, channel or ditch overflow, driveway and intersection floods, and storm system overflow or clog. Where two categories apply to a single complaint, both categories are shown for that complaint. The flooding complaint information is valuable in supporting and providing direction for hydraulic analyses of flow paths and probable direction of local surface flows. This information is also essential to highlight system performance and maintenance problem areas. Because some flooding has occurred historically on private property, the Town may elect to communicate these issues directly to the property owner as part of a long-term outreach program designed to facilitate future on-site drainage system modifications.



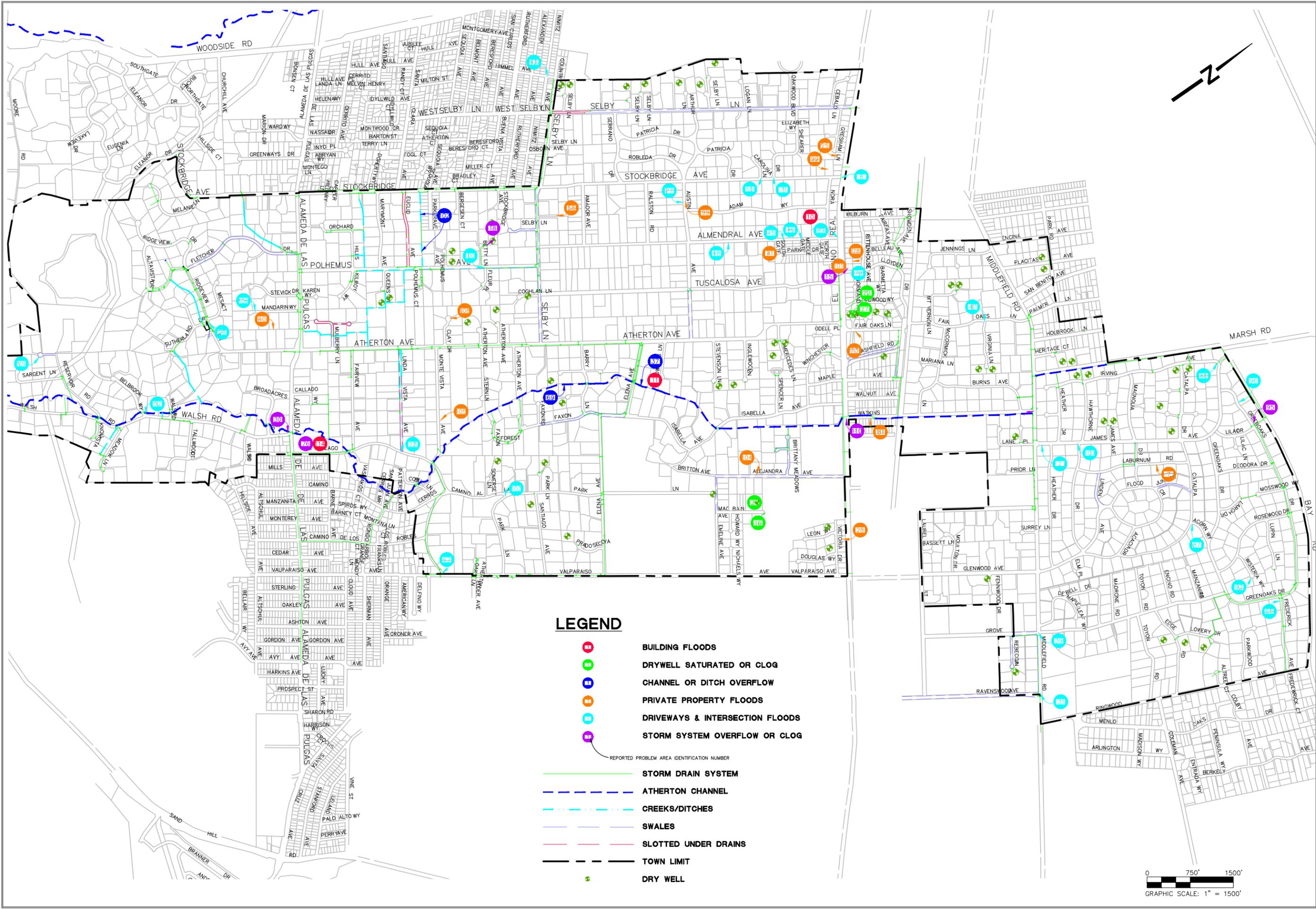
**LEGEND**

- 100 **OUTSTANDING FLOOD COMPLAINTS FROM 2001**
- 101 **2013 NEWLY IDENTIFIED FLOODING**
- **STORM DRAIN SYSTEM**
- - - **ATHERTON CHANNEL**
- - - **CREEKS/DITCHES**
- **SWALES**
- - - **SLOTTED UNDER DRAINS**
- TOWN LIMIT**
- **DRY WELL**

**TOWN WIDE DRAINAGE STUDY UPDATE**  
**FIGURE 3-5**  
**CURRENT REPORTED FLOODING ISSUES AND HISTORICAL**  
**OUTSTANDING FLOODING COMPLAINTS TO BE ADDRESSED**  
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## **CHAPTER 4 - DESIGN CRITERIA AND REGIONAL STORMWATER DETENTION EVALUATION**

In this chapter, the design criteria recommended in the 2001 Drainage Study will be reviewed and modified based on current constraints. In addition, regional stormwater detention will be evaluated for the purpose of providing future flood protection along Atherton Channel. The evaluation of regional stormwater detention will include a review of alternative sites and an opinion of probable construction costs for the recommended option.

### **DESIGN CRITERIA**

Design criteria from the 2001 Drainage Study and the current analytical approach are discussed below.

#### **2001 Drainage Study**

Protection of facilities from flooding is usually defined in terms of the probability of a facility being impacted by a storm event. The probability is then described in terms of the frequency of the event returning or the return frequency for a rainfall event. As an example, an event that has a 1 percent chance of occurring is an event that would occur an average of once in every 100 years. This is commonly referred to as a 100-year event. The following levels of protection were recommended as design criteria for the Town in the 2001 Drainage Study:

1. 10-year event – prevent flooding of streets and private property. Runoff from these storms should be collected and conveyed by storm drainage inlets, pipes, and ditches. At this level, standing water and surface flow of runoff should be minimized.
2. 25-year event – prevent flooding of intersections and collector streets.
3. 50-year event – prevent flooding of the major thoroughfares, El Camino Real and Middlefield Road.
4. 100-year event – prevent flooding from Atherton Creek.
5. Runoff from storms in excess of the 10-year event up through the 100-year event should be managed using established and maintained overland flow paths that prevent damage to the community.
6. Storm water detention basins should be constructed to mitigate increases in the peak flow rates created by changes in the amount of impervious surfaces.

#### **Current Approach**

At the Marsh Road box culvert, the existing capacity of the Atherton Channel is limited to less than estimated 10-year storm event flows. Previous studies have suggested the downstream capacity is limited to a 7-year event. Providing 100-year flood protection for the Atherton Channel is not currently feasible due to the existing downstream Atherton Channel constraints outside of the Town limits. Because of this condition, storm events greater than 10-year storms will continue to create flooding along the Atherton Channel. As an alternative, a regional approach is recommended to reduce storm flows conveyed by the Atherton Channel for the 10-year storm event (and mitigate associated flooding) by providing upstream detention basins.

Operationally, peak flows would be shunted to the detention basins and then released gradually as a storm event ends. Flows within the channel would then be maintained within the 10-year capacity, reducing the potential for adjacent flooding.

Hydrologic modeling was conducted for Atherton Channel; and peak storm flows during the 10-year, 25-year, 50-year, and 100-year storm events were estimated. For each storm event modeled, the detention basin storage volume required to mitigate overtopping of Atherton Channel at the existing Marsh Road box culvert was estimated. Based on available topographic and land use information, feasible detention basin site locations were selected for consideration by the Town. As part of the analysis, a conceptual design layout of detention basin(s) for the 10-year storm event is shown. This chapter concludes with a recommended detention basin site alternative and an opinion of probable construction cost.

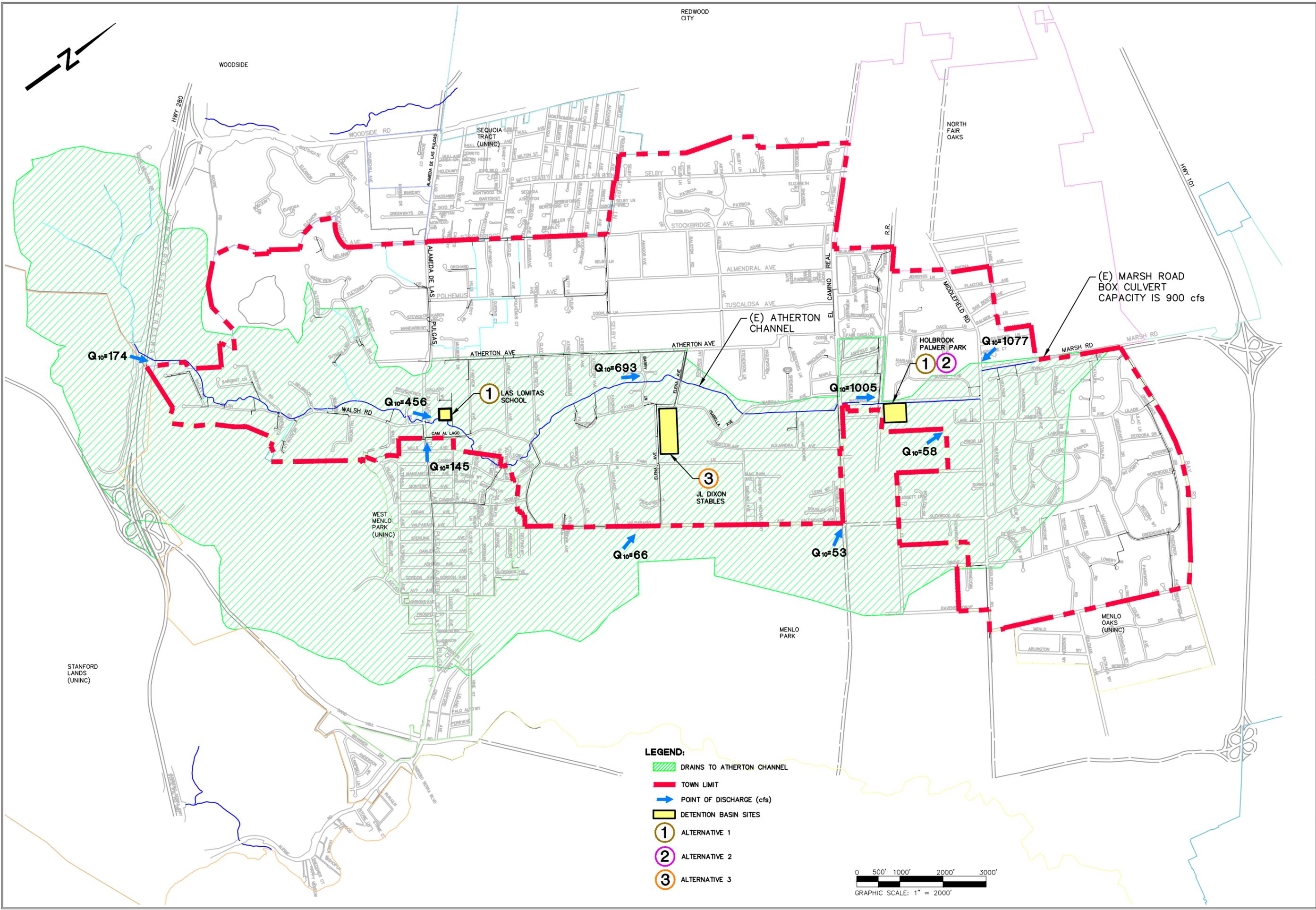
## **HYDROLOGIC MODELING RESULTS AND DETENTION VOLUME REQUIRED**

The hydrologic (HEC-1) model for Atherton Channel was executed to determine the estimated basin volume needed to detain runoff and mitigate overtopping of the Atherton Channel during the 10-year, 25-year, 50-year, and 100-year storm events. Table 4-1 summarizes the calculated peak flow for each storm event and compares the peak flow to the existing capacity of the box culvert located downstream of Marsh Road, roughly (900 cubic feet per second). A depiction of the Atherton Channel watershed, peak 10-year storm event flows at locations along the Channel, and the location of the Marsh Road box culvert are included in Figure 4-1.

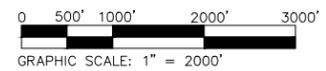
**TABLE 4-1  
TOWN OF ATHERTON DRAINAGE STUDY  
SUMMARY OF PEAK STORM FLOWS AND DETENTION VOLUME  
REQUIRED FOR ATTENUATION PURPOSES**

<b>Parameter</b>	<b>Storm Event</b>			
	<b>10-Year</b>	<b>25-Year</b>	<b>50-Year</b>	<b>100-Year</b>
Peak flows in channel at Marsh Road, cubic feet per second (cfs)	1,077	1,177	1,266	1,365
Existing box culvert capacity at Marsh Road (cfs)	900	900	900	900
Difference between peak flow and existing Marsh Road culvert capacity (cfs)	177	277	366	465
Detention volume required at Marsh Road, acre feet (ac-ft)	10	20	32	47

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- LEGEND:**
- DRAINS TO ATHERTON CHANNEL
  - TOWN LIMIT
  - POINT OF DISCHARGE (cfs)
  - DETENTION BASIN SITES
  - 1 ALTERNATIVE 1
  - 2 ALTERNATIVE 2
  - 3 ALTERNATIVE 3



**TOWN WIDE DRAINAGE STUDY UPDATE**  
**FIGURE 4-1**  
**STORMWATER FLOW SUMMARY/10-YEAR DETENTION SITE ALTERNATIVES**  
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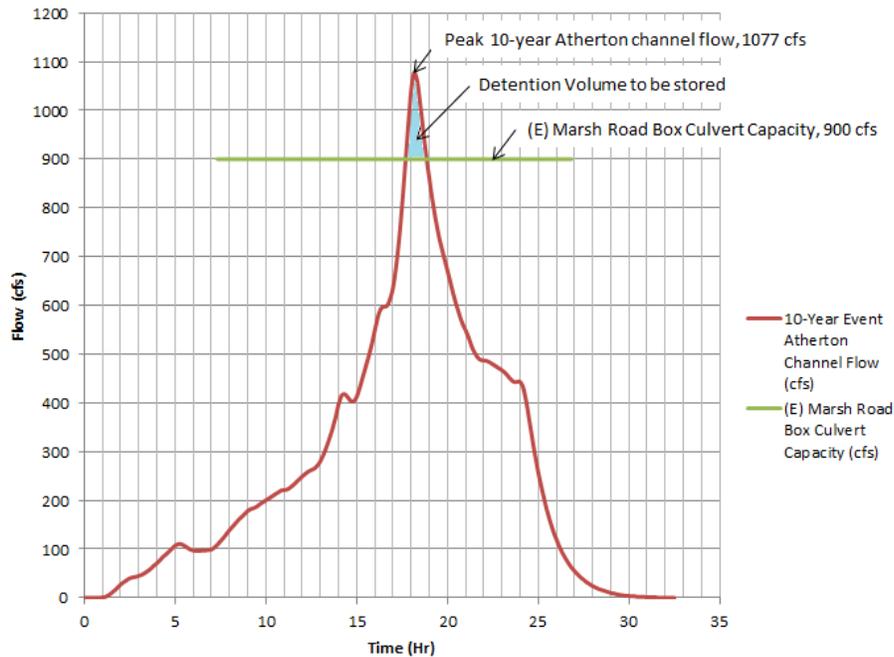
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To size appropriate detention basins, each storm event hydrograph was compared to the capacity of the existing box culvert at Marsh Road to determine the storage volume needed to attenuate the peak storm flow. For attenuation of the estimated 10-year storm peak flow to the existing culvert flow capacity, a detention volume at Marsh Road of approximately 10 ac-ft was calculated. Table 4-2 summarizes the HEC-1 modeling analysis results for the projected 10-year storm peak flow attenuated between the 10-year event and the existing culvert flow capacity, and presents the detention volume calculation.

**TABLE 4-2  
TOWN OF ATHERTON DRAINAGE STUDY  
10-YEAR EVENT AT MARSH ROAD WATERSHED  
DETENTION VOLUME REQUIRED**

Design Storm Event	Peak Flow Attenuated (cfs)	Required Detention Volume (ac-ft)
Up to 10-year event	177	10

Figure 4-2 depicts the 10-year storm event hydrograph for Atherton Channel at the intersection of Marsh Road and Middlefield Road. To mitigate potential flooding, peak storm flow above the existing box culvert capacity (177 cfs) would be diverted to the proposed detention basin(s), effectively maintaining channel flows at the capacity of the existing box culvert.



**Figure 4-2 Comparison of 10-Year Storm Event Hydrograph for Atherton Channel at Marsh Road/Middlefield Road Intersection and Existing Box Culvert Capacity at Marsh Road**

## 10-YEAR STORM EVENT DETENTION BASIN SITE ALTERNATIVE LOCATIONS

The 10 ac-ft detention volume required to attenuate the 10-year storm event was calculated based on construction of a proposed detention basin near Marsh Road/Middlefield Road. However, a review of available topographic and aerial data revealed a lack of open space to accommodate a detention basin of the required volume at this location. This area is near the Town limit and surrounded by residential land use. Thus, alternative detention basin sites were identified further upstream of Marsh Road. Basin sites were selected based on the following considerations:

1. Hydraulic feasibility to divert peak 10-year storm flows
2. Available site area to accommodate required detention basin volume
3. Proximity to public roads for installation of drainage piping to convey flows between the proposed basin site and Atherton channel

Figure 4-1 depicts the location of the three selected detention basin site alternatives:

Alternative 1	Open field at Las Lomas Elementary School (3.4 ac-ft) and open field at Holbrook-Palmer Park (9.3 ac-ft)
Alternative 2	Open field at Holbrook-Palmer Park (12.8 ac-ft)
Alternative 3	Open field at JL Dixon Stables (17.2 ac-ft)

To attenuate the peak storm flow at the box culvert with a detention basin site further upstream from the existing box culvert, the required detention volume increases slightly. The volume of required detention volume is influenced by the characteristics of the watershed from which the diversion of the peak flow occurs. A more developed watershed will generate more runoff than a less developed watershed of the same shape and acreage. In addition, the shape of a watershed's hydrograph varies based on degree of developed area within the watershed. A more developed watershed will have a hydrograph with a more distinct peak curve, whereas a less developed watershed will have a flatter hydrograph curve. These are some of the factors that influence the required detention volume to attenuate a downstream peak flow. Table 4-3 provides the required detention volumes estimated from the HEC-1 model to maintain an Atherton Channel 10-year event flow of 900 cfs at Marsh Road box culvert.

**TABLE 4-3  
TOWN OF ATHERTON DRAINAGE STUDY  
10-YEAR EVENT UPSTREAM DETENTION VOLUME REQUIRED  
FOR PEAK ATTENUATION AT MARSH ROAD BOX CULVERT**

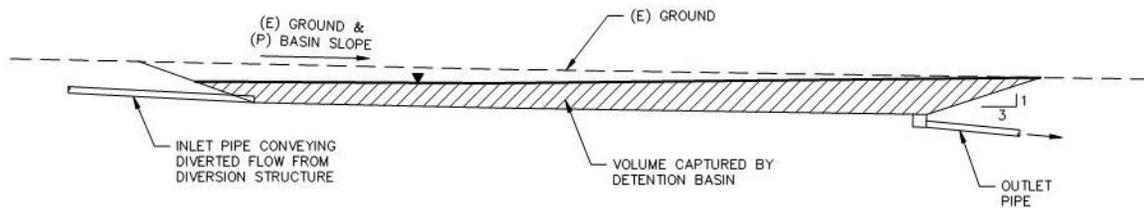
Detention Sites	Detention Volume (ac-ft)
Alternative 1 – Las Lomas School and Holbrook-Palmer Park	12
Alternative 2 – Holbrook-Palmer Park	11
Alternative 3 – JL Dixon Stables	16

Table 4-4 presents available storage volume at the selected detention basin sites based on the typical detention basin cross section depicted in Figure 4-3. Proposed detention basins would have side slopes with a minimum ratio of 3:1. Each site alternative is described in further detail in the next section.

**TABLE 4-4  
TOWN OF ATHERTON DRAINAGE STUDY  
DETENTION VOLUME AVAILABLE FOR 10-YEAR EVENT**

Site Alternative No.	Site Location	Basin Length (ft)	Basin Width (ft)	Basin Bottom Slope	Basin Depth (ft)	Available Volume (ac-ft)
1	Las Lomas School	230	250	0.004	3.00	3.4
1	Holbrook-Palmer Park	485	380	0.0085	4.25	9.3
2	Holbrook-Palmer Park	585	380	0.0085	5.00	12.8
3	JL Dixon Stables	1000	300	0.003	4	17.2

Final design of the detention facilities may include some level of underground pipe storage within public right of way (ROW) to reduce future easement acquisition costs.



**Figure 4-3 Typical Detention Basin Cross Section**

## DESCRIPTIONS OF DETENTION BASIN SITE ALTERNATIVES

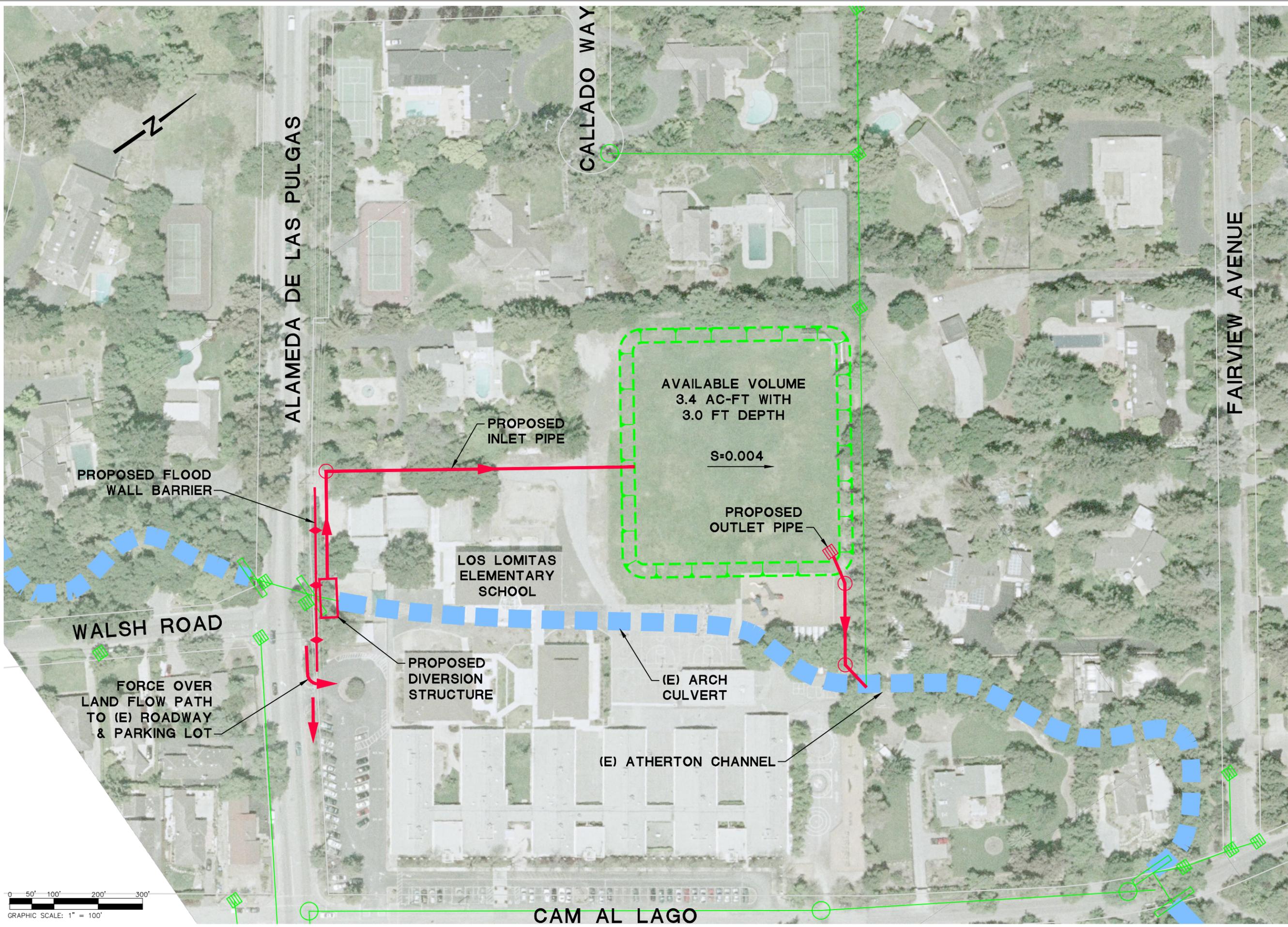
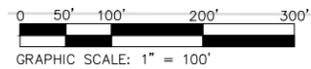
The three detention basin site alternatives are described below. Each alternative is based on diversion of sufficient flow to maintain 10-year storm event flows through the existing Atherton Channel at the capacity of the existing box culvert at Marsh Road, 900 cfs.

### Alternative 1 – Open Fields at Las Lomas Elementary School and Holbrook-Palmer Park

Alternative 1 was selected to utilize the existing fields at Los Lomas Elementary School and Holbrook-Palmer Park and minimize the detention basin footprint and depth. For this alternative, two new detention basins are recommended to obtain the required volume. The sites are located within close proximity to Atherton Channel, minimizing the length of proposed inlet and outlet piping conveying storm flows to and from the existing basins. Figure 4-4 depicts a conceptual layout of the detention basin at the existing Los Lomas Elementary School open field. The bottom of the detention basin would be approximately 3 feet below existing grade and provide 3.4 ac-ft of required volume. A proposed diversion structure at Alameda de las Pulgas would convey flows from Atherton Channel to the proposed detention basin.

Alternative 1 includes a second detention basin located at Holbrook-Palmer Park near the intersection of Watkins Avenue and the railroad. Figure 4-5 depicts a conceptual layout of the detention basin at the open field at Holbrook-Palmer Park. The detention basin is depicted with a rectangular shape to illustrate the footprint required. Final design of the detention basin may incorporate sculptured oval or curved shapes. A proposed weir diversion structure along the Atherton Channel would divert 10-year event storm flows to the proposed detention basin. The bottom of the detention basin would be approximately 4.25 feet below existing grade and provide 9.3 ac-ft of storage volume. The total available volume provided by detention basins at Las Lomas School and Holbrook-Parmer Park (12.7 ac-ft) will reduce the peak storm flow at the Marsh Road box culvert to its capacity (900 cfs) in the 10-year storm event.

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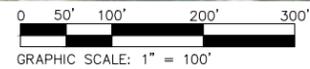
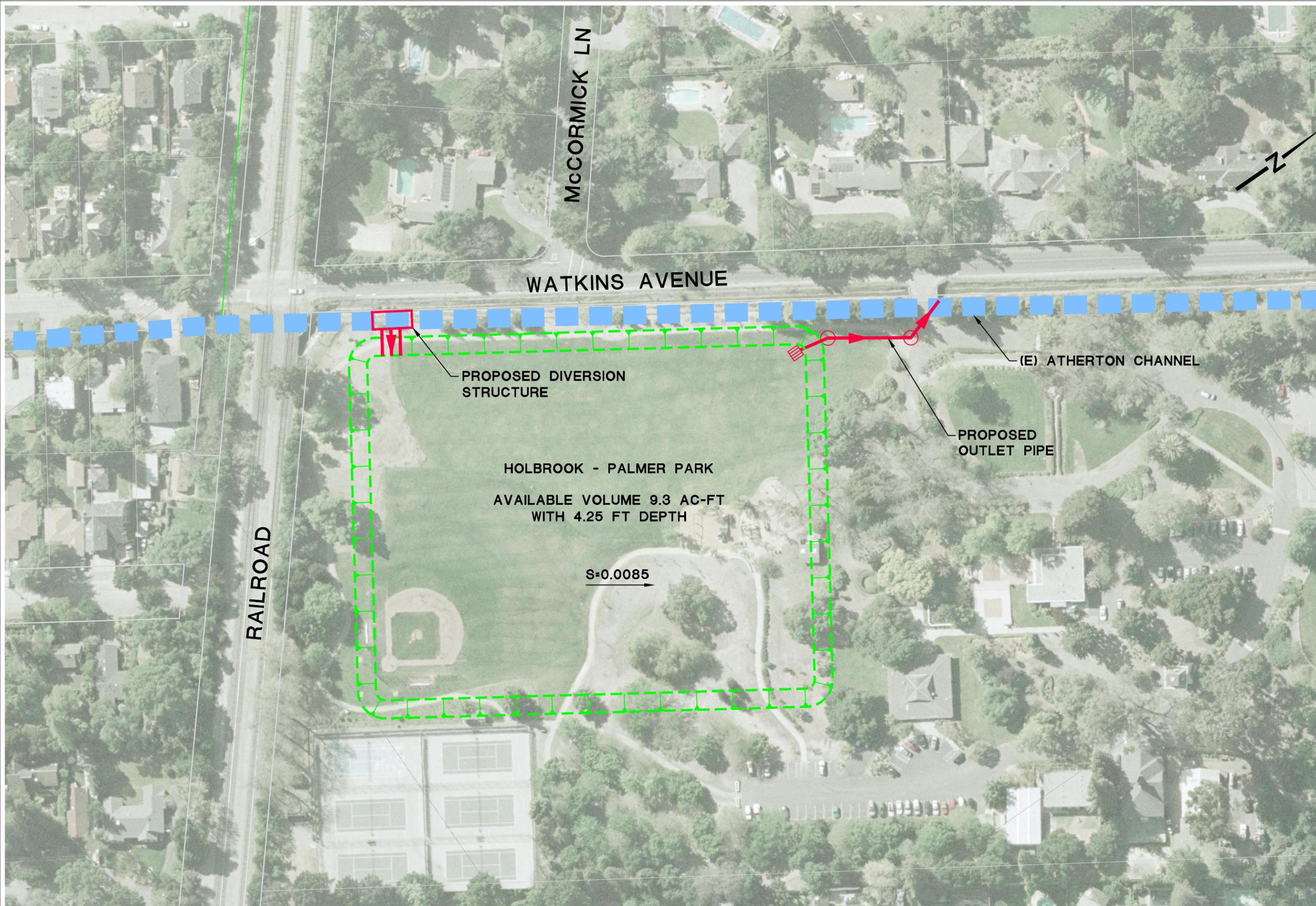


TOWN WIDE DRAINAGE STUDY UPDATE  
 FIGURE 4-4  
 ALTERNATIVE 1 LOS LOMITAS SCHOOL FIELD  
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TOWN WIDE DRAINAGE STUDY UPDATE  
 FIGURE 4-5  
 ALTERNATIVE 1 HOLBROOK PALMER PARK

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## **Alternative 2 – Open Field at Holbrook-Palmer Park**

Alternative 2 was selected due to its close proximity to Atherton Channel. This alternative features one proposed detention basin at the existing open field at Holbrook-Palmer Park. Figure 4-6 depicts a conceptual layout of the detention basin at the open field at Holbrook-Palmer Park. For this alternative, the proposed detention basin maintains the same width as the proposed Holbrook-Palmer Park detention basin depicted in Alternative 1, but extends an additional 100 feet in length. The detention basin is depicted with a rectangular shape to illustrate the footprint required. The bottom of the detention basin would be approximately 5 feet below existing grade and provide 13.5 ac-ft of available volume. A proposed weir diversion structure constructed along Watkins Avenue would divert storm flows to the proposed detention basin. The required detention volume to attenuate 10-year storm flows to the capacity of the existing Marsh Road box culvert is 11 ac-ft.

## **Alternative 3 – Open Field at JL Dixon Stables**

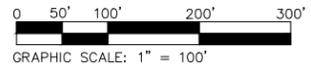
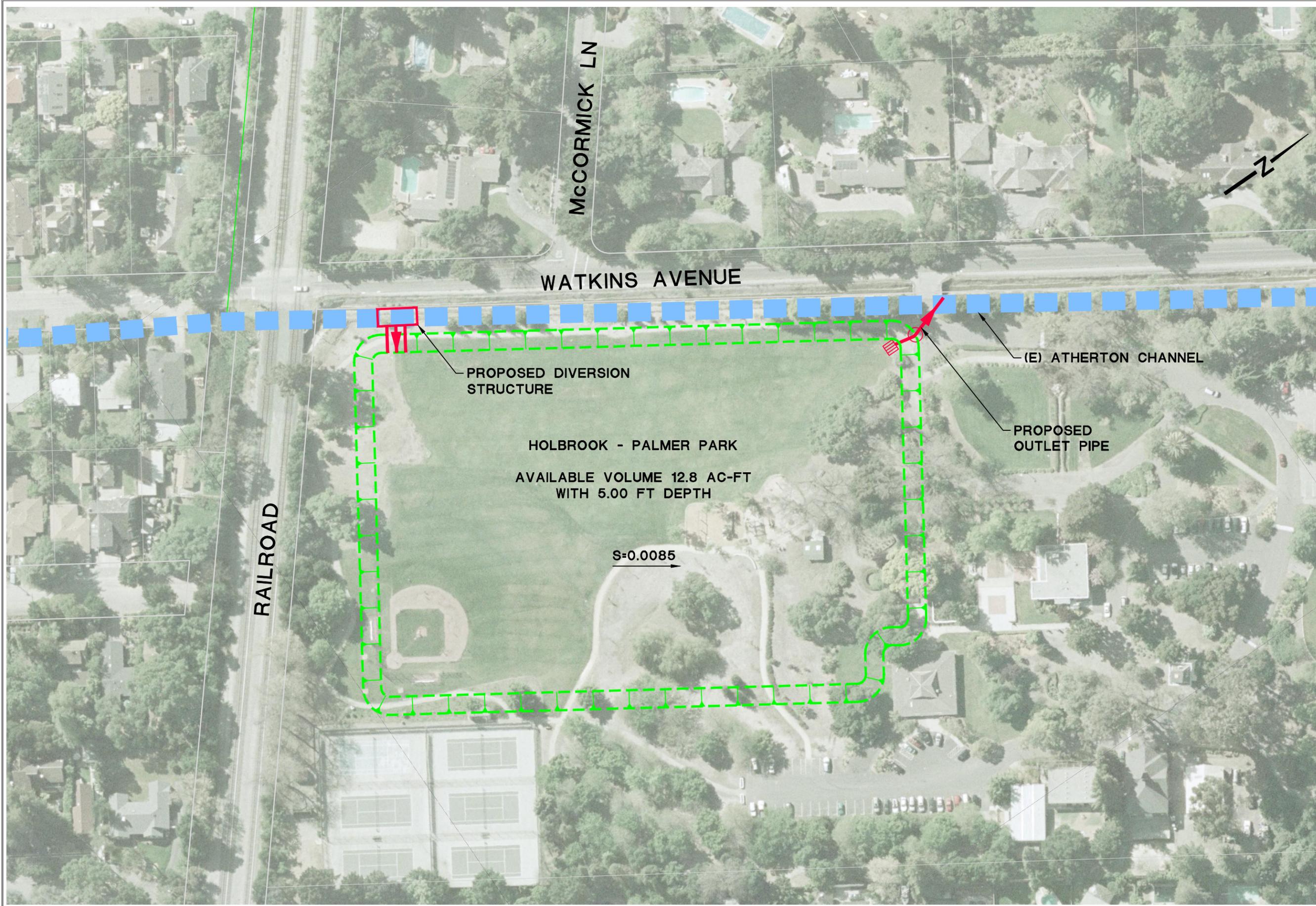
Alternative 3 was selected due to its proximity to the Atherton channel. Figure 4-7 depicts a conceptual layout of the detention basin at the open field at JL Dixon Stables. The bottom of the detention basin would be approximately 4 feet below existing grade and provide approximately 17.2 ac-ft of available detention volume. This alternative would require routing flow from Atherton Channel at Barry Lane into the new basin and routing a drain line back to the channel through Elena Avenue.

## **RECOMMENDED DETENTION BASIN SITE ALTERNATIVE**

Alternative 1 is the recommended detention basin alternative because of its location further upstream. This results in the greatest benefit with the least amount of detention constructed. Also, construction of a detention basin at the school site would help mitigate flooding during a 10-year storm event. In recent years, the school has experienced flooding into the building structures during 10-year or higher intensity storm events. In addition, a flood barrier wall is recommended along the school frontage at Alameda de las Pulgas to redirect overland storm flows away from the school buildings.

This alternative includes construction of two basins, one at Los Lomitas Elementary School, and one at Holbrook-Palmer Park. Just upstream of the school site, Atherton Channel transitions from an open channel to an arch culvert. Figure 4-4 depicts the location of the arch culvert. The existing arch culvert is not capable of capturing estimated 10-year event flows and has a capacity of approximately 400 cfs.

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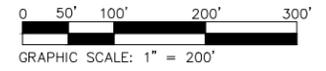
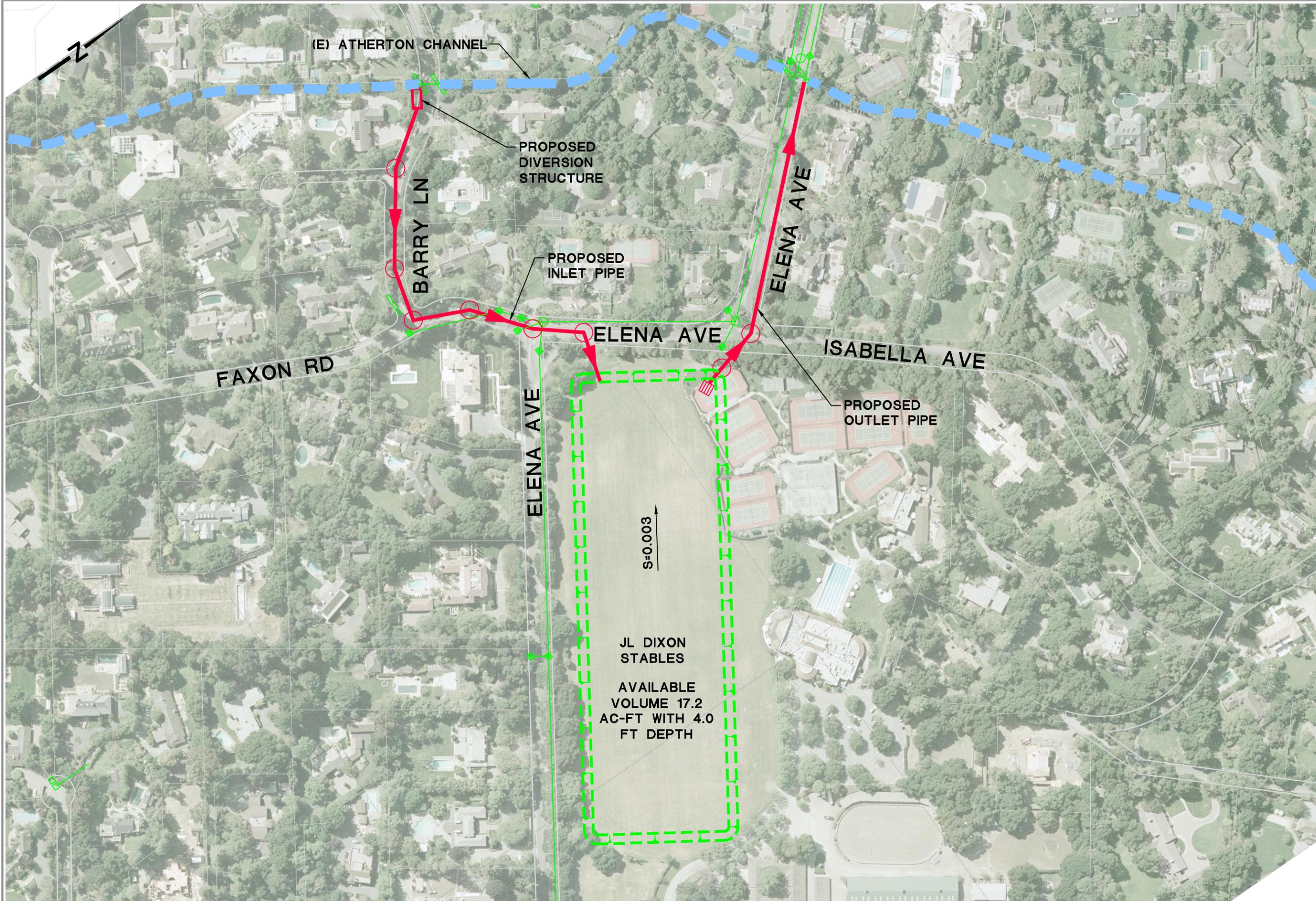
TOWN WIDE DRAINAGE STUDY UPDATE  
 FIGURE 4-6  
 ALTERNATIVE 2 HOLBROOK PALMER PARK  
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TOWN WIDE DRAINAGE STUDY UPDATE  
 FIGURE 4-7  
 ALTERNATIVE 3 JL DIXON STABLES  
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An opinion of probable construction cost for Alternative 1 is shown in Table 4-5.

**TABLE 4-5  
TOWN OF ATHERTON DRAINAGE STUDY  
OPINION OF PROBABLE CONSTRUCTION COST  
DETENTION SITES AT LAS LOMITAS SCHOOL AND HOLBROOK-PALMER PARK<sup>a</sup>**

Description of Item	Quantity	Unit	Unit Price (\$)	Amount (\$)
Mobilization	2	LS	50,000	100,000
Erosion Control / SWPPP	2	LF	20,000	40,000
Excavation offsite disposal (Las Lomas School)	6,800	CY	25	170,000
Excavation offsite disposal (Holbrook-Palmer Park)	29,800	CY	25	745,000
36-inch RCP Installed (Las Lomas School)	500	LF	250	125,000
18-inch RCP Installed	340	LF	200	68,000
42-inch RCP Installed (Holbrook-Palmer Park)	100	LF	300	30,000
36-inch/42-inch Concrete FES w/ Rock Slope Protection	2	EA	2,000	4,000
18-inch Flap Gate w/ Rock Slope Protection	2	EA	3,700	7,400
Storm Drain Manhole Installed	6	EA	5,000	30,000
Overflow Structure Installed	2	EA	10,000	20,000
Diversion Structure Installed	2	EA	100,000	200,000
Block Wall Barrier (3 ft height at Las Lomas School)	210	LF	250	52,500
Traffic Control	2	LS	10,000	20,000
Turf	287,600	SF	5.00	1,438,000
<b>Subtotal</b>				<b>3,049,900</b>
Pipe underdrain below basin, 20%				609,980
Contingency, 15%				457,485
<b>Summary of Probable Construction Costs</b>				<b>4,117,365</b>
<b>Summary of Probable Construction Costs (rounded)</b>				<b>4,120,000</b>

<sup>a</sup> Excludes easement acquisition costs.

## **CHAPTER 5 - MUNICIPAL REGIONAL PERMIT REQUIREMENTS**

On October 14, 2009, the San Francisco Bay Area Regional Board adopted the Municipal Regional Permit (MRP). The MRP contained significant changes from the previous permit including: 1) the types of projects regulated by the permit and 2) types of stormwater treatment best management practices approved for use. In this chapter, the current stormwater quality requirements will be summarized in reference to the Town as they relate to development projects. In addition, an assessment of Town practices as they relate to the MRP is presented.

### **OVERVIEW OF MUNICIPAL REGIONAL PERMIT**

The purpose of the MRP is to provide a uniform standard for the counties and agencies surrounding the San Francisco Bay. The Permittees include Santa Clara, Alameda, San Mateo and Contra Costa counties as well as Fairfield-Suisun and Vallejo. Discussion of the MRP and how it affects stormwater treatment will focus on Section c.3, *New Development and Redevelopment* as it relates to projects within the Town.

### **REGULATED PROJECTS**

In terms of application, the “in effect” threshold triggers are the same as those in effect prior to the adoption of the MRP. Table 5-1, provides a listing of regulated projects, the MRP section referenced, and the effective date of the designation. Three permit requirements which are currently in effect include those related to new development, new roadways, and redevelopment. For new development of a site or for the creation of a new roadway, if a project creates or replaces 10,000 SF or more of impervious surface, the project is considered a regulated project. For redevelopment projects, the project must create or replace more than 10,000 square feet of impervious surface and the “50% rule” applies. This rule states that:

1. If more than 50% of an existing site’s impervious surface is altered, all existing and new impervious surface must be treated.
2. If less than 50% of an existing site’s impervious surface is altered, only the new impervious surface requires treatment.

**TABLE 5-1  
TOWN OF ATHERTON DRAINAGE STUDY  
REGULATED PROJECTS AND EFFECTIVE DATES  
2009 MUNICIPAL REGIONAL PERMIT REQUIREMENTS**

REGULATED PROJECT TYPE	PERMIT REFERENCE	EFFECTIVE DATE
<b><i>Development/Redevelopment</i></b>		
Development: Greater than 10,000 SF of new, impervious surface	c.3.b.ii(1), c.3.b.ii(2) c.3.b.ii(4)	In effect
Redevelopment: Alter greater than 50% of existing impervious surface ("50% rule"). <i>Treat ALL on-site impervious surface</i>	c.3.b.ii(3)	In effect
Redevelopment: Alter less than 50% of existing impervious surface ("50% rule"). <i>Treat ONLY NEW on-site impervious surface</i>	c.3.b.ii(3)	In effect
Special Land Use <sup>a</sup> : greater than 5,000 SF new, impervious surface	c.3.b.ii(1)	12/1/2011
Small Development Projects including detached single-family homes not part of a larger development: Greater than 2,500 SF and less than 10,000 SF new or replaced impervious surfaces shall employ one or more site design measures specified in permit.	c.3.i	12/1/2012
<b><i>Roadway Projects</i></b>		
Construction of new street or road which creates 10,000 SF or more of new, impervious surface	c.3.b.ii(4)(a)	In effect
Roadway widening which alters more than 50% of the existing roadway surface <sup>b</sup> <i>Treat ALL existing, new and altered impervious surfaces.</i>	c.3.b.ii(4)(b)(i)	12/1/2011
Roadway widening which alters less than 50% of the existing roadway surface <sup>b</sup> <i>Treat only new and altered impervious surfaces.</i>	c.3.b.ii(4)(b)(ii)	12/1/2011
Impervious trails greater than 10 feet wide or within 50 feet of top of creek bank.	c.3.b.ii(4)(c)	12/1/2011

<sup>a</sup> Special Land Use category includes uncovered parking lots, auto facilities, gas stations, restaurants

<sup>b</sup> Includes sidewalks and bicycle lanes adjacent to roadways, unless noted otherwise

It is important to note that Special Land Use category projects which include uncovered parking lots, auto facilities, gas stations, and restaurants are regulated if the project creates or replaces 5,000 SF or more of impervious surface. For roadway widening projects, bike lanes and sidewalks are included in the calculation of the impervious surface requiring treatment unless specifically excluded as described below. Finally, there are two means by which a paved trail could trigger the need for stormwater treatment: (1) being constructed of an impervious surface greater than 10 feet wide or (2) being within 50 feet of the top of bank of a creek. There are exclusions to the need for treatment for trails as well.

## EXCLUSIONS

There are exclusions for regulated projects under the MRP. These exclusions are presented in Table 5-2.

**TABLE 5-2  
TOWN OF ATHERTON DRAINAGE STUDY  
EXCLUSIONS TO C.3 REGULATED PROJECTS**

EXCLUSION	PROJECT TYPE AFFECTED
Roadway resurfacing within existing footprint	roadway
Roof or exterior wall surface replacement	building
Interior remodels	building
Sidewalks, bicycle lanes, trails constructed of pervious pavement <sup>a</sup>	roadway, trail
Sidewalks, bicycle lanes, trails draining to vegetated areas <sup>a</sup>	roadway, trail

<sup>a</sup> Sidewalks and bicycle lanes must be hydraulically disconnected from the roadway.

## POST-CONSTRUCTION STORMWATER TREATMENT BEST MANAGEMENT PRACTICES

For C.3 regulated projects, post-construction stormwater treatment Best Management Practices (BMPs) are required to treat the runoff for the applicable project impervious area. Effective December 1, 2011, the MRP specified the use of Low Impact Development (LID) on project sites. LID incorporates a combination of source control, site design, and treatment measures. Source control measures include plumbing certain discharges to the sanitary sewer, such as covered outdoor vehicle wash areas. Site design measures include items which reduce impervious surfaces and direct runoff from impervious surfaces to vegetated areas.

The San Mateo Countywide Water Pollution Prevention Program (SMWPPP) C3 Stormwater Technical Guidance manual defines site design and source control measures as follows:

1. Site Design Measures: Site planning techniques for pollution prevention and reduction in flow rates and durations, by protecting existing natural resources and reducing impervious surfaces of development projects.
2. Source Control Measures: Structural project features or operational “good housekeeping” practices that prevent pollutant discharge and runoff at the source, such as by keeping pollutants from coming into contact with stormwater.

LID treatment measures include:

1. Rainwater harvesting and re-use
2. Infiltration
3. Evapotranspiration

Only if these three options are deemed infeasible may a project employ biotreatment to address stormwater treatment. Other treatment options which do not fall into the above categories are no longer acceptable (i.e., mechanical separators). Table 5-3 provides information concerning measures which fall under Source Control, Site Design, and Treatment, respectively.

**TABLE 5-3  
TOWN OF ATHERTON DRAINAGE STUDY  
C.3 STORMWATER TREATMENT BEST MANAGEMENT PRACTICES  
SOURCE CONTROL MEASURES, SITE DESIGN MEASURES, TREATMENT MEASURES**

SOURCE CONTROL	SITE DESIGN	TREATMENT MEASURES
<ul style="list-style-type: none"> <li>• Plumb certain discharges to sanitary sewer</li> <li>• Provide properly designed covers, drains and storage precautions for:               <ul style="list-style-type: none"> <li>○ outdoor material storage areas</li> <li>○ loading docks</li> <li>○ repair/maintenance bays</li> <li>○ fueling areas</li> </ul> </li> <li>• Provide properly designed trash storage areas</li> <li>• Sustainable landscaping practices (ex: Bay Friendly Landscaping)</li> <li>• Efficient irrigation</li> <li>• Storm drain stenciling or signage</li> </ul>	<ul style="list-style-type: none"> <li>• Limit disturbance of natural water bodies and drainage systems</li> <li>• Conserve natural areas</li> <li>• Minimize impervious surfaces</li> <li>• Minimize disturbance to natural drainages</li> <li>• Minimize stormwater runoff (incorporate one or more of the following):               <ul style="list-style-type: none"> <li>○ direct roof runoff for reuse</li> <li>○ direct roof runoff to vegetated areas</li> <li>○ direct runoff from impervious surfaces to vegetated areas</li> <li>○ construct sidewalks, walkways, patios, driveways, bike lanes, uncovered parking lots of permeable surfaces</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Harvesting and re-use</li> <li>• Infiltration</li> <li>• Evapotranspiration</li> <li>• Biotreatment</li> </ul>

Biotreatment is typically used for smaller projects where rainwater harvesting and infiltration are determined to be infeasible. The simplified method for sizing biotreatment measures (bioretention area or flow-through planter) requires a treatment surface area of 4 percent of the impervious area to be treated. The SMWPPP C3 Stormwater Technical Guidance manual cautions that it may result in a conservatively large stormwater treatment measure.

A new requirement for small development projects including detached single-family homes not part of a larger development was put into effect in December 2012. These projects, defined as greater than 2,500 SF and less than 10,000 SF new or replaced impervious surfaces, shall employ one or more of the following site design measures:

1. Direct roof runoff into cisterns or rain barrels for reuse
2. Direct roof runoff onto vegetated areas
3. Direct runoff from sidewalks, walkways, and/or patios onto vegetated areas
4. Direct runoff from driveways and/or uncovered parking lots onto vegetated areas
5. Construct sidewalks, walkways, and/or patios with permeable surfaces
6. Construct bike lanes, driveways, and/or uncovered parking lots with permeable surfaces

## **ALTERNATIVE OR IN-LIEU COMPLIANCE**

Stormwater treatment off the project site is acceptable in the MRP. There are two main options for in-lieu treatment: 1) LID treatment at an offsite location or 2) payment of in-lieu fees. The MRP states that LID treatment at an alternative project site must provide treatment for an equivalent quantity of stormwater runoff and pollutant loading, within the same watershed. Therefore, the type of area treated at the alternative treatment site should be similar to that of the project site.

Payment of in-lieu fees does not appear to be a desirable option in the Town. If this option is used, the Town would need to:

1. Develop a fee structure
2. Collect the funds from the project budget
3. Select the treatment BMP site and type
4. Design and construct the treatment BMP
5. Track any remaining capacity for future use of in-lieu treatment by another project

Construction of an offsite treatment facility would need to be complete prior to the completion of the project requiring in-lieu treatment. Section c.3.e of the MRP presents a more detailed discussion of in-lieu treatment for a project site.

## **TOWN COMPLIANCE**

SMWPPP offers checklists to assist agencies with C.3. stormwater compliance. The sample Stormwater Checklist for Small Projects (available at <http://www.flowstobay.org/newdevelopment>) is applicable for the majority of future development/re-development projects in the Town. Small projects are defined as individual single family home projects that create and/or replace 2,500 square feet or more of impervious surface and small projects that create and/or replace greater than 2,500 square feet and less than 10,000 square feet of impervious area. An abbreviated version of the SMWPPP sample checklist is provided in Appendix D. This checklist is recommended to assist Town staff with C.3 compliance monitoring for small projects. For regulated C.3 projects that do not meet the small projects definition, the SMWPPP C.3/C.6 Development Review Checklist (included in Appendix D) is recommended to ensure compliance is met. To simplify compliance tracking, it is recommended that mitigation for C.3 compliance not be combined with detention for stormwater management.

Additionally, the MRP outlines requirements for certain development projects located in less impervious watersheds. When a site is developed, much of the stormwater runoff can no longer infiltrate into the soil, which results in greater runoff volumes and flow rates. Hydrograph modification (hydromodification) refers to these changes in timing and volume of runoff from a site after the site is developed. The impact of hydromodification is that higher flow rates and runoff volumes increase the likelihood of erosion in natural creeks and earthen channels. As described in SMWPPP, the MRP requires that hydromodification controls be implemented if a project meets the following criteria:

1. The project is not a single family home (single family homes that are part of a larger development project are not exempt from implementing hydromodification controls if they meet all other criteria).
2. The project creates and/or replaces one acre or more of impervious surface.
3. The project increases impervious surface over pre-project conditions.
4. The project is located in a hydromodification management (HM) susceptible area as shown on the HM control area map (included in Appendix D).

The HM control area map defines the limits of the HM susceptible area within the Town as southwest of Alameda de las Pulgas, southeast of Atherton Avenue, and southwest of El Camino Real. A portion of the area south of the intersection of Atherton Avenue and El Camino Real is excluded from the HM control area applicability (see the map in Appendix D for more information). When development projects meet the criteria listed above, hydromodification management controls should be implemented to ensure compliance. The SMWPPP C.3/C.6 Development Review Checklist also provides guidance to assist developers in determining the applicability of hydromodification management requirements.

## **CHAPTER 6 - ANALYSIS AND PROJECT RECOMMENDATIONS**

The purpose of this chapter is to briefly describe the previous drainage analysis performed, summarize recommended projects to address known drainage problems, summarize a prioritization for implementation, and present background information for each project in tabular form.

### **DRAINAGE CALCULATIONS**

Drainage calculations of the existing drainage systems performed as part of the 2001 Drainage Study are included in Appendix E. These calculations were reviewed as part of this drainage study update. The calculations confirmed analytically the extent of flooding problems and likely solutions. In conjunction, the storage inventory exhibit prepared by BKF (see Appendix F) depicting existing detention storage sites within the Town was reviewed to estimate existing detention storage currently provided. No change was observed in drainage system calculated flows. This was confirmed by current detention storage provided and the requirement (enacted around 2001) to mitigate increases in runoff from new development with detention storage.

### **SUMMARY OF CHANNEL AND PIPE IMPROVEMENTS**

The recommended improvement projects are listed in Table 6-1 along with an estimated construction cost. Detailed cost estimate information is provided in Appendix G. Sequence/project numbers are also presented in Table 6-1. Figure 6-1 depicts the locations of the recommended projects. The following tiers for prioritization of projects were used:

- Tier 1 Improvements mitigate flooding problems that can create significant life and safety issues
- Tier 2 Improvements are intended to avoid damage to private property caused by storm runoff from public areas
- Tier 3 Projects are located on public property and not influenced by downstream drainage system
- Tier 4 Projects are located on public property and influenced by under capacity downstream drainage system
- Tier 5 Projects were recommended in the 2001 Drainage Study but drainage issues in these areas have not been observed recently

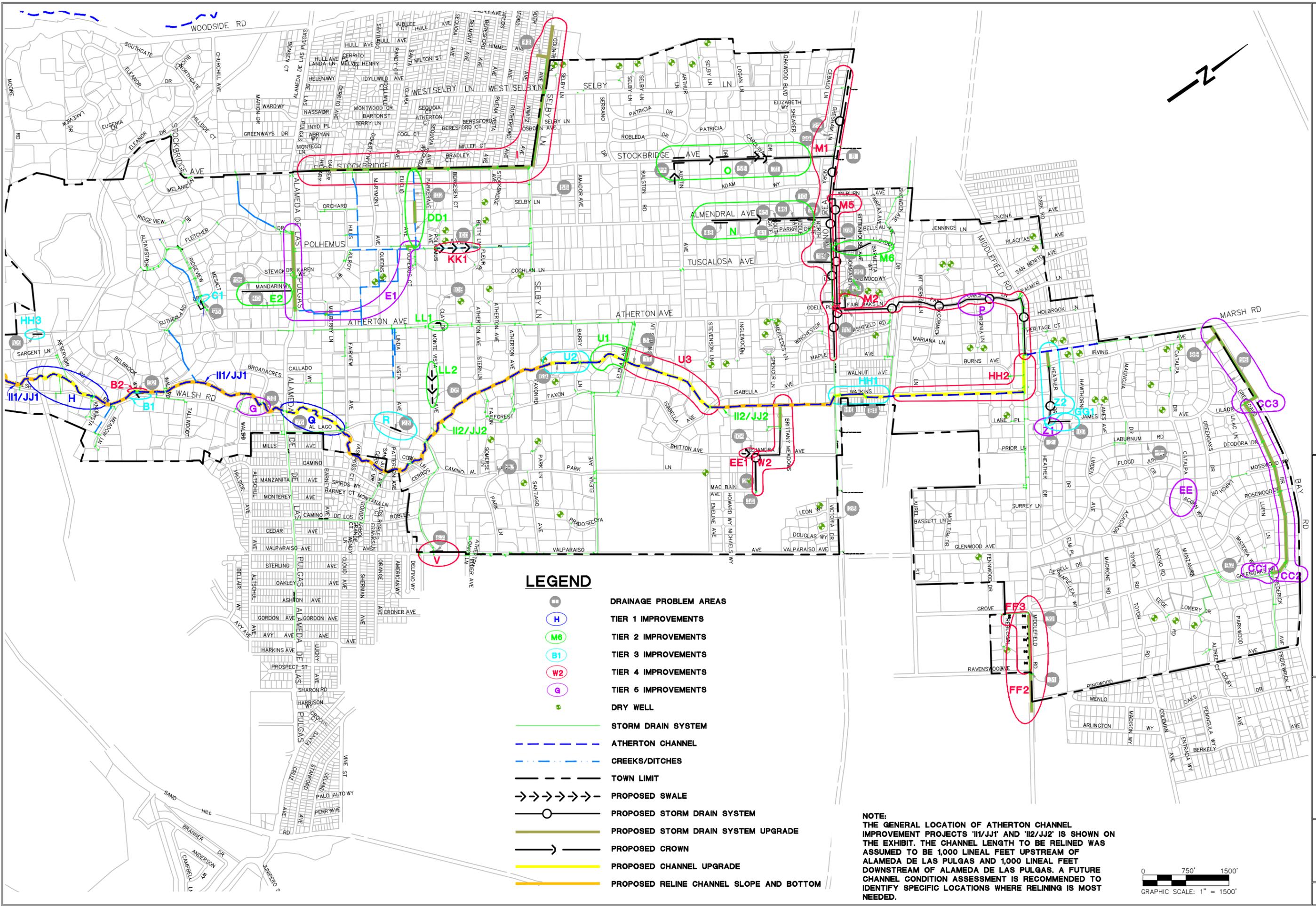
**TABLE 6-1  
TOWN OF ATHERTON DRAINAGE STUDY  
SUMMARY OF RECOMMENDED DRAINAGE IMPROVEMENT PROJECTS**

ID No.	Description	Total Cost, \$
<b>TIER 1</b>		
H	SF Waterline/Reservoir Channel Reline & Erosion Control	2,360,000
Q	Alameda De Las Pulgas/Camino Al Lago Upgrade Existing Channel <sup>a</sup>	1,467,000
II1	Reline Channel Slopes (Upstream of Alameda de las Pulgas)	2,000,000
JJ1	Reline Channel Bottom (Upstream of Alameda de las Pulgas)	310,000
<b>Tier 1 Subtotal</b>		<b>6,137,000</b>
<b>Tier 1 Subtotal (Rounded)</b>		<b>6,140,000</b>
<b>TIER 2</b>		
II2	Reline Channel Slopes (Alameda de las Pulgas to El Camino Real)	2,000,000
JJ2	Reline Channel Bottom (Alameda de las Pulgas to El Camino Real)	310,000
U1	Barry/Elena Upgrade Channel	2,300,820
E2	Mandarin SD System	322,000
M6	El Camino/Lloydden Storm Drainage System	254,000
DD1	Polhemus/Euclid/Parker Upgrade Backyard Ditch and Culvert	2,179,000
LL1	Clay Drive Storm Drain System and Barrier	52,000
N	Almendral Concrete Swale and Regrade	437,000
O	Stockbridge Concrete Swale and Regrade	697,000
LL2	Monte Vista Concrete Swale	68,000
<b>Tier 2 Subtotal</b>		<b>8,619,820</b>
<b>Tier 2 Subtotal (Rounded)</b>		<b>8,620,000</b>
<b>TIER 3</b>		
U2	Barry/Elena Upgrade Channel	1,700,000
HH1	Watkins South Channel & Culvert	625,000
B1	Belbrook/Walsh Storm Drainage System & Swale	79,000
Z2	Heather Storm Drainage System and Upgrade	473,000
GG1	James and Hawthorne Storm Drainage System	131,000
HH3	Reservoir Road Regrade and Crown	58,000
C1	Sutherland/Ridgeview Storm Drainage System	34,000
R	Linda Vista/Camino Al Lago Regrade Intersection	23,000
<b>Tier 3 Subtotal</b>		<b>3,123,000</b>
<b>Tier 3 Subtotal (Rounded)</b>		<b>3,120,000</b>

**Table 6-1 (cont.)  
Town of Atherton Drainage Study  
Summary of Recommended Drainage Improvement Projects**

ID No.	Description	Total Cost, \$
<b>TIER 4</b>		
HH2	Watkins/Middlefield Channel & Culvert	5,734,000
U3	Barry/Elena Upgrade Channel	2,300,820
M1	El Camino Real Storm Drainage System	2,348,000
M5	El Camino Real Storm Drainage Force Main & Pump Station	5,163,000
M2	Fair Oaks Lane Storm Drainage System	138,000
W2	Mac Bain/Alejandra/Brittany SD System and Upgrade	713,000
B2	Belbrook/Walsh Upgrade Culvert with Erosion Control	338,000
I	Selby/Stockbridge Upgrade Storm Drainage System	2,371,000
FF2	Middlefield East Upgrade Existing Storm Drainage System	629,000
FF3	East Middlefield Barriers and Backflow Preventers	17,000
V	Por Los Arboles/Valparaiso Regrade Intersection	22,000
EE1	Alejandra Swale	32,000
KK1	Polhemus/Fleur Swale Improvement and Perforated Underdrain	87,000
<b>Tier 4 Subtotal</b>		<b>19,892,820</b>
<b>Tier 4 Subtotal (Rounded)</b>		<b>19,890,000</b>
<b>TIER 5</b>		
E1	Alameda/Mulberry/Polhemus Upgrade Boxes & Ex. SD System	1,254,000
G	Broadacres Upgrade Culvert	350,000
CC2	Greenoaks Upgrade Existing Storm Drainage System	1,191,000
CC3	Bay Road Upgrade Existing Storm Drainage System	710,000
P	Virginia/Fair Oaks Regrade Intersection	17,000
Z1	Heather Swale	22,000
CC1	Greenoaks Swale	24,000
EE	Catalpa/Acorn Regrade Intersection	21,000
<b>Tier 5 Subtotal</b>		<b>3,589,000</b>
<b>Tier 5 Subtotal (Rounded)</b>		<b>3,590,000</b>

<sup>a</sup> Project Q is located on school district property, not within Town ROW



**LEGEND**

- DRAINAGE PROBLEM AREAS
- TIER 1 IMPROVEMENTS
- TIER 2 IMPROVEMENTS
- TIER 3 IMPROVEMENTS
- TIER 4 IMPROVEMENTS
- TIER 5 IMPROVEMENTS
- DRY WELL
- STORM DRAIN SYSTEM
- ATHERTON CHANNEL
- CREEKS/DITCHES
- TOWN LIMIT
- PROPOSED SWALE
- PROPOSED STORM DRAIN SYSTEM
- PROPOSED STORM DRAIN SYSTEM UPGRADE
- PROPOSED CROWN
- PROPOSED CHANNEL UPGRADE
- PROPOSED RELINE CHANNEL SLOPE AND BOTTOM

**NOTE:**  
THE GENERAL LOCATION OF ATHERTON CHANNEL IMPROVEMENT PROJECTS 'H1/JJ1' AND 'H2/JJ2' IS SHOWN ON THE EXHIBIT. THE CHANNEL LENGTH TO BE RELINED WAS ASSUMED TO BE 1,000 LINEAL FEET UPSTREAM OF ALAMEDA DE LAS PULGAS AND 1,000 LINEAL FEET DOWNSTREAM OF ALAMEDA DE LAS PULGAS. A FUTURE CHANNEL CONDITION ASSESSMENT IS RECOMMENDED TO IDENTIFY SPECIFIC LOCATIONS WHERE RELINING IS MOST NEEDED.



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LAYOUT: 11x17	
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OF SHEETS	
JOB NUMBER	
<b>SJB037500</b>	

## **BACKGROUND INFORMATION FOR RECOMMENDED PROJECTS**

Background information for each project is presented in Table 6-2. For each project, the following information is summarized:

Location	Approximate limits of the area protected.
Problems	Brief statement of the nature of the flooding problem specific to the area.
Solutions	The recommended improvements necessary to provide 10 and 25-yr flood protection.

**TABLE 6-2  
TOWN OF ATHERTON DRAINAGE STUDY  
BACKGROUND INFORMATION FOR RECOMMENDED PROJECTS**

AREA	LOCATION	PROBLEMS	SOLUTIONS
<b>Tier 1</b>			
H – SF Waterline/Reservoir Channel Reline & Erosion Control	Atherton Channel north of I-280 between San Francisco Water Line and Reservoir Road.	<ul style="list-style-type: none"> <li>The major problem is channel erosion. The channel bottom is about a foot lower than the existing channel lining and the side slopes have eroded nearby to the trees.</li> <li>Standing water can cause mosquito breeding problems. Picture was taken during a very dry week. The bottom of the channel has eroded below original elevation</li> </ul> <div style="display: flex; justify-content: space-around; align-items: center;">    </div> <p style="text-align: center;">2001 Photo                      2013 Photo                      2013 Photo</p>	<ul style="list-style-type: none"> <li>Re-grade channel bottom to eliminate ponding and repair eroded channel side slope/embankment.</li> </ul>
Q – Alameda de las Pulgas/Camino Al Lago Upgrade Existing Channel	Areas adjacent to Atherton Channel from Alameda de las Pulgas to Camino Al Lago.	<ul style="list-style-type: none"> <li>Existing metal arch box culvert crossing the Las Lomitas School and channel is under capacity for 10-year event.</li> <li>The school is located in the major flow path.</li> <li>Because of flow overtopping Alameda de las Pulgas in December of 2012, school classrooms were flooded. Location of overtopping is at the low point of the road.</li> <li>Increases in runoff flow rates due to the change from pervious to impervious surfaces have not been mitigated.</li> <li>Reduction of demand will be difficult to attain due to the contributing surface area upstream of the existing Alameda de las Pulgas box culvert. Watershed areas are 74 percent off-site of Town limit and 26 percent within the Town limit.</li> <li>The school is lower than the road, see photo below</li> </ul> <div style="display: flex; justify-content: space-around; align-items: center;">   </div>	<ul style="list-style-type: none"> <li>Upgrade the existing metal arch box culvert and the channel to increase capacity.</li> <li>Alternative to upsizing existing box culvert and channel is to install a 3 foot wall along south side of the property and force the higher flows to be diverted through the parking lot and into the road to Camino Al Lago. To reduce the amount of runoff on the diverted flow path, install a bypass inlet and pipe system along the parking lot and downstream channel at Camino Al Lago.</li> <li>The bypass piping system can be combined with regional detention basin for 10-year flood protection.</li> <li>This alternative leaves the existing culvert in place. Recommend inspection of existing pipe to determine the stability of the system.</li> </ul>
III – Reline Channel Slopes, Phase 1	Atherton Channel	<ul style="list-style-type: none"> <li>The channel side lining has cracks and holes, see 2013 photo.</li> </ul> 	<ul style="list-style-type: none"> <li>Restore the sides of the channel. Assume total channel length of 1000 lineal feet is in need of repair.</li> <li>Channel to be repaired excludes sections where other channel improvement projects are identified.</li> <li>Expand the life expectancy of the channel.</li> <li>This project would be phase 1 of two projects. Phase 1 would restore channel areas most needing improvement upstream of Alameda de las Pulgas.</li> <li>To identify specific locations most needing improvements, a condition assessment of the existing channel is recommended prior to design of channel improvements.</li> </ul>

**TABLE 6-2  
TOWN OF ATHERTON DRAINAGE STUDY  
BACKGROUND INFORMATION FOR RECOMMENDED PROJECTS**

AREA	LOCATION	PROBLEMS	SOLUTIONS
JJ1 – Reline Channel Bottom, Phase 1	Atherton Channel	<ul style="list-style-type: none"> <li>The channel bottom lining has cracks and holes, see 2013 photos.</li> <li>Life expectancy of the channel has been exceeded.</li> </ul> 	<ul style="list-style-type: none"> <li>Regrade the bottom of the channel. Assume total channel length of 1000 lineal feet is in need of repair.</li> <li>Channel to be repaired excludes sections where other channel improvement projects are identified.</li> <li>This project would be phase 1 of two projects. Phase 1 would restore areas most needing improvement upstream of Alameda de las Pulgas.</li> <li>To identify specific locations most needing improvements, a condition assessment of the existing channel is recommended prior to design of channel improvements.</li> </ul>
<b>Tier 2</b>			
II2 – Reline Channel Slopes, Phase 2	Atherton Channel	<ul style="list-style-type: none"> <li>The channel side lining has minor cracks and holes</li> </ul>	<ul style="list-style-type: none"> <li>Restore the sides of the channel. Assume total channel length of 1000 lineal feet is in need of repair.</li> <li>Channel to be repaired excludes sections where other channel improvement projects are identified.</li> <li>Expand the life expectancy of the channel.</li> <li>This project would be phase 2 of two projects and would address areas from Alameda de las Pulgas to El Camino Real.</li> <li>To identify specific locations most needing improvements, a condition assessment of the existing channel is recommended prior to design of channel improvements.</li> </ul>
JJ2 – Reline Channel Bottom, Phase 2	Atherton Channel	<ul style="list-style-type: none"> <li>The channel bottom lining has cracks and holes</li> <li>Exceeded the life expectancy of the channel.</li> </ul>	<ul style="list-style-type: none"> <li>Regrade the bottom of the channel. Assume total channel length of 1000 lineal feet is in need of repair.</li> <li>Channel to be repaired excludes sections where other channel improvement projects are identified.</li> <li>This project would be phase 2 of two projects and would address areas from Alameda de las Pulgas to El Camino Real.</li> <li>To identify specific locations most needing improvements, a condition assessment of the existing channel is recommended prior to design of channel improvements.</li> </ul>
U1 – Barry/Elena Upgrade Channel	Atherton Channel from Barry Lane to Isabella Avenue	<ul style="list-style-type: none"> <li>The project was divided into three phases. The first phase would address areas identified as the worst channel condition.</li> <li>The major problem is overtopping of the channel and flooding basements and properties.</li> <li>The Atherton Channel from upstream of Barry Lane and Elena to Isabella Avenue is undersized for higher flows.</li> <li>Channel is deteriorating.</li> </ul>	<ul style="list-style-type: none"> <li>This is the first part of the three phased improvement project.</li> <li>Inspect the condition of the channel and determine areas that need significant repair.</li> <li>Maintain the capacity of the channel by installing a U-shape concrete channel.</li> </ul>
E2 – Mandarin Storm Drainage System	Areas adjacent to Mandarin Way starting from cul-de-sac to Alameda de las Pulgas and upstream tributary flow paths that contribute flows to this area.	<ul style="list-style-type: none"> <li>The major problem is a large amount of runoff flows through the back property.</li> <li>Flooding on property occurs because the property is a flow path and a low point.</li> <li>Increases in runoff flow rates due to the change from pervious to impervious surfaces have not been mitigated.</li> <li>There is no release point for this area, such as a storm drainage system, to carry large amounts of flow.</li> </ul>	<ul style="list-style-type: none"> <li>Create a release point by installing a storm drainage system along Mandarin Way and connecting to an existing storm drainage system along Alameda de las Pulgas.</li> <li>Combined storm system with localized detention system.</li> </ul>

**TABLE 6-2  
TOWN OF ATHERTON DRAINAGE STUDY  
BACKGROUND INFORMATION FOR RECOMMENDED PROJECTS**

AREA	LOCATION	PROBLEMS	SOLUTIONS
M6 – El Camino/Lloyd Storm Drainage System	Areas adjacent to El Camino Real and upstream tributary flow paths that contribute flows to this area	<ul style="list-style-type: none"> <li>The major problem is the backflow in the pipe surcharges and causes flooding in the back of property.</li> <li>There is no release point for this area, like a storm drainage system to carry large amounts of flow.</li> </ul>	<ul style="list-style-type: none"> <li>Create a release point by installing a storm drainage system starting from an existing inlet and connecting to a new storm drainage system along El Camino Real and Lloyd Drive that bubbles out into the curb and gutter.</li> </ul>
DD1 – Polhemus/Euclid/Parker Upgrade Backyard Ditch and Culvert System	Areas adjacent to the existing box culverts crossing Alameda de las Pulgas, Mulberry Lane and Polhemus Avenue and an existing culvert along the back property of lot #68. Existing storm drainage system along Alameda de las Pulgas from Fletcher Drive to an existing ditch.	<ul style="list-style-type: none"> <li>Existing ditch and culvert is eroding and under capacity.</li> <li>Flooding in the ditch behind the house and in the north street frontage because the area is very flat.</li> <li>Flooding the house and front of yard because the road is very flat and the area is a low point.</li> </ul>	<ul style="list-style-type: none"> <li>Upgrade existing box culverts and storm drainage system to increase capacity.</li> </ul>
LL1 – Clay Drive Storm Drain System and Barrier	North side of Atherton Avenue and Clay Drive intersection	<ul style="list-style-type: none"> <li>During the major storm event in December 2012, runoff from Atherton Avenue flowed into Clay Drive towards the back of the cul-de-sac.</li> <li>Flooding on driveway was a foot deep.</li> <li>Atherton Avenue existing storm drainage system is undersized.</li> </ul>	<ul style="list-style-type: none"> <li>Create a release point by installing a storm drainage system between low point of the intersection and connect to existing system along Atherton Avenue.</li> <li>Install a barrier like a hump before entering Clay Drive, which would prevent water from entering from the street.</li> </ul>
N – Almendral Concrete Swale and Regrade	Areas adjacent to Almendral Avenue from lot #75 Almendral Avenue to Northgate Street and upstream tributary flow paths that contribute flows to this area.	<ul style="list-style-type: none"> <li>There are several low points along the road especially at the intersections. The road has a slight crown. All these low points have a tendency to flood and have no release point.</li> <li>The water flows across the road and accumulates on a property that is low, resulting in the basement flooding.</li> </ul>	<ul style="list-style-type: none"> <li>Install a concrete swale on low point and on all the intersections along the easterly side of Almendral Avenue from lot #75 to Northgate crossing the intersection to create a flow path.</li> <li>Regrade the crown of the road to prevent the water from flowing across the road. This creates several flow paths with smaller flow.</li> <li>Connect the swales to the new storm drainage system along El Camino Real for a release point.</li> </ul>
O – Stockbridge Concrete Swale and Regrade	Areas adjacent to Stockbridge Avenue from Austin Avenue to Nora Way and upstream tributary flow paths that contribute flows to this area.	<ul style="list-style-type: none"> <li>There are several low points along the road especially at the intersections and the road has a slight crown. All these low points flood and have no release point.</li> </ul>	<ul style="list-style-type: none"> <li>Install a concrete swale at the intersections along Stockbridge Avenue from Austin Avenue to Nora Way to create a flow path.</li> <li>Regrade the crown of the road to prevent the water from flowing across the road. This creates several flow paths with smaller flow.</li> <li>Connect the swales to the new storm drainage system along El Camino Real for release point.</li> </ul>
LL2 – Monte Vista Concrete Swale	Areas adjacent to Monte Vista Avenue from midpoint to Atherton Channel and upstream tributary flow paths that contribute flows to this area.	<ul style="list-style-type: none"> <li>Flooding into driveway and stagnant water along open ditch adjacent to the street (when it is not raining).</li> <li>Breeding ground for mosquitos.</li> </ul>	<ul style="list-style-type: none"> <li>Install a concrete swale at the northerly side of Monte Vista Avenue to establish the flow path or a gravel swale with underdrain and storm drain pipe to discharge into Atherton Channel.</li> </ul>
<b>Tier 3</b>			
U2 – Barry/Elena Upgrade Channel	Atherton Channel from Barry Lane to Isabella Avenue.	<ul style="list-style-type: none"> <li>The major problem is overtopping of the channel and flooding of basements and properties.</li> <li>The channel along Atherton Channel from Barry to Elena is undersized for the 10-year flow.</li> </ul>	<ul style="list-style-type: none"> <li>Phase 2 of the three phased improvements.</li> <li>Increase capacity of the channel by installing a U-shape concrete channel.</li> </ul>
HH1 – Watkins South Channel & Culvert	Atherton Channel from El Camino Real to Station Lane.	<ul style="list-style-type: none"> <li>The major problem is the box culvert crossing El Camino Real is undersized for the 10-year event.</li> <li>The box culvert (covered on top) from El Camino Real to Station Lane is undersized.</li> </ul>	<ul style="list-style-type: none"> <li>Increase capacity of the box culvert only for higher than 10-year event condition. Require inspection and maintenance of eroding sections of channel (assumed 25 percent of the total length of this section of the channel).</li> <li>Replace existing inlet into open curb inlet at the intersection of El Camino and Watkins to prevent blockage.</li> </ul>

**TABLE 6-2  
TOWN OF ATHERTON DRAINAGE STUDY  
BACKGROUND INFORMATION FOR RECOMMENDED PROJECTS**

<b>AREA</b>	<b>LOCATION</b>	<b>PROBLEMS</b>	<b>SOLUTIONS</b>
B1 – Belbrook/Walsh Storm Drainage System & Swale	Intersection of Walsh Road and Belbrook Way	<ul style="list-style-type: none"> <li>• Flooding on the northwest and southeast corners of the intersection because of low points.</li> <li>• Increases in runoff flow rates due to the change from pervious to impervious surfaces have not been mitigated.</li> <li>• There is no release point for this area, similar to a storm drainage system, to carry large amounts of flow.</li> </ul>	<ul style="list-style-type: none"> <li>• Create a release point by installing a storm drainage system from the low points and discharge to Atherton Channel.</li> <li>• Install concrete swales to direct flow into the new storm drainage system.</li> </ul>
Z2 – Heather Storm Drainage System and Upgrade	Areas adjacent to James Avenue starting from Middlefield to Heather Drive and upstream tributary flow paths that contribute flows to this area.	<ul style="list-style-type: none"> <li>• Flooding on property and streets because it is along the flow path and at a low point. Water flows along Middlefield and Heather Drive and accumulates onto the lot along James Avenue.</li> <li>• Increases in runoff flow rates due to the change from pervious to impervious surfaces have not been mitigated.</li> <li>• There is no release point for this area, similar to a storm drainage system, to carry large amounts of flow.</li> </ul>	<ul style="list-style-type: none"> <li>• Create a release point by installing a storm drainage system from the low point of the property to Heather Drive and connecting to an existing storm drainage discharge pipe into Atherton channel. This discharge pipe should be upgraded.</li> </ul>
GG1 – James and Hawthorne Storm Drain System	Intersection of James Avenue and Hawthorne Drive and upstream tributary flow paths that contribute flows to this area.	<ul style="list-style-type: none"> <li>• Intersection floods very quickly.</li> <li>• The intersection is a sag area along James Avenue and flows coming from adjacent areas from Middlefield Road and Hawthorne Drive converge at this intersection.</li> </ul>	<ul style="list-style-type: none"> <li>• Create a release point by installing a storm drainage system from the low point of the intersection connecting to the proposed system along Heather Drive and into the existing storm drainage discharge pipe into Atherton Channel.</li> </ul>
HH3 – Reservoir Road Regrade and Crown	Reservoir Road cul-de-sac	<ul style="list-style-type: none"> <li>• Standing water and debris along swale in front of property.</li> </ul> 	<ul style="list-style-type: none"> <li>• Install storm drain system with inlets upstream and downstream of property (bubbler system) or extend rock trench drain swale further upstream.</li> </ul>
C1 – Sutherland/Ridgeview Storm Drainage System	Areas adjacent to Mesa Court, Sutherland Drive, and Ridgeview Drive that release the upstream tributary flows into this path.	<ul style="list-style-type: none"> <li>• The intersection of Sutherland Drive and Ridgeview Drive floods.</li> </ul>	<ul style="list-style-type: none"> <li>• The intersection is near the low point of the watershed from Ridgeview Drive, Sutherland Drive, and Mesa Court. Flows coming from Mesa Court are not captured before flowing into Ridgeview Drive. Recommend installing inlets at the corners of the intersection to reduce the flow into the sag section of Ridgeview Drive near the detention structure.</li> </ul>
R – Linda Vista/Camino Al Lago Regrade Intersection	Westerly side of Camino Al Lago and Linda Vista Avenue intersection	<ul style="list-style-type: none"> <li>• The intersection has an existing concrete swale set too low with no defined release point. The northeast corner floods and the soil erodes because of ponding.</li> </ul>	<ul style="list-style-type: none"> <li>• Regrade the existing concrete swale at the same alignment as the edge of pavement creating a continuous flow path.</li> </ul>
<b>Tier 4</b>			
HH2 – Watkins/Middlefield/Marsh Channel & Culvert	Atherton Channel from Station Lane to Bay Road.	<ul style="list-style-type: none"> <li>• The major problem is the box culverts in Middlefield and Watkins are undersized.</li> <li>• The channel along Watkins from Station Lane to Middlefield Road is undersized.</li> </ul>	<ul style="list-style-type: none"> <li>• Channel and box culvert at Marsh Road from Middlefield Road to Bay Road is in final design (not included in this project).</li> <li>• Increase capacity of the box culverts. Add parallel box culvert to increase capacity of existing box culvert.</li> <li>• Increase capacity of the channel by installing a U-shape concrete channel.</li> <li>• Install side channel detention at park.</li> <li>• Decrease peak flow upstream.</li> </ul>
U3 – Barry/Elena Upgrade Channel	Atherton Channel from Barry Lane to Isabella Avenue.	<ul style="list-style-type: none"> <li>• Phase 3 consists of the balance of channel improvement for side and bottom improvements.</li> <li>• The major problem is overtopping of the channel and flooding basements and properties.</li> <li>• The Atherton Channel from upstream of Barry and Elena to Isabella has 10-year capacity but is undersized for higher flows.</li> <li>• Channel is deteriorating.</li> </ul>	<ul style="list-style-type: none"> <li>• This is the third element of the three phased improvement project.</li> <li>• Balance of the channel not repaired from U2 improvement project.</li> <li>• Maintaining the capacity of the channel by installing a U-shape concrete channel for 10-year event.</li> </ul>

**TABLE 6-2  
TOWN OF ATHERTON DRAINAGE STUDY  
BACKGROUND INFORMATION FOR RECOMMENDED PROJECTS**

AREA	LOCATION	PROBLEMS	SOLUTIONS
M1 – El Camino Real Storm Drainage System	Areas adjacent to El Camino Real starting from Maple Avenue to Selby Lane and upstream tributary flow paths that contribute flows to this area.	<ul style="list-style-type: none"> <li>• The major problem is a large amount of water flows through houses and neighboring properties.</li> <li>• Flooding on property and streets.</li> <li>• Increases in runoff flow rates due to the change from pervious to impervious surfaces have not been mitigated.</li> <li>• There is no release point for this area, similar to a storm drainage system, to carry large amounts of flow.</li> <li>• Based on 1986 Drainage Map, El Camino Real flow path drainage system is a channel/ditch with 12-inch culvert through streets. The existing condition does not show the ditch, the shoulder is completely paved and a very shallow swale section or in some places no swale exists.</li> </ul>	<ul style="list-style-type: none"> <li>• Install a storm drainage system along El Camino Real from Maple Avenue to Selby Lane. This includes sub-systems collecting runoff from the low point of the side streets.</li> <li>• Requires coordination with Caltrans.</li> </ul>
M5 – El Camino Real Storm Drainage Force Main and Pump Station	Starting from the new gravity storm system (M1) at the intersection of El Camino Real and Wilburn Avenue, the new force main is routed along El Camino Real, Fair Oaks Lane, and Middlefield before discharging into Atherton Channel.	<ul style="list-style-type: none"> <li>• There is no release point for Project M1, similar to a storm drainage system, to carry large amounts of flow.</li> <li>• The major flow path slopes into Redwood City. There is no facility to connect the new gravity storm drainage system.</li> </ul>	<ul style="list-style-type: none"> <li>• Create a release point by installing a pump station that discharges to Atherton channel.</li> </ul>
M2 – Fair Oaks Lane Storm Drainage System	Areas adjacent to Fair Oaks starting from cul-de-sac to El Camino Real and upstream tributary flow paths that contribute flows to this area.	<ul style="list-style-type: none"> <li>• The major problem is the old dry well is overflowing and causing flooding in the front yard up to the foundation of the house.</li> <li>• Flooding on streets because the street is a low point.</li> <li>• Increases in runoff flow rates due to the change from pervious to impervious surfaces have not been mitigated.</li> <li>• There is no release point for this area, similar to a storm drainage system, to carry large amounts of flow.</li> </ul>	<ul style="list-style-type: none"> <li>• Create a release point by installing a storm drainage system starting from existing dry wells and connecting to a new storm drainage system along El Camino Real.</li> </ul>
W2 – Mac Bain/Alejandra/Brittany Storm Drainage System and Upgrade	Areas adjacent to Mac Bain Avenue cul-de-sac starting from the cul-de-sac to Alejandra Avenue to Brittany Meadows and upstream tributary flow paths that contribute flows to this area.	<ul style="list-style-type: none"> <li>• The major problem is that the dry wells are saturated.</li> <li>• Flooding on property and streets because the street is a flow path or a low point.</li> <li>• Increases in runoff flow rates due to the change from pervious to impervious surfaces have not been mitigated.</li> <li>• There is no release point for this area, similar to a storm drainage system to carry large amounts of flow.</li> </ul>	<ul style="list-style-type: none"> <li>• Create a release point by installing a storm drainage system that starts from the existing dry wells and is routed along the property line into Alejandra Avenue and Brittany Meadows, connecting to an existing discharge pipe to Atherton channel. Discharge pipe should be upgraded.</li> </ul>
B2 – Belbrook/Walsh Upgrade Culvert with Erosion Control	Intersection of Walsh Road and Belbrook Way.	<ul style="list-style-type: none"> <li>• The existing Atherton channel culvert crossing Belbrook Way is under capacity.</li> <li>• Increases in runoff flow rates due to the change from pervious to impervious surfaces have not been mitigated.</li> <li>• Erosion problem along downstream end of the channel.</li> </ul> 	<ul style="list-style-type: none"> <li>• Upgrade existing box culvert to increase capacity.</li> <li>• Provide erosion control.</li> </ul>
I – Selby/Stockbridge Upgrade Storm Drainage System	Areas adjacent to Stockbridge Avenue from Hillary Lane to Selby Lane and Selby Lane from Stockbridge Avenue to Himmel Avenue.	<ul style="list-style-type: none"> <li>• Existing storm drainage system is under capacity.</li> <li>• Flooding at intersection.</li> <li>• Increases in runoff flow rates due to the change from pervious to impervious surfaces have not been mitigated.</li> </ul>	<ul style="list-style-type: none"> <li>• Upgrade existing storm drainage system along Stockbridge Avenue and along Selby Lane.</li> </ul>

**TABLE 6-2  
TOWN OF ATHERTON DRAINAGE STUDY  
BACKGROUND INFORMATION FOR RECOMMENDED PROJECTS**

<b>AREA</b>	<b>LOCATION</b>	<b>PROBLEMS</b>	<b>SOLUTIONS</b>
FF2 – Middlefield East Upgrade Existing Storm Drainage System	Areas adjacent to Middlefield Road from Oak Grove Avenue to Ravenwood Avenue and upstream tributary flow paths that contribute flows to this area.	<ul style="list-style-type: none"> <li>Existing storm drainage system is under capacity at the connection point off-site of Town limit.</li> <li>Intersection floods regularly.</li> <li>Increases in runoff flow rates due to the change from pervious to impervious surfaces have not been mitigated.</li> </ul>	<ul style="list-style-type: none"> <li>Upgrade existing storm drainage system to increase capacity.</li> </ul>
FF3 –Middlefield East Barriers and Backflow Preventers	Areas adjacent to Middlefield Road from Oak Grove Avenue to Ravenwood Avenue and upstream tributary flow paths that contribute flows to this area.	<ul style="list-style-type: none"> <li>Existing storm drainage system is under capacity at the connection point off-site of town limit.</li> <li>Intersection floods regularly.</li> <li>Floods private property and driveways.</li> </ul>	<ul style="list-style-type: none"> <li>Install hump/barrier along frontage of properties.</li> <li>Provide backflow preventers in existing storm drain connection from the properties to prevent backwater into private property storm drain system.</li> </ul>
V – Por Los Arboles/Valparaiso Regrade Intersection	Westerly side of Valparaiso Avenue and Por Los Arboles intersection.	<ul style="list-style-type: none"> <li>Flooding on street.</li> </ul>	<ul style="list-style-type: none"> <li>Install a concrete swale at the intersections along Valparaiso Avenue and Por Los Arboles to create a flow path.</li> <li>Connect swale to existing storm drainage system along Por Los Arboles.</li> </ul>
EE1 – Alejandra Swale	Areas adjacent to Alejandra Avenue to Brittany Meadows and upstream tributary flow paths that contribute flows to this area.	<ul style="list-style-type: none"> <li>Ponding at the area where the gravel meets the paved road.</li> </ul>	<ul style="list-style-type: none"> <li>Install a concrete swale at the intersections along Alejandra Avenue and connect to proposed storm drain system.</li> </ul>
KK1 – Polhemus/Fleur Swale Improvement and Perforated Underdrain	South side of Polhemus Avenue between Polhemus Avenue and Fleur Place.	<ul style="list-style-type: none"> <li>Standing water at intersection and ditch.</li> </ul>	<ul style="list-style-type: none"> <li>Regrade existing swale/ditch to remove low points and install underdrain due to flat slope.</li> </ul>
<b>Tier 5</b>			
E1 – Alameda/Mulberry/Polhemus Upgrade Boxes and Existing Storm Drainage System	Areas adjacent to the existing box culverts crossing Alameda de las Pulgas, Mulberry Lane, and Polhemus Avenue and an existing culvert along the back property of lot #68. Existing storm drainage system along Alameda de las Pulgas from Fletcher Drive to an existing ditch.	<ul style="list-style-type: none"> <li>Existing box culverts and storm drainage system are under capacity.</li> <li>Flooding in the ditch behind house and in the north street frontage because the area is very flat.</li> <li>Flooding the house and front of yard because the road is very flat and the area is a low point.</li> <li>Increases in runoff flow rates due to the change from pervious to impervious surfaces have not been mitigated.</li> </ul>	<ul style="list-style-type: none"> <li>Upgrade existing box culverts and storm drainage system to increase capacity.</li> </ul>
G – Broadacres Upgrade Culvert	Areas adjacent to the existing Atherton channel box culvert crossing Broadacres Road.	<ul style="list-style-type: none"> <li>Existing box culvert is under capacity.</li> <li>Increases in runoff flow rates due to the change from pervious to impervious surfaces have not been mitigated.</li> </ul>	<ul style="list-style-type: none"> <li>Upgrade existing box culvert to increase capacity.</li> </ul>
CC2 – Greenoaks Upgrade Existing Storm Drainage System	Areas adjacent to Greenoaks Drive from Frederick Avenue to Lilac Drive and upstream tributary flow paths that contribute flows to this area.	<ul style="list-style-type: none"> <li>Existing storm drainage system is under capacity.</li> <li>Increases in runoff flow rates due to the change from pervious to impervious surfaces have not been mitigated.</li> </ul>	<ul style="list-style-type: none"> <li>Upgrade existing storm drainage system to increase capacity.</li> </ul>
CC3 – Bay Road Upgrade Existing Storm Drainage System	Areas adjacent to Bay Road from Lilac Drive to Atherton Channel and upstream tributary flow paths that contribute flows to this area.	<ul style="list-style-type: none"> <li>Existing storm drainage system is under capacity.</li> <li>Flooding on streets and storm drain in front of house #372 backs up during heavy rain.</li> <li>Increases in runoff flow rates due to the change from pervious to impervious surfaces have not been mitigated.</li> </ul>	<ul style="list-style-type: none"> <li>Upgrade existing storm drainage system to increase capacity.</li> </ul>
P – Virginia/Fair Oaks Regrade Intersection	Easterly side of Fair Oaks Lane and Virginia Lane intersection	<ul style="list-style-type: none"> <li>Flooding at southeast corner of Fair Oaks Lane and Virginia Lane intersection. This is a low point with no release point.</li> </ul>	<ul style="list-style-type: none"> <li>Install a concrete swale along easterly side of Fair Oaks Lane crossing the intersection to create a flow path.</li> </ul>
Z1 – Heather Swale	Easterly side of James Avenue and Heather Avenue intersection	<ul style="list-style-type: none"> <li>Flooding on property and streets because it is along the flow path and a low point. Water flows along Middlefield and Heather Drive and accumulates onto the lot along James Avenue.</li> </ul>	<ul style="list-style-type: none"> <li>Install a concrete swale on the intersections along James Avenue to create a flow path.</li> <li>Connect swale to a new storm drainage system along Heather Avenue for release point.</li> </ul>

**TABLE 6-2  
TOWN OF ATHERTON DRAINAGE STUDY  
BACKGROUND INFORMATION FOR RECOMMENDED PROJECTS**

AREA	LOCATION	PROBLEMS	SOLUTIONS
CC1 – Greenoaks Swale	Areas adjacent to Greenoaks Drive and Frederick Avenue intersection and upstream tributary flow paths that contribute flows to this area.	<ul style="list-style-type: none"> <li>• Driveway floods at Lot #2 Frederick.</li> <li>• The area is a low point with no release.</li> </ul>	<ul style="list-style-type: none"> <li>• Install a concrete swale at the intersections along Greenoaks Drive to create a flow path.</li> <li>• Connect swale to an existing storm drainage system along Greenoaks Drive to create a release point.</li> </ul>
EE – Catalpa/Acorn Regrade Intersection	Areas adjacent to Catalpa Drive and Acorn Way intersection and upstream tributary flow paths that contribute flows to this area.	<ul style="list-style-type: none"> <li>• Southeast corner of Catalpa Drive and Acorn Way has drainage problems.</li> </ul>	<ul style="list-style-type: none"> <li>• Install a concrete swale at the intersections along Catalpa Drive to create a flow path.</li> </ul>

**APPENDIX A**

**INVENTORY OF EXISTING STORM DRAIN STRUCTURES  
EXISTING STORM SYSTEM MAPS**

## **IDENTIFICATION LEGEND:**

B	Box
C	Channel
D	Ditch
I	Inlet
J	Junction
M	Manhole
P	Pipe
V	Culvert
W	Drywell

Town of Atherton  
Existing Storm Drain Structures  
SORTED

Town Survey No.	I.D. No.	Structure	Pipe In			Pipe Out			Pipe Out			Rim Elevation	Record Data Only	Comments											
			Size	Material	Invert	Size	Material	Invert	Size	Material	Invert														
351	D12H2DI010	I	12"	RCP	-2.99											12"	RCP	-2.99							
920	D12H2DI020	I	12"	RCP	-3.79											12"	RCP	-3.79							
	D12H2DI030	I																					X		
	D12H4AW010	W														10"	RCP	-2.03							
	D12H4AW020	W														12"	RCP	-2.62							
	D12H4CM010	M	48"	RCP	-7.17											48"	RCP	-7.17							
1010	D12H4CM020	M	48"	RCP	-7.11											48"	RCP	-7.11						Additional pipe of unknown type exists	
956	D12H4CW030	W														10"	RCP	-1.84						Debris in basin	
	D12H4CW040	W														10"	RCP	-2.40						Pipe is full of dirt	
	D12H4CW050	W	10"	RCP	-2.40																			INV.= -0.60 Pipe is full of dirt	
	D12H4DV010	V																					X		
	D12H4DV020	V																					X		
	D12H4AI010	I														6"	HDPE	97.50							11 cleanout drains installed along swale
	D12H4AI020	I														6"	HDPE	97.50							11 cleanout drains installed along swale
	D12H4AI030	I	6"	HDPE	96.30											12"	RCP								11 cleanout drains installed along swale. Invert unknown.
	D12H4AI040	I	12"	RCP	96.10											12"	RCP								11 cleanout drains installed along swale. Invert unknown.
	D12H4AI050	I	12"	RCP	95.80											12"	RCP								11 cleanout drains installed along swale. Invert unknown.
	D12I1AW010	W																-2.70							
	D12I1AW020	W														12"	RCP	-2.46							Full of leaves
367	D12I1BW010	W														10"	RCP	-1.95							
366	D12I1BW020	W														10"	RCP	-1.74							
403	D12I1BW030	W														8"	RCP	-2.72							
404	D12I1BW040	W														8"	RCP	1.57							6" Standing water
409	D12I1BW050	W														10"	RCP	-2.43							
410	D12I1BW060	W														10"	RCP	-1.59							
394	D12I1BI070	I	12"	RCP	-2.22											12"	RCP	-2.22							
368	D12I1BI080	I														12"	RCP	-2.01							
369	D12I1BI090	I														10"	RCP	-1.93							
	D12I1BW100	W																-0.69							
	D12I1BV105	V																					X		
	D12I1BI110	I														12"	RCP	-2.14							
	D12I1BI120	I				12"	RCP	-2.03								12"	RCP	-2.05							
352	D12I1CI010	I	12"	RCP	-4.48											12"	RCP	-4.48							6" Standing water
	D12I1CI020	I														12"	RCP	-2.26							
	D12I1CM030	M	12"	RCP	-2.43	12"	RCP	-3.74	12"	RCP	-2.40					12"	RCP	-3.74							
	D12I1CI040	I														12"	RCP	-1.90							
	D12I1CI050	I	12"	RCP	-4.25	12"	RCP	-4.25								12"	RCP	-4.25							1 ft. standing water in basin
	D12I1CI060	I														12"	RCP	-4.42							
	D12I1CI070	I														12"	RCP	-3.78							
	D12I1CI071	I	12"			N/A										12"									Inverts unknown. Pipe size coming from D12I1CI072 unknown.

Town of Atherton  
Existing Storm Drain Structures  
SORTED

Town Survey No.	I.D. No.	Structure	Pipe In			Pipe Out			Pipe Out			Rim Elevation	Record Data Only	Comments										
			Size	Material	Invert	Size	Material	Invert	Size	Material	Invert													
	D12I1CI072	I													N/A								Invert and pipe size out unknown.	
	D12I1CI073	I	12"			N/A									12"								Inverts unknown. Pipe size coming in from D12I1CI074 unknown.	
	D12I1CI074	I													N/A								Invert and pipe size out unknown.	
	D12I1CI075	I	12"												12"								Inverts unknown.	
	D12I1CI076	I	12"												12"								Inverts unknown.	
	D12I1CI077	I													12"								Invert unknown.	
421	D12I1CW080	W																			-5.44			
	D12I1CW090	W													8"							-3.00		
	D12I1CW100	W																					8" INV.	
	D12I1CV110	V													6"	CMP							No actual headwalls, just 2-6" CMP pipes open at either ends.	
	D12I1CV120	V	6"	CMP																			No actual headwalls, just 2-6" CMP pipes open at either ends.	
	D12I1DW010	W													10"	RCP						-2.13	Lid too heavy to lift	
	D12I1DW020	W	10"	RCP	-2.13																			
	D12I1DV025	V																					X	
	D12I1DI030	I																					-2.27 TC Drop into channel, clogged with leaves	
	D12I1DI040	I																				-8.49	Drop into channel	
420	D12I1DI050	I	15"	RCP	-3.16										15"	RCP						-3.16	Direction unknown	
419	D12I1DI060	I	15"	RCP	-2.74										15"	RCP						-2.74	Direction unknown	
	D12I1DM070	M	15"	RCP	-3.71										18"	RCP						-3.71	Direction unknown	
	D12I1DM080	M	8"	RCP	-2.25																		Direction unknown	
	D12I1DI090	I																					Can't remove lid	
	D12I1DV095	V																					X	
	D12I1DI100	I													8"	RCP						-2.48		
	D12I1DI110	I																				-7.42	6" hole in lid, drop into channel	
	D12I1DI120	I																					INV=-2.46 Filled with leaves, can't see pipe.	
	D12I1DI130	I																				-7.44	6" hole in lid, drop into channel	
	D12I1DI140	I																				-7.68	6" hole in lid, drop into channel	
	D12I1DI141	I																					Invert and pipe size unknown.	
	D12I1DI142	I																					Invert and pipe size unknown.	
	D12I1DI143	I																					Invert and pipe size unknown.	
	D12I1DI144	I																					Invert and pipe size unknown.	
	D12I1DI145	I													12"								Invert unknown.	

Town of Atherton  
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Town Survey No.	I.D. No.	Structure	Pipe In			Pipe Out			Pipe Out			Rim Elevation	Record Data Only	Comments											
			Size	Material	Invert	Size	Material	Invert	Size	Material	Invert														
	D12I1DI146	I	12"												12"								Invert unknown.		
	D12I1DI147	I	12"												12"								Invert unknown.		
	D12I1DI148	I	12"																				Invert unknown.		
392	D12I1DW150	W													12"	RCP	-1.66								
393	D12I1DW160	W													12"	RCP	-1.42								
	D12I1DV170	V	12"	CMP																			INV. = -1.58 top of concrete structure		
	D12I1DV180	V	12"	CMP																			Metal Plate on top- too heavy to lift		
363	D12I1DI190	I													12"	CMP	-2.14								
364	D12I1DI200	I	12"	CMP	-2.59										12"	CMP	-2.59								
365	D12I1DI210	I													12"	CMP	-1.75								
	D12I1DW220	W																					-1.5		
370	D12I2AI010	I	24"	RCP	-2.37	15"	CMP	-2.37							18" or 24"	RCP	-2.37								
412	D12I2AW020	W																					-2.3		
	D12I2AI030	I	24"	RCP	-2.17										24"	RCP	-2.17								
372	D12I2AI040	I													12"	RCP	-2.02								
373	D12I2AM050	M	12"	RCP	-3.37	12"	RCP	-3.42	24"	RCP	-3.63				24"	RCP	-3.63								
371	D12I2AI060	I													12"	RCP	-2.23								
375	D12I2AI070	I													12"	RCP	-1.97								
376	D12I2AM080	M	12"	RCP	-3.92	12"	RCP	-3.71	24"	RCP	-4.00				24"	RCP	-4.00								
374	D12I2AI090	I													12"	RCP	-2.23								
411	D12I2AW100	W																					-2.71		
379	D12I2AI110	I													12"	RCP	-2.10								
377	D12I2AM120	M	12"	RCP	-3.48	12"	RCP	-3.48	24"	RCP	-3.65				24"	RCP	-3.65								
378	D12I2AI130	I	12"	RCP	-1.72										12"	RCP	-1.72								
380	D12I2AI140	I													12"	RCP	-1.17								
	D12I2AW150	W																					-4.33		
383	D12I2AM160	M	12"	RCP	-2.59	12"	RCP	-2.67	24"	RCP	-2.75				24"	RCP	-2.75							INV. = -4.33 TG	
381	D12I2AI170	I													12"	RCP	-1.44								
386	D12I2AI180	I													12"	RCP	-1.33							Manhole lid	
413	D12I2AW190	W																					-3		
	D12I2AI200	I													15"	CMP	-1.63								
	D12I2AM210	M																						X	
382	D12I2BI010	I													12"	RCP	-1.43								leaves in basin
	D12I2BM020	M	24"	RCP	-2.87										24"	RCP	-2.87								
384	D12I2BM030	M	24"	RCP	-3.65	12"	RCP	-3.19	12"	RCP	-3.21				24"	RCP	-3.65								
	D12I2BM040	M	12"	RCP	-2.89	12"	RCP	-2.59							12"	RCP	-2.89								
385	D12I2BI050	I													12"	RCP	-1.69								Manhole lid
995	D12I2BM060	M	12"	RCP	-2.75	12"	RCP	-3.04							12"	RCP	-3.04								
996	D12I2BI070	I													12"	RCP	-1.80								Manhole lid
801	D12I2CW010	W													12"	RCP	-3.30								
415	D12I2CW020	W													12"	RCP	-3.10								
806	D12I2CI030	I	12"	RCP	-1.61										15"	RCP	-1.61								
804	D12I2CI040	I	15"	RCP	-1.79										15"	RCP	-1.79								
	D12I2CM050	M	18"	RCP	-3.68										18"	RCP	-3.68								
389	D12I2CI060	I													12"	RCP	-2.07								Manhole lid
388	D12I2CI070	I													12"	RCP	-1.89								Manhole lid
391	D12I2CI080	I	18"	RCP	-3.61	18"	RCP	-3.61							18"	RCP	-3.65								Manhole lid

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Town Survey No.	I.D. No.	Structure	Pipe In			Pipe Out			Pipe Out			Rim Elevation	Record Data Only	Comments									
			Size	Material	Invert	Size	Material	Invert	Size	Material	Invert												
	D12I2DW010	W														-2.58				-2.58			Dry well filled with dirt
	D12I2DW020	W																					
416	D12I2DM030	M	12"	RCP	-2.46											12"	RCP	-2.58					
387	D12I2DI040	I														12"	RCP	-1.90					Manhole lid
337	D12I3AI010	I	12"	RCP	-1.85											12"	RCP	-2.04					
338	D12I3AI020	I														12"	RCP	-1.49					
	D12I3AI030	I	12"	RCP	-2.91											12"	RCP	-2.91					2-3" Debris in pipes
	D12I3AI040	I														12"	RCP	-2.02					3" Debris in pipe
	D12I3AI050	I														12"	RCP	-2.18					Junction?
	D12I3AM060	M	12"	RCP	-3.64	18"	RCP	-4.24								21"	RCP	-4.24					
	D12I3AM070	M	18"	RCP	-5.21											27"	RCP	-5.21					
	D12I3AM080	M	27"	RCP	-6.00											27"	RCP	-6.00					
	D12I3AV085	V																					X
	D12I3AI090	I	8'		-8.53											8'		-8.53					8' Culvert
	D12I3AV095	V																					X
	D12I3AV097	V																					X
	D12I3AI099	I																					X
	D12I3AM100	M	18"	RCP	-5.17	12"	RCP	-4.50								18"	RCP	-5.17					
	D12I3AI110	I	12"	RCP	-3.13											12"	RCP	-3.13					4" of debris in pipes
	D12I3AI120	I														12"	RCP	-2.88					
	D12I3AI130	I	18"	RCP	-4.02											18"	RCP	-4.02					
	D12I3AI140	I														18"	RCP	-2.41					
	D12I3AW150	W														12"	RCP	-2.05					
	D12I3AW160	W	12"	RCP	-2.05																		Can't remove lid
399	D12I3AW170	W	12"	RCP	-1.78																		Can't remove lid
396	D12I3AW180	W														12"	RCP	-1.78					Drywell? 4" of water
395	D12I3AW190	W			-2.73																		Cannot locate drywell manhole and can't see pipe location because of water depth.
	D12I3AI200	I																					X
	D12I3AI210	I																					X
	D12I3AI211	I														6"	HDPE						HDPE Perforate underdrain pipe
	D12I3AV220	V																					X
	D12I3BI010	I														12"	HDPE	39.40					43.1
	D12I3BI020	I														12"	HDPE	39.52					
	D12I3BI030	I														12"	HDPE	39.33					
	D12I3BI040	I	10"	HDPE	40.48	12"	HDPE	38.20								12"	HDPE	38.07					
	D12I3BI050	I														12"	HDPE						Invert unknown.
	D12I3BI060	I	12"	HDPE																			Invert unknown.
	D12I3BI070	I														24"							24" Pipe out based on field measurement. Invert unknown.
	D12I3BM080	M	12"	HDPE	39.30	12"	HDPE	39.30								12"	HDPE	39.10					
	D12I3BM090	M	12"	HDPE	38.90	12"	HDPE	39.10								12"	HDPE	38.90					
	D12I3CW010	W														12"	RCP	-1.64					
	D12I3CW020	W	12"	RCP	-1.94											12"	RCP	-1.94					Dry Well full of debris
173	D12I3CW030	W	12"	RCP	-1.90																		Full of debris

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Town Survey No.	I.D. No.	Structure	Pipe In			Pipe Out			Pipe Out			Rim Elevation	Record Data Only	Comments									
			Size	Material	Invert	Size	Material	Invert	Size	Material	Invert												
	D12I3CI039	I																					
630	D12I3CM040	M	6"	PVC	-5.65	6"	PVC	-4.95	12"	RCP	-5.69				18"	RCP	-5.73						
631	D12I3CM050	M	18"	RCP	-5.33	12"	RCP	-5.33							18"	RCP	-5.33						
622	D12I3CI060	I													12"	RCP	-5.46						
129	D12I3CI070	I	18"	RCP	-5.34										18"	RCP	-5.34						Manhole lid, pipes 4" full of debris
	D12I3CI080	I													12"	RCP	-2.95						3" Debris at bottom of basin
	D12I3CI090	I	12"	RCP	-2.81										12"	RCP	-2.81						
	D12I3CW100	W															-3.42						-3.42 INV. (CMP)
	D12I3CW110	W															-6.50						-6" INV. Full
	D12I3CV120	V																					X
	D12I3CV130	V																					X
	D12I3CV140	V																					X
808	D12I4AI010	I													12"	RCP	-2.54						
417	D12I4AI020	I													12"	RCP	-2.00						
	D12I4AI030	I	24"	RCP	-6.47										24"	RCP	-6.47						
	D12I4AI040	I	24"	RCP	-5.98										24"	RCP	-5.98						
	D12I4AI060	I			-4.29												-4.29						
	D12I4CW010	W																					-2.91
	D12I4CI020	I													15"	RCP	-3.23						
	D12I4CM050	M																					Lid bolted down
	D13H4DI030	I																					X
	D13H1DM010	M	18"	RCP	-5.42	18"	RCP	-6.28	24"	RCP	-10.20				24"	RCP	-10.20						
	D13H1DI020	I	8"	PVC	-5.25										18"		-5.35						Invert to TC; PVC?
102	D13H1DM030	M													15"	RCP	-2.56						Direction unknown
101	D13H1DV040	V																					
	D13H2AV094	V													36"	RCP	-5.20						
	D13H2AM100	M	24"	RCP	-7.20	24"	RCP	-7.20							24"	RCP	-7.20	24"	RCP	-7.20			
	D13H2AM101	M	18"	CMP	-3.03										24"	RCP	-3.88						
	D13H2AM102	M	36"	RCP	-5.73	24"	RCP	-5.95							24"	RCP	-5.94						
	D13H2AI103	I	12"	PVC	-1.78										24"	RCP	-5.31						
	D13H2AI105	I	27"	RCP	-4.05										27"	RCP	-4.15						
	D13H2AI107	I	36"X24"		-3.30										36"X24"		-3.30						Grate Inlet across street
982	D13H2AI110	I													36"	RCP	-4.32						
	D13H2AM111	M	36"X24"		-4.32										36"	RCP	-4.32						
	D13H2AI112	I	36"	RCP	-3.73										36"	RCP	-4.15						
129	D13H2AM120	M	36"	RCP	-6.00										36"	RCP	-6.00						Additional pipe in of unknown size
	D13H2AI121	I	3"	PVC	-1.84										18"	RCP	-2.85						
986	D13H2AM130	M	36"	RCP	-6.35										36"	RCP	-6.35						
984	D13H2AI140	I																					Bolted shut
134	D13H2AM170	M			-6.59												-6.59						Additional pipe in of unknown size
128	D13H2AI180	I													18"	RCP	-3.93						Manhole Lid, wood cover over inlet, 1 pipe exiting of unknown size
	D13H2AM181	M	36"	RCP	-6.51										36"	RCP	-6.51						
127	D13H2AI190	I	8"	PVC	-4.05										18"	RCP	-4.32						

Town of Atherton  
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Town Survey No.	I.D. No.	Structure	Pipe In			Pipe Out			Pipe Out			Rim Elevation	Record Data Only	Comments										
			Size	Material	Invert	Size	Material	Invert	Size	Material	Invert													
	D13H2AI191	I																					Wood cover bolted over inlet, one pipe out of unknown size	
	D13H2AM192	M	36"	RCP	-6.37	18"	RCP	-3.87							36"	RCP	-6.37						Additional pipe in, out, of unknown size.	
	D13H2AI200	I													15"	PVC	-2.05							
	D13H2AI210	I	15"	PVC	-2.61										15"	PVC	-2.83							
	D13H2AW220	W	10"	CMP	-2.85																			
	D13H2AW230	W													10"	CMP	-3.10							
	D13H2AM240	M	15"	RCP	-8.26	15"	RCP	-5.98							24"	RCP	-8.75							
	D13H2AM250	M	24"	RCP	-9.47	12"	RCP	-7.25							24"	RCP	-9.47							
	D13H2AI260	I													12"	RCP	-4.81							
	D13H2AM270	M	24"	RCP	-9.50	12"	RCP	-6.60							24"	RCP	-9.50							
	D13H2AI280	I													12"	RCP	-4.81							
	D13H2AM290	M	24"	RCP	-8.05	15"	RCP	-6.90							24"	RCP	-8.05							
	D13H2AI300	I													15"	RCP	-4.90							
328	D13H2AM310	M	42"	RCP	-8.14										42"	RCP	-8.14							
	D13H2AW400	W																						
	D13H2BI010	I													24"X18"		-2.27						Conc. Box approx. 1'x15'	
	D13H2BM020	M	24"	RCP	-3.65			-2.64							24"	RCP	-3.65							
	D13H2BM030	M	27"	RCP	-4.16										27"	RCP	-4.16							
	D13H2BI040	I	21"	RCP	-3.19										21"	RCP	-3.19							
189	D13H2BI050	I	24"	RCP	-6.78										24"	RCP	-6.78							
	D13H2BI060	I													10"	CMP	-1.25							
188	D13H2BI070	I															-5.87							
179	D13H2BM080	M	10"	CMP	-2.64	15"	RCP	-6.73	24"	RCP	-6.90				27"	R	-6.90							
186	D13H2BI090	I															-4.91							
187	D13H2BV100	V															-4.81						Pipes in, out w/ -4.81 TC	
	D13H2BI110	I													8"		-1.92							
	D13H2BI120	I													10"	PVC	-1.20							
	D13H2BI130	I	10"	PVC											15"	RCP	-2.56							
	D13H2BI140	I	15"	RCP	-6.15										15"	RCP	-6.19							
	D13H2BM150	M	15"	RCP	-7.29	15"	RCP	-7.29							15"	RCP	-7.29							
	D13H2BI160	I	24"	RCP	-3.08										24"	RCP	-3.08							
869	D13H2BI170	I	24"	RCP	-3.31	12"	RCP	-2.00							24"	RCP	-3.31							
	D13H2BI180	I													12"	RCP	-2.50							
870	D13H2BI190	I	24"	RCP	-3.35										24"	RCP	-3.35							
	D13H2BI200	I													10"	RCP	-1.72							
871	D13H2BI210	I	24"	RCP	-3.46										24"	RCP	-3.46							
333	D13H2BM220	M	33"	RCP	-6.35										33"	RCP	-6.35						Additional pipe out	
240	D13H2BM230	M	33"	RCP	-6.40	15"	RCP	-2.80							33"	RCP	-6.40							
	D13H2BM240	M	24"	RCP	-3.45										24"	RCP	-3.45							
	D13H2BV250	V													15"	CMP	-1.50						Full of Debris	
	D13H2BM260	M	30"	RCP	-6.80										30"	RCP	-6.80							
	D13H2BM270	M	30"	RCP	-6.87										30"	RCP	-6.87							
	D13H2BI280	I	15"	RCP	-1.62										15"	RCP	-1.62							
	D13H2BM290	M	30"	RCP	-7.09										30"	RCP	-7.09							
177	D13H2BI300	I													12"	RCP	-3.36							
180	D13H2BM310	M	18"	RCP	-8.13	12"	RCP	-7.30	12"	RCP	7.30	24"	RCP	-8.13	24"	RCP	-8.13							Direction unknown

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Town Survey No.	I.D. No.	Structure	Pipe In			Pipe Out			Pipe Out			Rim Elevation	Record Data Only	Comments											
			Size	Material	Invert	Size	Material	Invert	Size	Material	Invert														
	D13H2BI320	I																							
	D13H2BI330	I	12"	CIP	-1.90									12"	CIP	-1.90									
	D13H2BI340	I	12"	CIP	-1.98									12"	CIP	-1.98									
	D13H2BW500	W														-2.00							Can't see pipe in/out		
	D13H2BV510	V																					No access to structure		
	D13H2BV520	V																					No access to structure		
	D13H2BV530	V																				X			
	D13H2BV540	V																				X			
	D13H2CM010	M	18"	RCP	-5.42	18"	RCP	-6.28	24"	RCP	-10.20				24"	RCP	-10.20								
	D13H2CI020	I												18"	CMP	-3.60									
	D13H2CI030	I	12"	CMP	-1.80									18"	CMP	-1.80									
	D13H2CI040	I	6"	CMP	-1.30	18"	CMP	-1.65						18"		-2.10								Half full	
	D13H2CM050	M	18"	RCP	-5.30	24"	RCP	-5.00						30"	RCP	-5.67									
	D13H2CI060	I	30"	RCP	-4.38									24"	RCP	-4.38								Appears to have box culvert coming across road.	
	D13H2CI070	I												18"	RCP	-3.68									
980	D13H2CI080	I	24"	RCP	-4.17									27"	RCP	-4.20									
981	D13H2CI090	I	27"	RCP	-3.88									30"	RCP	-3.95									
	D13H2CC091	C												12"	RCP	-1.65									
	D13H2CI092	I	12"	RCP	1.83	4"		-2.60						15"	RCP	-3.57									
	D13H2CI093	I	27"	RCP	-3.15									27"	RCP	-3.15									
	D13H2CI095	I	6"		-0.80									6"		-0.80									
323	D13H2CM110	M	6"	PVC	-2.93	36"	CMP	-5.17						36"	CMP	-5.40									
324	D13H2CI120	I																							
	D13H2CI121	I	6"	PVC	86.25	6"	PVC	86.50						14"	PVC	86.00									3-14" PVC pipe out
	D13H2CI122	I	6"	PVC	86.25									6"	PVC	86.15									
	D13H2CI123	I																							
	D13H2CI124	I	6"	PVC	85.70	18"	PVC	85.65						18"	PVC	85.65									
	D13H2CI125	I	6"	PVC	85.65	18"	PVC	85.50						18"	PVC	85.50									
	D13H2CI126	I	6"	PVC	85.50									14"	PVC	85.40									
	D13H2CI127	I	18"	PVC	85.25	14"	PVC	85.30	6"	PVC	85.30			18"	PVC	85.20									2-18" PVC pipe in and 2-18" PVC pipe out
	D13H2CI128	I												18"	PVC	84.62									
	D13H2CI129	I	18"	PVC	84.50	18"	PVC	84.51						18"	PVC	84.48									2-18" PVC pipe in at invert 84.50 and 2-18" PVC pipe out
126	D13H2CM130	M	36"	CMP	-4.70	36"	CMP	-4.70						36"	CMP	-4.70									
	D13H2CV140	V												36"	CMP	-3.75									
	D13H2CI150	I	8"	PVC	-2.00									8"	PVC	-2.00									
	D13H2CI151	I	6"											6"											10 clean out drains found along Euclid. Underdrain Pipe flows to SD sytem at Stockbridge.

Town of Atherton  
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Town Survey No.	I.D. No.	Structure	Pipe In			Pipe Out			Pipe Out			Rim Elevation	Record Data Only	Comments									
			Size	Material	Invert	Size	Material	Invert	Size	Material	Invert												
	D13H2CI152	I																					10 clean out drains found along Euclid. Underdrain Pipe that flows to SD sytem at Stockbridge. Inlet/outlet diameter unknown. Drain blocked with leaves.
	D13H2CI153	I	6"											6"									10 clean out drains found along Euclid. Underdrain Pipe that flows to SD sytem at Stockbridge.
	D13H2CI160	I	12"	RCP	-4.80									15"	RCP	-4.67							
	D13H2CI170	I	12"	RCP	-4.28									12"	RCP	-4.28							
120	D13H2CI180	I	12"	RCP	-4.60									12"	RCP	-4.67							
121	D13H2CI190	I	6"	PVC	-3.20	3"	PVC	-2.20						12"	RCP	-4.20							
161	D13H2CI200	I	12"	PVC	-3.08									12"	RCP	-3.60							
	D13H2CI201	I												12"	PVC	-3.62							Manhole lid
162	D13H2CI210	I	12"	RCP	-3.14									18"	RCP	-3.33							Standing water
165	D13H2CM290	M	12"	RCP	-3.24	12"	RCP	-3.00						15"	RCP	-3.62							
	D13H2CI291	I												12"	RCP	-3.00							
234	D13H2CV300	V	12"	CMP	-1.34									12"	CMP								
	D13H2CV301	V												12"	CMP								
	D13H2CV302	V	12"	CMP																			
159	D13H2CI310	I	12"	RCP	-2.30	18"	RCP	-3.45	12"	CMP	1.45			18"	RCP	-3.57							
160	D13H2CI320	I												12"	RCP	-2.35							
	D13H2CI321	I	12"	RCP	-3.35									12"	RCP	-3.40							
	D13H2CM322	M	12"	RCP	-2.80	21"	RCP	-2.97						21"	RCP	-2.97							
	D13H2CI323	I	21"	RCP	-2.00									21"	RCP	-2.00							
	D13H2CW400	W																					Pipe buried
	D13H2CW410	W																					Pipe buried
	D13H2CI420	I																					Full
171	D13H2DI010	I												12"	RCP								Ditch enters inlet
173	D13H2DM020	M	18"	RCP	-2.19	12"	RCP	-2.86						21"	RCP	-2.30							
172	D13H2DM030	M												15"	RCP	-2.68							In pipe sealed with bricks, out pipe exists, size unknown
	D13H2DI040	I	21"	RCP	-3.45	8"	PVC	-2.20						21"	RCP	-3.45							
	D13H2DM050	M	21"	RCP	-3.65	12"	RCP	-3.18						21"	RCP	-3.65							
	D13H2DI060	I												12"	RCP	-2.52							
	D13H2DM070	M	12"	RCP	-2.48	12"	RCP	-3.00	21"	RCP	-3.21			21"	RCP	-3.21							
	D13H2DI080	I												12"	RCP	-2.67							Wood cover over inlet
618	D13H2DM090	M	18"	RCP	-6.19	12"	RCP	-4.87	10"	RCP	-6.08			24"	RCP	-6.19							
193	D13H2DI100	I	8"	RCP	-4.48									12"	RCP	-4.48							Direction unknown; Manhole lid
194	D13H2DI110	I	10"	RCP	-6.09									10"	RCP	-6.09							Manhole lid
198	D13H2DI120	I	12"	RCP	-6.78	12"	RCP	-6.18						18"	RCP	-7.28							
196	D13H2DI130	I												12"	RCP	6.59							
199?	D13H2DI140	I	10"	RCP	-4.10									10"	RCP	-4.28							Manhole lid
617	D13H2DM150	M	8"	RCP	-3.46	12"	RCP	-4.21						12"	RCP	-5.32							

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Town Survey No.	I.D. No.	Structure	Pipe In			Pipe Out			Pipe Out			Rim Elevation	Record Data Only	Comments												
			Size	Material	Invert	Size	Material	Invert	Size	Material	Invert															
197	D13H2DI160	I	8"	RCP	-3.13										12"	RCP	-3.13						Manhole lid			
199?	D13H2DI170	I	8"	CMP	-3.41	8"	CMP	-3.41							15"	RCP	-3.41							Manhole lid		
202	D13H2DM180	M	10"	RCP	-4.46	15"	RCP	-4.46							15"	RCP	-4.46									
200	D13H2DI190	I	15"	?	-4.25	8"		-4.21							21"	?	-4.44							Manhole lid		
192	D13H2DI200	I	21"	RCP	-5.89										24"	RCP	-5.89							Manhole lid		
191	D13H2DI210	I	21"	RCP	-5.67										21"	RCP	-5.67							Manhole lid		
215	D13H2DI220	I	4"	PVC	-0.77										8"	RCP	-2.10									
	D13H2DW230	W	8"	RCP	-3.34																			Bottom= -3.34		
	D13H2DW300	W																								
	D13H3BI030	I	15"	PVC	-1.33																			Additional pipes in, out, of unknown size. Inlet is full of mud.		
	D13H3BI031	I	12"	HDPE	215.65																					
	D13H3BI040	I													12"	RCP	-1.30									
254	D13H3BI070	I	6"	CMP	-2.74										6"	CMP	-2.74									
	D13H3BI071	I	6"	CMP	-1.95	6"	VCP	-1.90	8"	PVC	-2.68				8"	VCP	-2.15								Wood cover, check pipe out, on private property	
255	D13H3BW080	W	12"	CMP	-2.10																			Dry well?		
	D13H3BW101	W																							Dry well 60' North of 385 Fletcher.	
252	D13H3BI110	I	12"	CMP	-2.50										12"	CMP	-2.50									
	D13H3BI111	I	12"	CMP	-4.65										18"	CMP	-4.65									
	D13H3BI112	I	8"	CMP	-2.30																				Dry well?, Culvert?	
	D13H3BI113	I	18"	CMP	-3.60	8"	RCP	-1.90							18"	RCP	-5.10								Wood cover. Size out?	
253	D13H3BI120	I	6"	PVC	-2.43										12"	CMP	-2.43									
954	D13H3BI130	I													24"	CMP	-4.35								Culvert across road to creek?	
	D13H3BI131	I	18"	CMP	-3.07										18"	CMP	-4.62									
	D13H3BI132	I	18"	CMP	-4.00										21"	PVC	-4.15									
	D13H3BW133	W	12"	CMP	-3.10																				Dry well?	
	D13H3BI134	I	24"	PVC	-2.34										24"	CMP	-3.53								Wood cover; 447 Eleanor Dr. City limits.	
	D13H3BI135	I	24"	CMP	-2.60										24"	CMP	-2.60								Could be culvert.	
	D13H3BI200	I																								
	D13H3BI210	I																								
	D13H3BW220	W																								X
	D13H3BW230	W																								X
	D13H3BV300	V													12"	CMP	-1.00									
	D13H3BI310	I	12"	RCP	-3.55	15"	RCP	-3.55							18"	RCP	-3.55									
	D13H3DI010	I													15"	CMP	-3.30									
	D13H3DI020	I													12-15"	PVC	-1.40									
	D13H3DI030	I																								X
	D13H3DI040	I																								X
	D13H3DI041	I													12"	HDPE	267.90									
	D13H3DI042	I	15"	HDPE	256.79										15"	HDPE	256.79									
	D13H3DI043	I													12"	HDPE	249.28									
	D13H3DI044	I	15"	HDPE	234.75										15"	HDPE	234.75									
	D13H3DI045	I	12"	HDPE	227.59										12"	HDPE	226.20									
	D13H3DI046	I													12	HDPE	221.10									

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Town Survey No.	I.D. No.	Structure	Pipe In			Pipe Out			Pipe Out			Rim Elevation	Record Data Only	Comments									
			Size	Material	Invert	Size	Material	Invert	Size	Material	Invert												
	D13H3DI047	I	12"	HDPE	220.50										12"	HDPE	216.25						
	D13H3DI048	I													12"	HDPE	219.96						
	D13H3DI049	I													12"	HDPE	218.60						
	D13H3DI050	I																				X	
	D13H3DI051	I													12"	HDPE	205.74						
	D13H3DI052	I													12"	HDPE	205.55						
	D13H3DI053	I	15"	HDPE	226.70										15"	HDPE	226.70						Existing inlet removed and replaced
	D13H3DM060	M	12"	HDPE	268.20	12"	HDPE	267.65							12"	HDPE	267.55						
	D13H3DM070	M	12"	HDPE	256.34	15"	HDPE	256.28							15"	HDPE	256.24						
	D13H3DM080	M	15"	HDPE	249.20	12"	HDPE	248.95							15"	HDPE	248.95						
	D13H3DM090	M	15"	HDPE	226.50	15"	HDPE	227.28							21"	HDPE	226.30						
	D13H3DM100	M	21"	HDPE	224.73										21"	HDPE	224.73						
	D13H3DM110	M	21"	HDPE	219.03	12"	HDPE	219.77							21"	HDPE	219.03						
	D13H3DM120	M	21"	HDPE	218.20	12"	HDPE	218.32							24"	HDPE	217.80						
	D13H3DM130	M	24"	HDPE	214.72										24"	HDPE	214.72						
	D13H3DM140	M	12"	HDPE	205.25	12"	HDPE	205.25	24"	HDPE	203.40				24"	HDPE	203.40						
328	D13H4AM390	M													15"	RCP	-3.50						
	D13H4AI400	I																				X	
	D13H4AI410	I																				X	
	D13H4AI431	I	6"	PVC	-2.50										12"	RCP	-3.01						100' SOUTH OF ALAMEDA
	D13H4AI432	I	12"	RCP	-2.25	24"	CMP	-2.70							21"	RCP	-2.85	12"	RCP	-2.55			2" FULL
	D13H4AI433	I															-3.10						Pipe full, can't get size, material, inv.
	D13H4AI434	I	10"	PVC	-1.67	4"	PVC	-1.60							12"	PVC	-2.00						
	D13H4AV435	V																				X	
	D13H4AI440	I																				X	
152	D13H4AM450	M	12"	RCP	-5.98										12"	RCP	-5.98						Not sure about direction of flow.
153	D13H4AI460	I													12"	PVC	-6.94						Not sure about pipe size
147	D13H4AI470	I	24"	CMP	-4.71										24"	CMP	-4.71						
146	D13H4AI480	I	24"	CMP	-5.40										24"	CMP	-5.40						
148	D13H4AM481	M	21"	RCP	-4.85	30"	RCP	-4.85							30"	RCP	-4.85						
145	D13H4AI490	I	15"	RCP	-4.17										21"	RCP	-4.67						
144	D13H4AI500	I													15"	RCP	-3.90						
154	D13H4AV510	V																					Creek and Culvert size 3.4' x1.6'
155	D13H4AV520	V																					Creek and Culvert size 3.4' x1.6'
143	D13H4AI530	I													12"	PVC	-1.16						
141	D13H4AM540	M	12"	RCP	-2.90										18"	RCP	-2.93						
141	D13H4AI550	I	15"	RCP	-2.95										18"	RCP	-2.98						
142	D13H4AI560	I													12"	PVC	-0.93						
	D13H4AI561	I	8"	PVC	-2.30	10"	PVC	-2.17							18"	RCP	-3.55						
	D13H4AI562	I	10"	PVC	-2.20										18"	RCP	-3.32						18" .25 FULL
140	D13H4AM570	M	6"	PVC	-1.95										12"	RCP	-2.30						
140	D13H4AI580	I	6"	PVC	-1.89										15"	RCP	-2.37						2" FULL
	D13H4AM590	M																				X	Can't get cover off
321	D13H4AI600	I																					Metal top bolted on
	D13H4AM610	M																				X	Can't get cover off
320	D13H4AI620	I													15"	RCP	-4.45						

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Town Survey No.	I.D. No.	Structure	Pipe In			Pipe Out			Pipe Out			Rim Elevation	Record Data Only	Comments												
			Size	Material	Invert	Size	Material	Invert	Size	Material	Invert															
104	D13H4AI630	I	12"	RCP	-2.40	21"	RCP	-3.90	12"		-2.50	21"	RCP	-3.90	24"	RCP	-4.05							MH and inlet appear to be one structure.		
	D13H4AI640	I																						Concrete box bolted down.		
	D13H4AM650	M																						MH too large to lift.		
	D13H4AM660	I																				X				
156	D13H4AI670	I	15"	RCP	-2.57									15"	RCP	-2.85										
233	D13H4AI680	I	6"	VCP										18"	CMP	-3.12								Additional in pipe capped		
232	D13H4AI690	I	18"	CMP				-1.96						18"	CMP	-2.07								pipe type "valve"		
231	D13H4AI700	I	18"	CMP	-1.89	10"		-1.43						12"	CMP	-1.86	12"	CMP	-1.86							
157	D13H4AI710	I	15"	CSP	-2.39									15"	CSP	-2.39										
	D13H4AM711	M	12"	CMP	-2.70	12"	CMP	-2.70	15"	RCP	-2.98				18"	RCP	-2.98									
	D13H4AI712	I																						Cleanout drain for perforated pipe. Could not measure diameter/invert		
	D13H4AI713	I																						Cleanout drain for perforated pipe. Could not measure diameter/invert		
	D13H4BM335	M																					X			
	D13H4BV340	V																						X		
	D13H4BM345	M																						X		
	D13H4BV350	V																						X		
235	D13H4BI360	I	15"	CMP	-1.85									12"	VCP	-2.16										
236	D13H4BI370	I	12"	CMP	-1.71	15"	CMP	-1.61						15"	CMP	-1.73										
	D13H4BI375	I												15"	CMP										No Structure	
237	D13H4BI380	I	4"	PVC	-0.89									12"	CMP	-1.19										
	D13H4BI420	I																					X			
211	D13H4BI720	I																							Too heavy, too deep	
210	D13H4BI730	I																							Too heavy, too deep	
209	D13H4BI740	I																							Grate too big	
204	D13H4BI750	I																							Grate too heavy	
208	D13H4BI760	I																							Grate too heavy	
207	D13H4BI770	I												10"	RCP	-1.91										
	D13H4BV774	V																						X		
	D13H4BV778	V																							X	
201	D13H4BI780	I	10"	CMP	-2.04																				Wooden lid	
	D13H4BV785	V																							X	
	D13H4BI790	I																								Drop structure w/culvert
	D13H4BI791	I	6"											6"												6" underdrain pipe.
	D13H4BI792	I	6"											6"												6" underdrain pipe.
	D13H4BI793	I	6"											6"												6" underdrain pipe.
	D13H4BI800	I																								Drop Structure Inv. -8.19 TC
	D13H4BV805	V																							X	
	D13H4BV806	V	6"																							Pipe collects flow at end of channel at intersection of Linda Vista/Atherton Ave and conveys it to SD system.

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Town Survey No.	I.D. No.	Structure	Pipe In			Pipe Out			Pipe Out			Rim Elevation	Record Data Only	Comments												
			Size	Material	Invert	Size	Material	Invert	Size	Material	Invert															
	D13H4CI010	I	6"	PVC	-1.00	12"	PVC	-1.66							15"	CMP	-1.74									
	D13H4CI020	I	12"	PVC	-2.00										12"	PVC	-2.10									
	D13H4CI030	I													8"	RCP	-1.55									
	D13H4CV035	V																					X			
	D13H4CI040	I	8"	RCP	-1.55										8"	RCP	-1.57							X		
	D13H4CV045	V																								
	D13H4CI050	I	12"	CMP	-2.20										12"	PVC	-2.23									
	D13H4CI060	I	15"	CMP	-2.04										15"	CMP	-2.15									
	D13H4CI070	I	15"	CMP	-2.50										15"	CMP	-2.60								Pipes partially full	
	D13H4CI080	I													15"	CMP	-1.72								Pipes partially full	
	D13H4CI085	I													6"	CMP	-0.50								Drains to creek	
	D13H4CM087	M	15"	RCP	-6.40	8"	PVC	-5.95							15"	RCP	-6.58								Drains to creek	
274	D13H4CI090	I	15"	RCP	-2.83										15"	RCP	-3.40									
	D13H4CI100	I	8"		-3.60										8"		-3.6								Type of pipes unknown	
	D13H4CI110	I																								
	D13H4CI120	I																								
	D13H4CI130	I																								
	D13H4CV135	V																						X		
	D13H4CI140	I																						X		
	D13H4CI150	I																						X		
	D13H4CM155	M																						X		
267	D13H4CM160	M	18"	RCP	170.10	24"	HDPE	170.10							24"	RCP	170.00								2001 existing MH removed and replaced	
269	D13H4CI170	I													15"	CMP	-3.22								Additional connecting pipe buried	
265	D13H4CI180	I	8"	CMP	-1.42										8"	CMP	-1.42									
266	D13H4CI190	I													8"	CMP	-1.21								Half Full	
	D13H4CV195	V																						X		
	D13H4CV200	V																						X		
	D13H4CV205	V																						X		
	D13H4CI210	I	12"	CMP	-2.10																					
241	D13H4CI250	I													18"	PVC	-3.45									
	D13H4CV255	V																						X		
240	D13H4CI260	I	60"	RCP	-10.66																				Large culvert?	
240	D13H4CI261	I																							MH too large to lift.	
	D13H4CV265	V																						X		
	D13H4CI270	I													18"	HDPE	173.67									
	D13H4CI280	I													12"	HDPE	171.63									
	D13H4CI290	I													12"	HDPE	177.06									
	D13H4CI300	I													12"	HDPE	177.03									
	D13H4CI310	I													21"	HDPE	188.03									
	D13H4CI320	I													12"	HDPE	188.90									
	D13H4CM330	M	12"	HDPE	188.20	21"	HDPE	187.05	24"	HDPE	185.15				24"	HDPE	185.15									
	D13H4CM335	M	24"	HDPE	182.39										24"	HDPE	182.39									
	D13H4CM340	M	12"	HDPE	176.50	12"	HDPE	176.50	24"	HDPE	176.00				24"	HDPE	176.00									
	D13H4CM350	M																								
	D13H4CM360	M	18"	HDPE	172.14																					Detention Chamber MH Access

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Town Survey No.	I.D. No.	Structure	Pipe In			Pipe In			Pipe In			Pipe In			Pipe Out			Pipe Out			Rim Elevation	Record Data Only	Comments	
			Size	Material	Invert	Size	Material	Invert	Size	Material	Invert	Size	Material	Invert	Size	Material	Invert	Size	Material	Invert				
	D13H4CM361	M	24"	HDPE	172.14																		Detention Chamber MH Access	
	D13H4CM362	M																			175.86		Detention Chamber MH Access	
	D13H4CM363	M																			175.92		Detention Chamber MH Access	
	D13H4CM364	M																			176.13		Detention Chamber MH Access	
	D13H4CM365	M																			176.14		Detention Chamber MH Access	
	D13H4DI010	I																				X		
	D13H4DI020	I																				X		
	D13H4DM040	M																				X		
	D13I1AI010	I												12"	RCP	-3.27								
	D13I1AI020	I	12"	RCP	-3.73	21"	RCP	-7.23						21"	RCP	-7.23								
226	D13I1AW030	W																					Has screen under grate	
	D13I1AW030	W																					Full	
	D13I1AW040	W																						
	D13I1AW040	W																					Full	
223	D13I1CI010	I												24"	RCP	-7.06								
222	D13I1CI020	I	15"	RCP	-6.29	21"	RCP	-6.69						21"	RCP	-6.69								
220	D13I1CI030	I	12"	RCP	-3.26	21"	RCP	-6.85						21"	RCP	-6.85								
221	D13I1CI040	I												15"	RCP	-5.40								
219	D13I1CI050	I												12"	RCP	-2.83								
	D13I1CI060	I												15"	CMP	-2.44								
	D13I1CI070	I												12"	RCP	-4.91								
	D13I1CM080	M	21"	RCP	-8.38	15" or 18"	RCP	-3.85						21"	RCP	-8.38								
	D13I1CM090	M	12"	CMP	-2.04	15"	CMP	-2.16						18"	RCP	-2.34							Appears to be abandoned	
614	D13I1CM100	M																					Can't open	
950	D13I1CM120	M																						
611	D13I1CI130	I												15"	RCP	-5.31								
610	D13I1CM140	M	12"	RCP	-6.94	18" or 21"	RCP	-7.50						18" or 21"	RCP	-7.50							12" pipe abandoned? Dry!	
609	D13I1CM150	M	15"	RCP	-6.58	18" or 21"	RCP	-1.33						18" or 21"	RCP	-1.33								
612	D13I1CM160	M	18"	RCP	-7.29									18"	RCP	-7.29								
613	D13I1CM170	M	18"	RCP	-7.99									18"	RCP	-7.99								
	D13I1CW180	W	4"	VCP	-0.90	6"	VCP	-0.90															Depth of water = 0.4"	
	D13I1CW300	W																				X		
214	D13I3AM010	M	36"	RCP	-12.90									36"	RCP	-12.90								
213	D13I3AM020	M	36"	RCP	-12.30									36"	RCP	-12.30								Through pipe
212	D13I3AM030	M	42"	RCP	-11.90									42"	RCP	-11.90								
	D13I3AI040	I												15"	RCP	-4.50							Direction unknown	
	D13I3AI050	I	42"		-12.02	6"	CMP	-1.96						42"		-12.02								
	D13I3AI060	I												8"		-1.80							Bolted lid	
600	D13I3AM070	M	24"	RCP	-10.90	12"	RCP	-6.10						24"	RCP	10.90								
	D13I3AI080	I																						
947	D13I3AM090	M	8"	PVC	-7.74	8"	PVC	-7.78	8"	PVC	-7.78	12"	PVC	-7.78	21"		-8.35						Additional in pipe 15" RCP at -8.35	
949	D13I3AI100	I												15"	RCP	-7.57								
948	D13I3AM110	M																					Bolted on	

Town of Atherton  
Existing Storm Drain Structures  
SORTED

Town Survey No.	I.D. No.	Structure	Pipe In			Pipe Out			Pipe Out			Rim Elevation	Record Data Only	Comments									
			Size	Material	Invert	Size	Material	Invert	Size	Material	Invert												
	D13I3AI120	I													15"		-4.48						
	D13I3AI130	I													10"	RCP	-4.74						
	D13I3AI140	I	12"	RCP	-4.90										12"	RCP	-4.90						Direction unknown; No water+W392
601	D13I3AM150	M	18"	RCP	-9.10										18"	RCP	-9.10						
	D13I3AB160	B																					2' x 2' Culvert -4.05 TC
	D13I3AB170	B																					2' x 2' Culvert
604	D13I3AI180	I													12"	RCP	-5.14						
605	D13I3AM190	M	12"	RCP	-7.38	18"	RCP	-7.38	15"	RCP	-7.38				18"	RCP	-7.38						
603	D13I3AM200	M													15"								Lid stuck
	D13I3AM210	M	18"		-7.40										18"		-7.40						
	D13I3AM220	M	18"		-7.40	18"		-4.38							21"		-4.38						
	D13I3AM230	M	18"		-7.37										18"		-7.37						Direction unknown; Dry
	D13I3AM240	M	18"		-7.38										18"		-7.38						
303	D14H1BI080	I													12"	RCP	-2.85						Manhole lid
304	D14H1BI090	I	12"	RCP	-3.50	15"	RCP	-3.90	4"	PVC					24"	RCP	-8.60						Additional 4' PVC pipe flowing into inlet. Manhole lid.
302	D14H1BI100	I													18"	PVC	-6.06						Manhole Lid
	D14H1BV105	V																					X
301	D14H1BI110	I	18"	PVC	-6.14										18"	PVC	-6.14						Manhole Lid
	D14H1BI140	I	18"	RCP	-4.60										channel								Channel with sacked lipping flows out.
	D14H1BI150	I	12"	RCP	-4.60										12"	RCP	-4.60						90% full
	D14H1BI151	I	12"	RCP	-2.50										12"	RCP	-3.00						
	D14H1BI155	I	8"	PVC	-5.65										12"	PVC	-5.65						
951	D14H1BI160	I													12"	RCP	-2.00						
953	D14H1BI170	I													12"	RCP	-1.85						
952	D14H1BI180	I	12"	RCP	-2.10	24"	RCP	-2.62							33"	RCP	-2.74						
	D14H1DI020	I																					Unable to get invert
	D14H1DI040	I	6"	PVC	-2.62	6"	PVC	-2.62							12"	PVC	-3.02						Manhole Lid
	D14H1DI050	I																					Unable to get invert
	D14H1DI060	I	12"	RCP	-3.50	12"	RCP	-3.25							12"	RCP	-3.50						Manhole Lid
	D14H1DI070	I													15"	PVC	-3.20						Manhole Lid
	D14H1DM110	M	21"	RCP	-5.11										21"	RCP	-4.50						
	D14H1DI120	I	21"	RCP	-5.11										21"	RCP	-5.11						
	D14H1DM120	M																					Drops into channel
	D14H1DI125	I	36"	RCP	-4.60										36"	RCP	-4.60						
	D14H1DI129	I	6"	PVC	-1.40										15"	CI	-1.65						Manhole Lid
	D14H1DI130	I	15"	CI	-1.70	18"	RCP	-2.45							18"	RCP	-2.45						
	D14H2AI001	I	12"	RCP	-2.40										12"	RCP	-2.85						
	D14H2AI003	I	12"	RCP	-2.70	18"	RCP	-2.60							18"	RCP	-2.85						
	D14H2AI005	I	18"	RCP	-3.00										18"	RCP	-3.00						
250	D14H2AI010	I	12"	RCP	-4.82										12"	RCP	-4.95						
	D14H2AM015	M	12"	RCP	-4.77										12"	RCP	-4.83						
	D14H2AV025	V																					X
248	D14H2AI030	I	12"	RCP	-4.16	12"	RCP	-3.95							12"	RCP	-4.16						
249	D14H2AI040	I	10"	PVC	-1.85										12"	RCP	-3.13						
280	D14H2AI050	I	12"	RCP	-5.55										12"	RCP	-5.70						

Town of Atherton  
Existing Storm Drain Structures  
SORTED

Town Survey No.	I.D. No.	Structure	Pipe In			Pipe Out			Rim Elevation	Record Data Only	Comments									
			Size	Material	Invert	Size	Material	Invert												
279	D14H2AI060	I	12"	RCP	-4.95										12"	RCP	-5.00			
282	D14H2AI070	I	12"	RCP	-2.90	12"	RCP	-2.90							15"	RCP	-2.90			
281	D14H2AI080	I													12"	RCP	-1.80			
	D14H2AI090	I													8"	CMP	-1.10			
	D14H2AI100	I	12"	RCP	-2.65										12"	RCP	-3.80			
	D14H2AV101	V													8"	CMP	-1.10			
	D14H2AI110	I															-8.50			
	D14H2AV112	V	36"	CMP	-8.50	36"	CMP	-8.50												
	D14H2AV114	V													36"	CMP	-8.50	36"	CMP	-8.50
247	D14H2AI120	I	8"	PVC	-1.00										12"	RCP	-1.67			
246	D14H2AI121	I	12"	RCP	-1.60										12	RCP	-1.60			
	D14H2AV125	V																		X
	D14H2AV145	V																		X
280	D14H2DI130	I	72"	CMP	-11.30										72"	CMP	-11.30			
	D14H2DI140	I	72"	CMP	-11.50										72"	CMP	-11.50			
	D12I1BM130	M																		X
	D12I3CV130	V																		X
	D12I3CV140	V																		X

**APPENDIX B**

**DRY WELLS REGULATION OF POTENTIAL POLLUTION SOURCES**

## **REGULATION OF POTENTIAL POLLUTION SOURCES**

### **SHALLOW DRAINAGE WELLS**

#### **INTRODUCTION**

The California Water Code, Section 13710, defines the term "well" or "water well" to mean any artificial excavation constructed by any method for the purpose of extracting water from or injecting water into the underground. The definition does not include (a) oil, gas, and geothermal wells, or (b) construction dewatering wells and hillside stabilization dewatering wells. Therefore, all shallow drainage wells (also known as dry wells, infiltration basins, and shallow injection wells) used for the purpose of disposing of stormwater or surface runoff are covered under this definition. The purpose of this Basin Plan section is to clarify the Regional Board's position in regard to the construction, usage, and regulatory permitting aspects of shallow drainage wells.

#### **BACKGROUND**

In 1951, the Regional Board adopted Resolution No. 81, "Statement of Policy on Sewer and Drainage Wells," which is incorporated by reference into this plan. This resolution states that the Regional Board disapproves of the construction and use of wells for disposal of effluent from septic tanks and surface runoff from streets and highways except where such wells discharge into a formation that at no time will contain groundwater fit for domestic, agricultural, or industrial use. At the same time, the Regional Board recognized that these wells already existed in the region and that immediate abandonment may be impractical. Therefore no new installations were to be permitted, more satisfactory drainage methods were to be substituted for existing installations at the earliest practicable date, and the Regional Board was to consider the matter of prescribing requirements for the discharge in granting any exceptions to the prohibition. After review of Regional Board files, it does not appear that any exceptions to the resolution were officially granted.

An "Explanation of Policy" was adopted with the resolution. The reasons for concern over the continuation of such practices can be summarized as follows:

- (A) Wells used to dispose of sewage and surface drainage bypass the normal processes of nature that occur at or near the surface of the soil. The use of such wells may allow for injection of waste into subsurface strata rapidly and unchanged in chemical quality.
- (B) It is not practical to control the quality of water entering these wells to the degree needed to protect beneficial uses. The only practical method of controlling groundwater pollution is prevention. Groundwater pollution is not usually noticed until the damage is done, and rapid abatement is impractical.
- (C) Relatively small quantities of pollutants may be introduced over a long period of time and eventually cause cumulative damage of large proportions.

Board staff in cooperation with U.S. EPA recently surveyed municipalities and a number of industries to determine the usage of shallow drainage wells in the region. Results indicate that shallow drainage wells have been haphazardly installed throughout the region, use of the wells is prevalent, and construction and usage has gone virtually unregulated. Additionally, shallow drainage wells are still being constructed in new residential and industrial developments.

U.S. EPA has investigated numerous cases nationwide in which the use of shallow drainage wells impacted drinking water supplies. Within the San Francisco Bay region, a number of groundwater investigations revealed stormwater drainage wells as possible sources of pollutants. While it was not possible to determine if the pollutants detected in groundwater originated from the identified wells, it was determined that current practices associated with these wells posed a serious threat to groundwater supplies.

Shallow drainage wells concentrate runoff and allow for its rapid infiltration to the subsurface. In turn, the buffering capacity of soils for removing pollutants and protecting groundwater supplies is reduced. The threat a shallow drainage well may pose to groundwater is directly related to the quality of the water entering the well, along with its location and design. The location of the well must be taken into consideration. Subsurface conditions, such as the permeability of underlying soils and the depth to groundwater, vary considerably throughout the region. In this regard, design is also important, as deeper wells may penetrate confining or semi-confining clay layers and serve as conduits for pollutants to migrate to lower aquifers. Managing surrounding land uses is one means of controlling the quality of water entering the well. For instance, wells should be labeled and not used in areas where there is a high probability of a highway accident or spill, and not located in certain industrial areas. With proper management, placement, and design, shallow drainage wells can have a positive environmental benefit, as there is a need to allow stormwater to recharge shallow groundwater and to protect surface water from excessive sedimentation and other water quality problems associated with high stormwater discharge flows.

The Federal Underground Injection Control Program was established in 1984 with the adoption of the Safe Drinking Water Act. In California, U.S. EPA is the lead agency in charge of administering the program. Under this program, wells used to dispose of surface water runoff are classified as Class V injection wells. The owner or operator of any existing Class V well is required to submit information on each well, including the nature and type of discharge and operating status. For the San Francisco Bay region, no voluntary reports of the existence of Class V wells were received by U.S. EPA as required under these regulations.

There are a number of applicable state regulations pertaining to the construction and use of shallow drainage wells. AB2182 (Ch. 1131, Sec. 4458) of the California Health and Safety Code, passed in 1961, prohibits the use of drainage wells for the disposal of sewer water unless authorized by the Regional Board. The California Water Code (Ch. 10, Secs. 13700 13806) defines the terms "well" and "water well" and states that any person who intends to dig, bore, or drill such a well must file a notice of intent with the California Department of Water Resources (DWR) or the designated local enforcement agency. A detailed report of completion must then be filed after construction. If the Regional Board finds that standards of water well construction, maintenance, abandonment, and destruction are needed in any area to protect beneficial uses of

groundwater, it shall determine the area to be involved and so report to each affected county and city in the area. Each such affected county shall, within 120 days of receipt of the report, adopt an ordinance establishing standards of water well construction, maintenance, abandonment, and destruction for the designated area. To date, standards and siting criteria for shallow drainage wells are nonexistent in this region and subsequently not included in the well-permitting process.

The Regional Board is now issuing NPDES permits for stormwater discharges to surface water for certain industrial and construction activities and to the larger municipalities in the region. The permits require the implementation of control measures to reduce pollutant loading, along with water quality monitoring to assure that the waters being discharged will not impact the beneficial uses of receiving waters. The discharge of industrial waste into the sanitary sewer system is now closely regulated under a pretreatment program. Likewise, the discharge of stormwater to the subsurface must also be regulated to assure the protection of groundwater supplies. Standards for shallow drainage well construction, maintenance, abandonment, destruction and siting criteria are needed throughout the region. Land-use decisions, such as stormwater structural controls and well-construction permitting, are most often made by local government agencies, including water districts and planning and building departments. Many of these agencies are not aware of the Regional Board's Resolution No. 81, or the rationale behind it.

In summary, the rationale for adopting Resolution No. 81 in 1951 is still very much applicable today. The only practical method of controlling groundwater pollution is prevention, since groundwater pollution is not usually noticed until the damage is done.

## **GOAL**

The goal of the Shallow Drainage Program is to eliminate the unregulated construction and use of shallow drainage wells in areas where municipal, domestic, agricultural, and industrial groundwater supplies are threatened.

This goal is to be attained by a coordinated effort on the part of U.S. EPA, the Regional Board, DWR, and local government agencies to implement a shallow drainage well control program.

## **PROGRAM**

The Regional Board prohibits the unauthorized construction and use of shallow drainage wells. The shallow drainage well control program shall consist of two main elements: 1) locating existing wells; and 2) regulating the construction and use of existing and new wells.

### **1. Locating existing wells**

U.S. EPA, the Regional Board, and local government agencies will need to work together to identify all existing shallow drainage wells.

### **2. Regulating existing wells and new wells**

Continued use of existing wells or construction of new wells may be authorized by a local enforcing agency through its well-permitting process. The Regional Board will work with DWR and each city, county, and local water supply and flood control agency on developing standards for adoption by ordinance for the construction, maintenance, abandonment, and destruction of shallow drainage wells. Additionally, it must be demonstrated that the use of the well will not result in a discharge that may pose a threat to municipal, domestic, agricultural, and industrial groundwater supplies. If this cannot be adequately demonstrated, the well must be permanently closed. Closure of each well must be done in compliance with U.S. EPA Class V injection well closure guidelines and applicable local agency guidelines or regulations.

## **APPENDIX C**

### **DRAINAGE COMPLAINTS**

Contents:

1. Drainage complaints reported in 2001
2. Drainage complaints reported as part of Drainage Study Update

Town of Atherton  
Drainage Complaints

REPORTED IN 2001 TOWN WIDE DRAINAGE STUDY (SHADED ISSUES ARE THOSE ADDRESSED BY IMPROVEMENT PROJECT CONSTRUCTED SINCE 2001)

No.	Imp	Street Number	Location/Street	Contact Information	Phone Numbers	e-mail Address	Description	Grid No.	Picture (Old/Resent)	Source	APN. #	Problem Addressed?	Proposed Solutions by Others	Proposed Solutions by Nolte
1	E1, E4	57	Mulberry	Linda Lynch	650-234-9878	alphalynch@aol.com	Standing water along the roadside in the north street frontage of her house and in the ditch behind her house.	13H4	NO/YES	Current; e-mail 8/6/00	070-032-330			Frontage of the driveway has no slope. Install on both sides of the street, slotted grates to discharge to existing ditch. Existing ditch is undercapacity for a 10-year event.
2	Y, Z1, Z2	102	Heather Dr and James Ave.	Richard/Rita Jenson	650-324-1349		Water accumulates in the street and on property.	12I1	YES(19)/YES	Current; 7/28/00	061-155-060			Property is lower than street. Water coming from Middlefield & Heather will accumulate in the property. Install a swale along the edge of pavement. Regrade intersections along James Ave to be a main flow path & pipe a system to the channel.
3	C	401	Fletcher Dr.	Frank Novak, M.D.	650-854-5741		Culvert clogs, threatening property. Perennial neglect of Alta Vista/Upper Fletcher storm drain system.	13H3	NO/YES	Current	073-202-430			Alta Vista/Upper Fletcher 18" or 24" SD system is installed, but cannot see where it daylight at 489 property. Property has a natural gully & there is a culvert/ditch between 489 & 471. System is roughly designed for less than a 5-year event. Property is lower than street; ponding can occur on the property. Install a new SD system.
4	C		Fletcher Dr.	Mrs. John Fisher			Water flows through culvert under driveway and through property.	12H4	NO/YES	Current	070-103-380			As explained in Prob# 3, I think this property is #471 which is a natural flow path. Upgrade system that goes thru the channel or Atherton or Ridgeview.
5	C	471	Fletcher Dr.	W. H. Johnston			Water from properties above are directed to culvert under driveway and through length of property. Increased development upstream of property resulted in higher flows.	13H3	NO/YES	Current	073-202-410			See Prob#4.
6	BB	148	Magnolia Drive	De Whit	(650) 321-8499		Water from properties above collects at property at Magnolia and Laburnum.	12I1	NO/YES	Current	061-181-020			Property is in the natural flow path and it is lower than street. Install a berm along the road to direct flow to Laburnum to Magnolia.
7	PRIVATE PROP.	74	Laburnum				Paving block used to build driveway block flow causing ponding into the street. Typical in Lindenwood.	12I1	NO/YES	Current	061-184-020			Existing road slope is roughly 1% with a slight crown. Anything that blocks the flow will create a pond because the road is very flat.
8	M1		Stockbridge/EI Camino				Plan for drainage on west side of EI Camino never built.	12H2	NO/NO	Current	None			On the south side of EI Camino there is only a natural earth swale that goes west. Is this the planned system for ECR? EI Camino is a barrier to areas south, which are lower than the road. Install a new SD system.
9	T1	126	Elena Ave.	Liz Cox	(650) 321-4446		1000's of gallons of water under her house coming from Elena, water all the way to Joyce at front of her house.	13H2	YES(7)/NO	97 Storm	070-212-100	Investigated only.		Property is located on the natural flow path. The existing drainage system is designed for roughly a 5-year event. When the system is clogged, the flow will naturally go to the property. Upgrade system or create a barrier along Faxon road to keep water in the road.
10	N	15	Adam	Patrick Shockey	(605) 369-7059		Gutter at 28 Admendral is not adequate. Water flows through neighborhood into his yard, floods basement.	12H4	NO/NO	97 Storm	059-312-120	Investigated only.		Natural contour, the water flows thru this property. Admendral has some block walls, but the majority of the water will flow thru the properties to Adam. Install a berm along the west side of Admendral or create a crown in the middle of Admendral.
11	U	80	Edwards Lane	Don Anderson	(650) 323-2186 VM:(650)843-6015		Next to channel, water from street is flooding his basement.	13H2	NO/NO	97 Storm	070-211-460	Investigated only.		Based on the contours, Edwards street slopes toward the property. If the channel spills, it will flow thru this property. Upgrade existing channel.
12	S	20	Linda Vista	Mr. Cotton	(650) 326-6600		Flooded under house.	13H2/4	NO/NO	97 Storm	070-151-020	Investigated & pumped out under house.		The SD system along Atherton is undersized. The slope along Linda Vista is very flat. If system is clogged, it will pond in the area and flood the property. Upgrade system and install a swale in front of property to contain flow in the road.
13	DONE	415	Walsh Road	Marion Euphrat	(650) 854-6821		Hillside is sliding down just before her home. Drain at Walsh is clogged. Creek at Reservoir Road is backing up due to lumber.	14H2	NO/YES	97 Storm	073-213-070	Cleaned out creek. DONE!		Maintenance crew cleaned the channel and home owner is happy.
14	MAINT.	68	Elena Ave.	Mrs. Graf	(650) 322-7640		SW corner of the bridge at Elena, two large oak branches went by.	13H2	NO/YES	97 Storm	070-212-050	Not an emergency. Nothing done.		Maintenance required to keep channel and culvert at its full capacity.
15	M1	7	Lloyd Drive	Judy Massy	(650) 323-7812		Clogged drain caused runoff from her house to her neighbors.	12I3	NO/NO	97 Storm	060-303-050	Cleaned drain, pumped, & sandbagged.	Roto-rooter drain.	Natural flow goes thru neighbor's property. EI Camino's culvert discharges to this property and will flow to the next property. Need to verify if there is an existing ditch going west to divert it from flowing thru these properties. Need swale & SD system.
16	W2	71	McBain	Eastman	(650) 321-6674		McBain storm drain blocked, caused flooding. Drywells saturated; supposed to be pumped by Menlo College.	13I1	YES(6)/NO	97 Storm	070-355-010		Call Menlo College to pump dry well.	There is no SD system along McBain. There is a dry well located at cul-de-sac. When well is saturated, the area floods. Install a SD system to discharge to the channel or connect to the nearest SD system. This system needs to be upgraded too.
17	KK	105	Linden Ave.	Dorothy Eggebreacht	(650) 322-9878		Flooding in backyard, driveway, & into street.	12I1	NO/NO	97 Storm; Current	061-171-010			Linden Street is in the flow path. The property's backyard is probably set low causing it to flood. Need to install SD system to discharge into the street. Also, street floods. Need to swale drainage to Laburnum towards the bay.

Town of Atherton  
Drainage Complaints

REPORTED IN 2001 TOWN WIDE DRAINAGE STUDY (SHADED ISSUES ARE THOSE ADDRESSED BY IMPROVEMENT PROJECT CONSTRUCTED SINCE 2001)

No.	Imp	Street Number	Location/Street	Contact Information	Phone Numbers	e-mail Address	Description	Grid No.	Picture (Old/Resent)	Source	APN. #	Problem Addressed?	Proposed Solutions by Others	Proposed Solutions by Nolte
18	G	6	Betty lane	Orland Eliason	(650) 365-2184 (650) 369-0389		Sewer overflow backing up into house. Runoff of Polhemus flooding yard. Sewer has illegal hookup (not prop. owner).	13H2	NO/NO	97 Storm	070-022-590			Install new SD system.
19	D	302	Fletcher Dr.	Jerry Finch	(510) 297-5793 WK (650) 854-1867		House at 312 is draining into his yard all the way up to the front door. Wants on record that City assured him this would NEVER happen.	13H4	NO/YES	97 Storm	070-011-220			Existing SD system is undersized which floods the property. Upgrade SD system.
20	W2	60	McBain	Mike Gilmore	(650) 716-1536		Storm drain end of McBain, near Emily, overflowing. Linda Klamp of Menlo College called to pump dry well to field. Not possible.	13I1	YES(6)/NO	97 Storm	070-354-020	Advised to call Menlo College to pump dry well. College said no?		There is no SD system along McBain. There is a dry well located at cul-de-sac. When well is saturated, the area floods. Install a SD system to discharge to the channel or connect to the nearest SD system. This system needs to be upgraded too.
21	E1, E3	243	Polhemus	Ann Gunderson	(650) 327-9313		Neighbors are pumping water into the street which is flooding their house and drainage system. Lake in front of house @ east end of cul-de-sac.	13H2	YES(21)/YES	Current VM & 97 Storm	070-040-070			Polhemus Ave is a barrier and a major flow path. Intersection of Polhemus Ct and Polhemus Ave should be regraded to let flow through the intersection. Need a system along Polhemus Ct and connection to existing system.
22	M2	7	Fair Oaks Lane	Donna Hopkins	(650) 322-3824	donna.d.hopkins@att.net	Old drywell at the end of cul-de-sac overflowing causing flooding in her front yard up to the foundation of the house.	12I3	NO/NO	97 Storm/ & 10/2/00	060-313-140	Send someone ASAP when can...did Town do this???		Cul-de-sac is the low point of the street. Need to connect to proposed El Camino SD system.
23	R		Linda Vista and Camino al Lago	Mike Ladra	(650) 322-8952		Corner is eroded due to construction; 2nd call.	13H4	NO/NO	97 Storm	None			Camino Al Lago is a flow path. Intersection needs to be regraded to let flow through.
24	AA2	61	Irving	Nakai			Flooding on street near drainage ditch.	12I1	NO/YES	97 Storm	061-121-010			Irving street is really flat. Need to extend existing SD system along Irving and also upgrade SD system.
25	M1	99	Gresham Lane	George Papadoyannis	(650) 568-3470		Water from El Camino Real is flooding onto property, Storm Drains on ECR & Selby are backed up.	12H2	NO/NO	97 Storm	059-303-090			El Camino Real's SD system is undersized or does not exist. ECR is much higher than the properties upstream and properties along the edge of ECR will flood. Need to install a SD system.
26	S, T2	255	Atherton	Pamela Reeder	(650) 321-2557		Linda Vista/ Atherton Ave. flooding into driveway.	13H2	NO/NO	97 Storm	070-132-140		Looks like being caused by paving of driveway.	See Prob#12.
27	M2	15	Fair Oaks Lane	Pricilla Robinson	(650) 854-0796		Dry Well is clogged, street has standing water.	12I3	NO/NO	97 Storm	060-313-150	Dry well, not storm drain.		See Prob#22.
28	PRIVATE PROP.	45	Victoria	Stewart Turnell	(650) 325-1831		Reported flooding.	12I3	NO/NO	97 Storm	070-370-040			Private property- property is the low point
29	AA2	81	Irving	Wall	(650) 324-0321		Storm drain blocked.	12I1	NO/YES	97 Storm	061-041-010	Cleared.		Existing SD system is undersized which floods the intersection. Upgrade SD system. Street is very flat.
30	Q	306	Walsh Road	Dick Winieke	(650) 854-2281		Culvert blocked with debris at Walsh Road and Alameda.	13H4	YES(8)/NO	97 Storm	073-220-270			Culvert at school is undersized. Install new culvert & upgrade channel.
31	FF1		Middlefield/ Ravenswood	Sue Kayton		kayton@alum.mit.edu	Intersection floods regularly.	12I4	NO/NO	Current e-mail 7/26/00	None			Based on the contours, this intersection is the low spot of the road. Upgrade SD system.  <b>2013 Update: Flooding still an issue from back flow in SD system.</b>
32	DONE	499	Fletcher Dr.				Runoff is concentrated on the site and then released onto the street at the head of driveway.	13H3	NO/YES	Current	073-202-250			Check existing SD system to see if it is designed for 10-year event.
33	DONE	491	Fletcher Dr.				Runoff is collected in percolation ponds which are inadequate and overflowed.	13H3	NO/YES	Current	073-202-260			Check existing SD system to see if it is designed for 10-year event.
34	DONE	489	Fletcher Dr.				Planned retention pond not completed, hard-line piped runoff flows onto neighbors property.	13H3	NO/YES	Current	073-202-400			Check existing SD system to see if it is designed for 10-year event.
35	T2	222	Atherton Ave.	Cindra/John Nicholson	(650) 322-1020		Foot of driveway flooded.	13H2	NO/NO	Current	070-040-370			Property is near the end of the cul-de-sac and the street is flat. Typically the existing drywell is saturated. Install a SD system to connect to nearest existing SD system. Existing SD system is probably undersized & needs upgrading.
36	E3	240	Polhemus Ave.	Christina Isenberg	(650) 368-2605	isenberg@wai.com	Drainage ditch that runs across Polhemus doesn't collect enough water, causes yard to flood.	13H2	YES(11)/NO	Current	070-022-490			Driveway located at the cul-de-sac which is the low point of the street. Existing drywell, located before the cul-de-sac, when saturated will flow towards the cul-de-sac. Install SD system and connect to existing SD system. Check existing SD system for capacity.
37	U	55	Elena Ave.	Jeffrey A. Morris	(650) 854-1123	jeff@jamorris.com	Channel overflows to property.	13H2	NO/YES	97 Storm	070-211-470			Channel is undersized. Upgrade channel.
38	S	47	Linda Vista Ave.	Jean Davidson	(650) 330-0552	JeanDavi@aol.com	Ditch along west side of Linda Vista overflows, and has stagnant water when not raining.	13H4	NO/NO	Current; e-mail 7/26/00	070-132-090			The SD system along Atherton is undersized. The slope along Linda Vista is very flat. If system is clogged, it will pond in the area and flood the property. Upgrade system and install a swale in front of property to contain flow in the road.

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39	FF1		Middlefield/ Oak Grove	Sue Kayton		kayton@alum.mit.edu	Intersection floods regularly.	12I4	NO/NO	Current e-mail 7/26/00	None			Based on the contours, this intersection is the high point of the road and the barrier for the existing SD system that flows towards the east. Upgrade SD system.  <b>2013 Update: Flooding still an issue from back flow in SD system.</b>
40	E2	53, 71 & 89	Mandarin Way	Neil Coberty, Tom Warda & Dr. Dellatorta	(650) 854-1168, 854-7447, 854-6933		All residents have water problems. Water flows through back of property from uphill. Possible reservoir leaking?	13H4	NO/NO	Current; VM	070-031-270			Existing ditch is probably undersized. Upgrade SD system.
41	N	76	Southgate St.	Dick Sperisen	(650) 366-9767		He has drainage issues to discuss per 7/27/00 phone call. Almendral needs a swale and the north side of the curve at Southgate and Park has a huge pothole that needs to be filled.	12H4	NO/YES	Current; VM	070-103-060			Almendral is a barrier and flow path. It is very flat. The intersection of Southgate and Almendral should be regraded to allow flow through this intersection. Also, repair AC pothole @ Southgate & Park.
42	I		Nimitz and Himmel	Richard Cramer	(650) 218-3120		Manhole at Intersection floods regularly due to inadequate size pipe.	12H4	NO/NO	Current; call 7/25/00	None			Intersection is located outside of Town of Atherton limit. The existing SD system along Selby is undersized.
43	L	356	Austin Ave.				Flooding at driveway.	12H4	YES(1)/YES	92 Storm	070-080-190		Regrade driveway.	Regrade driveway, but the whole street is very flat. Probably need slotted drains and SD system.
44	L		Tuscaloosa and Austin				Flooding at SW corner.	12H4	YES(2)/YES	92 Storm	None		Replace culverts.	Regrade the intersection to flow along Tuscaloosa as the major flow path. Road slope is very flat. Install swales & grade to El Camino Real.
45	N	2	Southgate St.	Anthony Applewhite	650-365-5213		Flooding at intersection.	12H4	YES(3)/YES	92 Storm/ Current 10/24/00	070-103-030		Swale from Southgate to Middlegate.	Regrade the intersection to flow along Almendral as the major flow path. Road slope is very flat. Need a SD system to connect to existing ECR system.
46	N		Almendral and Middlegate				Flooding at intersection.	12H4	YES(3)/YES	92 Storm	None		Swale from Southgate to Middlegate.	Regrade the intersection to flow along Almendral as the major flow path. Road slope is very flat. Need a SD system to connect to existing ECR system.
47	P		Virginia and Fair Oaks				Flooding at SE Corner.	12I1	YES(4)/NO	92 Storm	None		Swale SW quadrant.	Regrade the intersection to flow along Fair Oaks as the major flow path. Road slope is very flat.
48	N	75	Almendral				Flooding on both sides of driveway.	12H4	YES(5)/YES	92 Storm	070-090-040		Regrade driveway.	Regrade driveway but the whole street is very flat. Probably need gutters, slotted drains and SD system.
49	W1		MacBain and Emilie				Dry Well clogs.	13I1	YES(6)/NO	92 Storm	None		Resurface cul-de-sac.	There is no SD system along McBain. There is a dry well located at cul-de-sac. When well is saturated, the area floods. Install a SD system to discharge to the channel or connect to the nearest SD system. This system needs to be upgraded too.
50	T1		Faxon and Elena				North side of intersection floods.	13H2	YES(7)/NO	92 Storm	None		Swales @ driveway & street.	Upgrade existing SD system to handle more flow and add more inlets. Regrade intersection to flow along Faxon as the major flow path. Need berm to contain water in the road & upgrade SD system.
51	DONE		Walsh Road and Alameda de las Pulgas	No Problem			No flooding at school observed.	13H4	NO/NO	92 Storm	None		NOT A PROBLEM.	NOT A PROBLEM.
52	B 1		Belbrook and Walsh				Flooding at NW corner.	13H4	YES(9)/NO	92 Storm	None		Swale across Belbrook.	Regrade the intersection to flow along Marsh as the major flow path. Find the low point and install or upgrade SD system to discharge into channel.
53	K		Serrano and Selby				SW corner floods.	12H4	YES(10)/NO	92 Storm	None		Swale across Selby.	Regrade the intersection to flow along Selby as the major flow path. Find the high point and install SD system to connect to existing SD system along Selby
54	J1, J2		Polhemus and Selby				CMP's silted.	13H2	YES(11,21)/YES	92 Storm	None		Replace CMP culverts.	Upgrade existing SD system to handle more flow and add more inlets. Regrade intersection to flow along Selby as the major flow path. Need berm to contain water in the road.
55	O		Stockbridge and Carolina				North side of intersection floods.	12H4	YES(12)/YES	92 Storm	None		Swales @ Carolina & Shearer.	Regrade the intersection to flow along Stockbridge as the major flow path. Road slope is very flat. Need to install swales and berms.
56	DONE		Clay and Atherton	No Problem			No flooding observed.	13H2	YES(13)/	92 Storm	None		NOT A PROBLEM.	NOT A PROBLEM.
57	M3		Isabella and El Camino				West side intersection floods.	12I3	YES(19)/NO	92 Storm	None		Repave Isabella/driveway.	Regrade the intersection to flow along ECR as the major flow path. Install SD system to discharge into channel or connect to existing SD system of ECR.
58	PRIVATE PROP.	345	Selby Lane				Driveway floods.	13H2	YES(15)/NO	92 Storm	059-291-230		Repave 345 & adjust driveway.	Existing driveway slopes toward property and slope is very flat. Water will flow thru driveway when Selby SD system fails. Regrade driveway to slope towards Selby.
59	DONE	86	Fredrick	No Problem			No flooding observed.	12I2	YES(16)/	92 Storm	061-093-060		NOT A PROBLEM.	NOT A PROBLEM.
60	CC1		Fredrick and Green Oaks				1st driveway floods #2 Fredrick.	12I2	YES(17)/YES	92 Storm	None found for Fredrick St.		Swale from #2 Fredrick.	Regrade the intersection to flow along Green Oaks as the major flow path. Upgrade existing SD system and install swale to contain the water in the road.
61	AA1	41	Irving				Intersection floods.	12I1	YES(18)/YES	92 Storm	061-121-040		Swale across Irving Ct.	Irving street is really flat. Need to extend existing SD system along Irving and also upgrade SD system. Regrade the intersection to flow along Irving as the major flow path.
62	DONE		James and Heather	No Problem			No flooding observed.	12I1	NO	92 Storm	None		NOT A PROBLEM.	NOT A PROBLEM.

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63	W1		Park and Emilie				Flooding next to Circus.	13I1	YES(20)/NO	92 Storm	None		Swales @ Emilie & Park.	Regrade the intersection to flow along Emilie as the major flow path.
64	DONE	247	Polhemus	No Problem			No flooding observed.	13H2	YES(21)/YES	92 Storm	070-040-050		NOT A PROBLEM.	NOT A PROBLEM.
65	M4		Fair Oaks Lane and El Camino				Flooding on south side.	12I3	YES(22)/NO	92 Storm	None		Swale along Fair Oaks.	Regrade the intersection to flow along ECR as the major flow path. Need a SD system along ECR or upgrade system.
66	DONE	15	Valley Road	No Problem			No flooding observed.	14H1	YES(23)	92 Storm	073-261-200		NOT A PROBLEM.	NOT A PROBLEM.
67	V		Por Los Arboles/ Valparaiso				Street floods.	13I3	YES(24)/NO	92 Storm	None		Repave Por Los Arboles.	Regrade the intersection to flow along Valparaiso into Por Los Arboles as the major flow path. Upgrade existing SD system.
68	M4		O'dell / Atherton				Intersection floods.	12I3	YES(24)/NO	92 Storm	None		Repave O'Dell.	Regrade the intersection to flow along Atherton as the major flow path. Need a SD system along Atherton and connect to existing ECR SD system.
69	U	72	Barry Lane				Atherton channel overtops.	13H2	YES(26)/YES	92 Storm	070-201-050		Raise wall by 1-2 feet.	Redesign channel section with a steeper side slope for more capacity. This will widen channel bottom, similar to downstream end. Raise side walls if needed.
70	F 1, F2	68	Euclid				Driveway floods.	13H2	YES(27)/YES	92 Storm	070-021-040		Swale across driveway.	Regrade the driveway to flow along Euclid as the flow path. Need a SD system along Euclid to connect to existing SD along Stockbridge. Euclid is very flat.
71	O		Shearer/ Stockbridge				NW Intersection floods.	12H4	YES(28)/YES	92 Storm	None		Swale across Shearer.	Regrade the intersection to flow along Stockbridge as the major flow path. Road slope is very flat. Need to install SD system to connect to existing SD system ERC. Probably slotted drains and berms.
72	X		Maple / Station Lane				Flooding on south side.	12I3	YES(29)/NO	92 Storm	None		Swale @ Maple.	Regrade the intersection to flow along Station Lane as the major flow path. Upgrade existing SD system along Station Lane and add inlets.
73	Y		Watkins / Middlefield				Leaves clog storm drain system.	12I1	YES(30)/YES	92 Storm	None		Trim trees along Watkins.	Regrade the intersection to flow along Middlefield as the major flow path. Upgrade existing SD system along Middlefield and add inlets.
74	J1, J2		Selby: Atherton to Stockbridge				Flooding along Selby.	13H2	NO/YES	92 Storm	None		Install buried storm drain.	System installed but designed for less than 5-year event. Upgrade SD system.
75	Y		Middlefield: Glenwood to Marsh				Flooding along street.	12I1,3 &4	NO/NO	92 Storm	None		Install 24" buried storm drain.	Install SD system to drain towards channel. Regrade the intersection to flow along Middlefield as the major flow path.
76	Q		Alameda de Las Pulgas				Elementary school: buried conduit undersized.	13H4	YES(8)/YES	92 Storm	None		Replace with larger size pipe.	Upgrade existing SD system and channel.
77	O	136	Austin Ave.	Mrs.Klaus Dahl			No drainage system exists on Austin Ave., properties flood.	12H4	NO/YES	Current; fax 8/6/00	059-293030			Regrade the intersection to flow along Austin as the flow path. install SD system???
78	M1	86	Rittenhouse Avenue	Bill Awbrey	(650) 369-4326		River runs through backyard during heavy rain, water comes from west side of El Camino, under street.	12I3	NO/NO	Current; VM; 8/24/00	060-303-030			Existing SD culvert from ECR discharges near area. If there is no ditch to direct it westward, then water will flow along the neutral path that may go thru the property. Install SD system.
79	M1		Lloyd/Lynden Park				Sandbags under El Camino, west to east.	12I1/3	NO/NO	Current	None			Install SD system. Regrade the intersection to flow along ECR as the major flow path westward.
80	NO PROBLEM	230	Oak Grove	Eugene/Gloria Berry	(650)323-5737		??? From GBO notes	12I4	NO/NO	Current	061-290-060			Assume problem is flooding of the cul-de-sac and then the driveway, or water flows to property. Install SD system and connect to ex. system along Middlefield.
81	PRIVATE PROP.	48	Watkins	Margot Lockwood	W:(650)-851-2666; VM: (650)637-7369	lockwood@sirius.com	Wants sewer removed from under driveway.	12I3	NO/NO	Current; e-mail 9/5/00	060-333-210			Regrade driveway with a swale to maintain the flow path. Upgrade existing SD system to handle more capacity. PRIVATE PROPERTY.
82	A	105	Reservoir Road	Dianne & Gary Snable	(650)854-7002	dsnable@pacbell.net	Water from hillside drains into pipe on property; then directly onto road. Need storm sewer to Sargent Ln.	14H1	NO/YES	Current; e-mail 9/20/00	073-141-320			Regrade swale to maintain the flow path and remove low spot.
83	W1, W2	69	Alejandra Ave.	Dianne & Gary Snable	(650)854-7002	dsnable@pacbell.net	Lakes form in front of house and driveway.	12I3;13I1	NO/NO	Current; e-mail 10/5/00	070-354-010			Regrade the driveway to flow along Alejandra as the major flow path. Need a SD system along Alejandra and connect to existing Brittany SD system.
84	J1, J2	420	Selby Lane	Stephen/Susan Gaddis	650-321-7171; wk 510-784-8800		Water is ponding at the base of property's wall/fence.	13H2	NO/YES		070-040-610			Upgrade existing SD system in Selby/Stockbridge & regrade intersection.
85	CC2		James & Irving				Corner floods every year, particularly bad when the Marsh Rd. "drainage" canal plugs up & doesn't drain.	12I1	NO	Current-10/6/00				Upgrade existing SD system in Greenoaks.
86	DD		James & Greenoaks				Intersections flood at both ends of Greenoaks.	12I1	NO	Current-10/6/00				Regrade intersection of Greenoaks and James.
87	EE	98	Catalpa	Jim Collins			Southeast corner of Acorn & Catalpa has drainage problems.	12I2	NO	Current-10/6/00	061-212-080			Regrade intersection of Catalpa and Acorn.
88	KK		Lindenwood Area				Drainage problems in this area.	12I1;12I2	NO	Current-10/6/00				Can't determine problem from fax from Town.
89	M1		Almendral & El Camino				Flooding at west side.	12H4	NO/NO	Current-10/24/00	None			Install SD system. Regrade the intersection to flow along ECR as the major flow path westward.
90	GG		Fair Oaks/Middlefield	Temps/GBO			Intersection floods		NO/NO	Current-11/09/00	None			

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91	KK		Linden/Laburnum	Temps			Intersection floods		NO/NO	Current-11/09/00	None			
92	F1	36	Euclid	Temps/Giancarlo Trust Pt.			Flooding		NO/NO	Current-11/09/00	070-021-020			
93	C	440	Fletcher Dr.	Temps/Charles Dyer			Drainage pipe clogged from Ridgeview (check condition of pipe).		NO/NO	Current-11/09/00	073-182-060			
94	M4	2	Atherton Ave.	Temps/Mary Durkin			Driveway/front yard.		NO/NO	Current-11/09/00	070-120-100			
95	CC2	372	Green Oaks	Temps/Ralph/Susan Coal	650-322-2655		Storm drain in front of house backs up during heavy rains.		NO/NO	Current-11/09/00	061-051-020			Upgrade existing SD system in Greenoaks.
96		386	Green Oaks	Temps/Joel/Joy Kellman					NO/NO	Current-11/09/00	061-014-060			
97		94	Wisteria	Temps/Israel Gilboa					NO/NO	Current-11/09/00	061-103-060			

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REPORTED DURING TOWN WIDE DRAINAGE STUDY UPDATE (2014)

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98	C1		Sutherland/Ridgeview Dr.				Intersection floods		NO/NO	2014 Drainage Study Update	None			Flows coming from Mesa Court are not captured before flowing into Ridgeview Drive. Recommend installing inlets at the corners of the intersection to reduce the flow into the sag section of Ridgeview Drive near the detention structure.
99	M1	10	Stockbridge Ave				Floods basement of property		NO/NO	2014 Drainage Study Update	059-303-130			Install a storm drainage system along El Camino Real from Maple Avenue to Selby Lane. This includes sub-systems collecting runoff from the low point of the side streets.
100	KK1		Polhemus/Fleur Pl.				Standing Water at intersection		NO/NO	2014 Drainage Study Update	None			Regrade existing swale/ditch to remove low points and install underdrain due to flat slope.
101	M6		El Camino				Back flow in pipe discharges to back of property		NO/NO	2014 Drainage Study Update				Create a release point by installing a storm drainage system starting from an existing inlet and connecting to a new storm drainage system along El Camino Real and Lloyd Drive that bubbles out into the curb and gutter.
102	DD1		Euclid/Parker Ave.				Ditch line between Euclid and Parker is eroding. This causes reduction in capacity and subsequent overflow into the backyards of adjacent properties		NO/NO	2014 Drainage Study Update				Upgrade existing box culverts and storm drainage system to increase capacity.
103	LL		Camino Al Lago/Park Ln.				Intersection floods		NO/NO	2014 Drainage Study Update	None	Resolved. Bubblers installed.		Done.
104	EE1	70	Alejandra Ave.	Stephen L. Englert	415-398-6393		Water ponds in portion of area where gravel meets the paved road.			2014 Drainage Study Update				Install a concrete swale at the intersections along Alejandra Avenue and connect to proposed storm drain system.
105	LL2	61	Monte Vista Ave.	Maddy Stein	650-328-1686	<a href="mailto:Maddy@Steinfamily.com">Maddy@Steinfamily.com</a>	1) Open Drainage ditch is a breeding ground for mosquitoes 2) Water sheet flows from upstream homeowner's property to her driveway and garden			2014 Drainage Study Update				Install a concrete swale at the northerly side of Monte Vista Avenue to establish the flow path or a gravel swale with underdrain and storm drain pipe to discharge into Atherton channel.
106	E2		Mandarin Way	Elizabeth Dascgbach	Office:650-323-7751 Cell:650-207-0781	<a href="mailto:lizdaschbach@gmail.com">lizdaschbach@gmail.com</a>	Stevick property diverting runoff onto Mandarin Way			2014 Drainage Study Update				Create a release point by installing a storm drainage system along Mandarin Way and connecting to an existing storm drainage system along Alameda De Las Pulgas.
107	GG1	28	James Ave	Sandy/Tom Anderson	None		Intersection of James/Hawthorne floods very quickly. Flood spreads to middle of intersection.			2014 Drainage Study Update				Create a release point by installing a storm drainage system from the low point of the intersection connecting to the proposed system along Heather Drive and into the existing storm drainage discharge pipe into Atherton channel.
108	LL1	96	Clay Drive	Rick Degoalia, Vice Mayor	650-793-2800	<a href="mailto:rdegolia@ci.atherton.ca.us">rdegolia@ci.atherton.ca.us</a>	Christmas Eve 2012 rain event, runoff flowed from Atherton Ave towards the back of the cul-de-sac of Clay Drive standing water 1 foot deep.			2014 Drainage Study Update				Create a release point by installing a storm drainage system between low point of the intersection and connect to existing system along Atherton Avenue. Install a barrier like a hump before entering Clay Drive, which would prevent water from entering from the street.
109	HH3	99	Reservoir Road	Jeanette/Ike Goodman	650-854-3500		Standing Water/leaves/debris along swale in front of property			2014 Drainage Study Update				Install storm drain system with inlets upstream and downstream of property (bubbler system). Or extend rock trench drain swale further upstream.
110	HH1		ECR/Watkins	Anne/Bill McNertney		<a href="mailto:annescs@hotmail.com">annescs@hotmail.com</a>	Ponding in driveway. Drain at corner of El Camino/Watkins clogged with leaves/debris.			2014 Drainage Study Update				Increase capacity of the box culvert only for higher than 10 year event condition. Require inspection and maintenance of eroding sections of channel (assumed 25 percent of the total length of this section of the channel). Replace existing inlet into open curb inlet at the intersection of El Camino and Watkins to prevent blockage

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111	E2		Mandarin Way	Janet Coberly		<a href="mailto:jcoberly@pacbell.net">jcoberly@pacbell.net</a>	North side of mandarin way has had rushing water down the gutter; not in last few months Cannot attend meeting			2027 Drainage Study Update				Create a release point by installing a storm drainage system along Mandarin Way and connecting to an existing storm drainage system along Alameda De Las Pulgas.
112	O	136	Austin Ave.	Elizabeth/Klaus Daul	cell:650-400-1734 tel:650-363-8251	<a href="mailto:kdkayak@gmail.com">kdkayak@gmail.com</a>	Area between street and driveway leading up to gate remains flooded after significant rain for more than 48 hours.			2028 Drainage Study Update				Install a concrete swale on all the intersections along Stockbridge Avenue from Austin Avenue to Nora Way to create a flow path. Regrade the crown of the road to prevent the water from flowing across the road. This creates several flow paths with smaller flow. Connect the swales to the new storm drainage system along El Camino Real for release point.
113	M2	2	Fair Oaks Ln	Don Young	415-606-3401	<a href="mailto:don_young@pipeline.com">don_young@pipeline.com</a>	Persistent ponding of water at SE corner of 2 Fair Oaks Ln. Runoff from El-Camino rounds the corner and floods his property along Fair Oaks Ln.			2029 Drainage Study Update				Create a release point by installing a storm drainage system starting from existing dry wells and connecting to a new storm drainage system along El Camino Real.
114	Q		Alameda de Las Pulgas				Elementary school experienced flooding of buildings in December 2012 storm.	13H4		2030 Drainage Study Update			Replace with larger size pipe.	Upgrade existing SD system and channel to increase capacity. Alternatives include: (1) Install a three foot wall along south side of property to divert flows to parking lot and Camino Al Lago and install bypass inlet and piping to capture flows along this diverted flow path; (2) Install regional detention for 10-year storm event protection.

## **APPENDIX D**

### **MRP COMPLIANCE**

Contents:

1. Stormwater Checklist for Small Projects
2. C.3 and C.6 Development Review Checklist
3. HM Control Area Map

# Stormwater Checklist for Small Projects

Municipal Regional Stormwater Permit (MRP)  
Order No. R2-2009-0074 ; Order No. R2-2011-0083  
NPDES No. CAS612008

TOWN OF ATHERTON  
91 Ashfield Road Atherton, CA 94027  
Phone 650-752-0541  
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Web <http://www.ci.atherton.ca.us>

Complete this form for individual single family home projects that create and/or replace 2,500 square feet or more of impervious surface and small projects that create and/or replace greater than 2,500 square feet and less than 10,000 square feet of impervious area<sup>1</sup>.

## A. Project Information

- A.1 Project Name: \_\_\_\_\_
- A.2 Project Address: \_\_\_\_\_
- A.3 Project APN: \_\_\_\_\_

## B. Select Appropriate Site Design Measures

- B.1 Does the project create and/or replace 2,500 square feet or more of impervious surface<sup>1</sup>?  Yes  No
- If yes, and the project will receive final discretionary approval on or after December 1, 2012, the project must include one of Site Design Measures a through f.<sup>2</sup> Fact sheets regarding site design measures a through f may be downloaded at [http://www.flowstobay.org/bs\\_new\\_development.php#flyers](http://www.flowstobay.org/bs_new_development.php#flyers).
  - If no, or the project will receive final discretionary approval before December 1, 2012, the project is encouraged to implement site design measures<sup>3</sup>, which may be required at municipality discretion. Consult with municipal staff about requirements for your project.

B.2 Is the site design measure included in the project plans?#

Yes	No	Plan Sheet No.
<input type="checkbox"/>	<input type="checkbox"/>	a. Direct roof runoff into cisterns or rain barrels and use rainwater for irrigation or other non-potable use.
<input type="checkbox"/>	<input type="checkbox"/>	b. Direct roof runoff onto vegetated areas.
<input type="checkbox"/>	<input type="checkbox"/>	c. Direct runoff from sidewalks, walkways, and/or patios onto vegetated areas.
<input type="checkbox"/>	<input type="checkbox"/>	d. Direct runoff from driveways and/or uncovered parking lots onto vegetated areas.
<input type="checkbox"/>	<input type="checkbox"/>	e. Construct sidewalks, walkways, and/or patios with permeable surfaces.
<input type="checkbox"/>	<input type="checkbox"/>	f. Construct bike lanes, driveways, and/or uncovered parking lots with permeable surfaces.

<sup>1</sup> Complete the C.3/C.6 Development Review Checklist if the project is not an individual single family home, and it creates and/or replaces 10,000 square feet or more of impervious surface; or if it is a restaurant, retail gasoline outlet, auto service facility, or parking lot project that creates and/or replaces 5,000 square feet or more of impervious surface.

<sup>2</sup> See MRP Provision C.3.i.

<sup>3</sup> See MRP Provision C.3.a.i.(6).

**C. Implement construction Best Management Practices (BMPs)** (Required for all projects.)

Yes  No

C.1 Is the site a "High Priority Site"? (Municipal staff will make this determination; if the answer is yes, the project will be referred to construction site inspection staff for monthly stormwater inspections during the wet season, October 1 through April 30.)

- "High Priority Sites" are sites that require a grading permit, are adjacent to a creek, or are otherwise high priority for stormwater protection during construction per MRP Provision C.6.e.ii(2).

C.2 All projects require appropriate stormwater BMPs during construction, indicate which BMPs are included in the project, below.

Yes	No	Best Management Practice (BMP)
<input type="checkbox"/>	<input type="checkbox"/>	Attach the San Mateo Countywide Water Pollution Prevention Program's construction BMP plan sheet to project plans and require contractor to implement the applicable BMPs on the plan sheet.
<input type="checkbox"/>	<input type="checkbox"/>	Temporary erosion controls to stabilize all denuded areas until permanent erosion controls are established.
<input type="checkbox"/>	<input type="checkbox"/>	Delineate with field markers clearing limits, easements, setbacks, sensitive or critical areas, buffer zones, trees, and drainage courses.
<input type="checkbox"/>	<input type="checkbox"/>	Provide notes, specifications, or attachments describing the following: <ul style="list-style-type: none"> <li>▪ Construction, operation and maintenance of erosion and sediment controls, include inspection frequency;</li> <li>▪ Methods and schedule for grading, excavation, filling, clearing of vegetation, and storage and disposal of excavated or cleared material;</li> <li>▪ Specifications for vegetative cover &amp; mulch, include methods and schedules for planting and fertilization;</li> <li>▪ Provisions for temporary and/or permanent irrigation.</li> </ul>
<input type="checkbox"/>	<input type="checkbox"/>	Perform clearing and earth moving activities only during dry weather.
<input type="checkbox"/>	<input type="checkbox"/>	Use sediment controls or filtration to remove sediment when dewatering and obtain all necessary permits.
<input type="checkbox"/>	<input type="checkbox"/>	Protect all storm drain inlets in vicinity of site using sediment controls such as berms, fiber rolls, or filters.
<input type="checkbox"/>	<input type="checkbox"/>	Trap sediment on-site, using BMPs such as sediment basins or traps, earthen dikes or berms, silt fences, check dams, soil blankets or mats, covers for soil stock piles, etc.
<input type="checkbox"/>	<input type="checkbox"/>	Divert on-site runoff around exposed areas; divert off-site runoff around the site (e.g., swales and dikes).
<input type="checkbox"/>	<input type="checkbox"/>	Protect adjacent properties and undisturbed areas from construction impacts using vegetative buffer strips, sediment barriers or filters, dikes, mulching, or other measures as appropriate.
<input type="checkbox"/>	<input type="checkbox"/>	Limit construction access routes and stabilize designated access points.
<input type="checkbox"/>	<input type="checkbox"/>	No cleaning, fueling, or maintaining vehicles on-site, except in a designated area where washwater is contained and treated.
<input type="checkbox"/>	<input type="checkbox"/>	Store, handle, and dispose of construction materials/wastes properly to prevent contact with stormwater.
<input type="checkbox"/>	<input type="checkbox"/>	Contractor shall train and provide instruction to all employees/subcontractors re: construction BMPs.
<input type="checkbox"/>	<input type="checkbox"/>	Control and prevent the discharge of all potential pollutants, including pavement cutting wastes, paints, concrete, petroleum products, chemicals, washwater or sediments, rinse water from architectural copper, and non-stormwater discharges to storm drains and watercourses.

Name of applicant completing the form: \_\_\_\_\_

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

**D. Comments (for municipal staff use only):**

# # # # # # # # # # # # # # # #  
 # # # # # # # # # # # # # # # #  
 # # # # # # # # # # # # # # # #  
 #  
 #

**C.3 and C.6 Development Review Checklist**  
**Municipal Regional Stormwater Permit (MRP)**  
**Stormwater Controls for Development Projects**

Project Information

**I.A Enter Project Data** (For "C.3 Regulated Projects," data will be reported in the municipality's stormwater Annual Report.)

Project Name: \_\_\_\_\_ Case Number: \_\_\_\_\_

Project Address & Cross St.: \_\_\_\_\_

Project APN: \_\_\_\_\_ Project Watershed: \_\_\_\_\_

Applicant Name: \_\_\_\_\_

Applicant Phone: \_\_\_\_\_ Applicant Email Address: \_\_\_\_\_

- Development type: (check all that apply)
- Single Family Residential: A stand-alone home that is not part of a larger project.
  - Single Family Residential: Two or more lot residential development.<sup>1</sup>
  - Multi-Family Residential
  - Commercial
  - Industrial, Manufacturing
  - Mixed-Use
  - Streets, Roads, etc.
  - 'Redevelopment' as defined by MRP: creating, adding and/or replacing exterior existing impervious surface on a site where past development has occurred.<sup>2</sup>
  - 'Special land use categories' as defined by MRP: (1) auto service facilities<sup>3</sup>, (2) retail gasoline outlets, (3) restaurants, (4) uncovered parking area (stand-alone or part of a larger project)
  - Institutions: schools, libraries, jails, etc.
  - Parks and trails, camp grounds, other recreational
  - Agricultural, wineries
  - Kennels, Ranches
  - Other, Please specify \_\_\_\_\_

Project Description<sup>4</sup>: \_\_\_\_\_  
(Also note any past or future phases of the project.) \_\_\_\_\_

**I.A.1** Total Area of Site: \_\_\_\_\_ acres

**I.A.2** Total Area of land disturbed during construction (include clearing, grading, excavating and stockpile area): \_\_\_\_\_ acres.

**Certification:**

I certify that the information provided on this form is correct and acknowledge that, should the project exceed the amount of new and/or replaced impervious surface provided in this form, the as-built project may be subject to additional improvements.

- Attach Preliminary Calculations     Attach Final Calculations     Attach copy of site plan showing areas

Name of person completing the form: \_\_\_\_\_ Title: \_\_\_\_\_

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Phone number: \_\_\_\_\_ Email address: \_\_\_\_\_

<sup>1</sup> Subdivisions or contiguous, commonly owned lots, for the construction of two or more homes developed within 1 year of each other are considered common plans of development and are subject to C.3 requirements.

<sup>2</sup> Roadway projects that replace existing impervious surface are subject to C.3 requirements only if one or more lanes of travel are added.

<sup>3</sup> See Standard Industrial Classification (SIC) codes [here](#)

<sup>4</sup> Project description examples: 5-story office building, industrial warehouse, residential with five 4-story buildings for 200 condominiums, etc.

1 Final Draft October 31, 2014

**I.B Is the project a “C.3 Regulated Project” per MRP Provision C.3.b?****I.B.1 Enter the amount of impervious surface<sup>5</sup> Retained, Replaced and/or Created by the project:****Table I.B.1 Impervious and Pervious Surfaces**

Type of Impervious Surface	I.B.1.a	I.B.1.b	I.B.1.c	I.B.1.d	I.B.1.e
	Pre-Project Impervious Surface (sq.ft.)	Existing Impervious Surface to be Retained <sup>6</sup> (sq.ft.)	Existing Impervious Surface to be Replaced <sup>6</sup> (sq.ft.)	New Impervious Surface to be Created <sup>6</sup> (sq.ft.)	Post-Project Impervious Surface (sq.ft.) (=b+c+d)
Roof area(s)					
Impervious <sup>5</sup> sidewalks, patios, paths, driveways, streets					
Impervious <sup>5</sup> uncovered parking <sup>7</sup>					
Totals of Impervious Surfaces:					
<b>I.B.1.f - Total Impervious Surface Replaced and Created (sum of totals for columns I.B.1.c and I.B.1.d):</b>					
Type of Pervious Surface	Pre-Project Pervious Surface (sq.ft.)				Post-project Pervious Surface (sq.ft.)
Landscaping					
Pervious Paving					
Green Roof					
Totals of Pervious Surfaces:					
Total Site Area (Total Impervious+Total Pervious=I.A.1)					

**I.B.2 Please review and attach additional worksheets as required below using the Total Impervious Surface Replaced and Created in cell I.B.1.f from Table I.B.1 above and other factors:**

	Check all that apply:	Check If Yes	Attach Worksheet
I.B.2.a	Does this project involve any earthwork?	<input type="checkbox"/>	A
I.B.2.b	Is <b>I.B.1.f</b> greater than or equal to 2,500 sq.ft? <i>If YES, the Project is subject to Provision C.3.i.</i>	<input type="checkbox"/>	B, C
I.B.2.c	Is the total Existing Impervious Surface to be Replaced (column <b>I.B.1.c</b> ) 50 percent or more of the total Pre-Project Impervious Surface (column <b>I.B.1.a</b> )? <i>If YES, site design, source control and treatment requirements apply to the whole site; if NO, these requirements apply only to the impervious surface created and/or replaced.</i>	<input type="checkbox"/>	
I.B.2.d	Is this project one of the Special Land Use Categories (box checked in section I.A. above) and is <b>I.B.1.f</b> greater than or equal to 5,000 sq.ft? <i>If YES, project is a C.3 Regulated Project.</i>	<input type="checkbox"/>	D, D-1, D-2
I.B.2.e	Is <b>I.B.1.f</b> greater than or equal to 10,000 sq.ft? <i>If YES, project is a C.3 Regulated Project.</i>	<input type="checkbox"/>	D, D-1, D-2
I.B.2.f	Is <b>I.B.1.f</b> greater than or equal to 43,560 sq.ft. (1 acre)? <i>If YES, project may be subject to Hydromodification Management requirements.</i>	<input type="checkbox"/>	E
I.B.2.g	Is <b>I.A.2</b> (pg. 1) greater than or equal to 1 acre? <i>If YES, obtain coverage under the state's Construction General Permit and submit to the municipality a copy of your Notice of Intent. See: <a href="http://www.swrcb.ca.gov/water_issues/programs/stormwater/construction.shtml">www.swrcb.ca.gov/water_issues/programs/stormwater/construction.shtml</a>.</i>	<input type="checkbox"/>	
I.B.2.h	Is this a Special Project or does it have the potential to be a Special Project?	<input type="checkbox"/>	F
I.B.2.i	Is this project a High Priority Site? (Determined by the Permitting Jurisdiction. High Priority Sites can include those located in or within 100 feet of a sensitive habitat, ASBS, or body of water, or on sites with slopes, and are subject to monthly inspections from Oct 1 to April 30.)	<input type="checkbox"/>	G
B.2.10	For Municipal Staff Use Only (Alternative Certification, O&M Submittals, Project Close Out)	<input type="checkbox"/>	G

<sup>5</sup> Per the MRP, pavement that meets the following definition of pervious pavement is NOT an impervious surface. Pervious pavement is defined as pavement that stores and infiltrates rainfall at a rate equal to immediately surrounding unpaved, landscaped areas, or that stores and infiltrates the rainfall runoff volume described in Provision C.3.

<sup>6</sup> “Retained” means to leave existing impervious surfaces in place, unchanged; “Replaced” means to install new impervious surface where existing impervious surface is removed anywhere on the same property; and “Created” means the amount of new impervious surface being proposed which exceeds the total existing amount of impervious surface at the property.

<sup>7</sup> Uncovered parking includes the top level of a parking structure.

## Worksheet A

<b>C6 – Construction Stormwater BMPs</b>
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Identify Plan sheet showing the appropriate construction Best Management Practices (BMPs) used on this project:  
(Applies to all projects with earthwork)

Yes	Plan Sheet	Best Management Practice (BMP)
<input checked="" type="checkbox"/>		Control and prevent the discharge of all potential pollutants, including pavement cutting wastes, paints, concrete, petroleum products, chemicals, wash water or sediments, rinse water from architectural copper, and non-stormwater discharges to storm drains and watercourses.
<input checked="" type="checkbox"/>		Store, handle, and dispose of construction materials/wastes properly to prevent contact with stormwater.
<input checked="" type="checkbox"/>		Do not clean, fuel, or maintain vehicles on-site, except in a designated area where wash water is contained and treated.
<input checked="" type="checkbox"/>		Train and provide instruction to all employees/subcontractors re: construction BMPs.
<input type="checkbox"/>		Protect all storm drain inlets in vicinity of site using sediment controls such as berms, fiber rolls, or filters.
<input type="checkbox"/>		Limit construction access routes and stabilize designated access points.
<input type="checkbox"/>		Attach the San Mateo Countywide Water Pollution Prevention Program's construction BMP plan sheet to project plans and require contractor to implement the applicable BMPs on the plan sheet.
<input type="checkbox"/>		Use temporary erosion controls to stabilize all denuded areas until permanent erosion controls are established.
<input type="checkbox"/>		Delineate with field markers clearing limits, easements, setbacks, sensitive or critical areas, buffer zones, trees, and drainage courses.
<input type="checkbox"/>		Provide notes, specifications, or attachments describing the following: <ul style="list-style-type: none"> <li>▪ Construction, operation and maintenance of erosion and sediment controls, include inspection frequency;</li> <li>▪ Methods and schedule for grading, excavation, filling, clearing of vegetation, and storage and disposal of excavated or cleared material;</li> <li>▪ Specifications for vegetative cover &amp; mulch, include methods and schedules for planting and fertilization;</li> <li>▪ Provisions for temporary and/or permanent irrigation.</li> </ul>
<input type="checkbox"/>		Perform clearing and earth moving activities only during dry weather.
<input type="checkbox"/>		Use sediment controls or filtration to remove sediment when dewatering and obtain all necessary permits.
<input type="checkbox"/>		Trap sediment on-site, using BMPs such as sediment basins or traps, earthen dikes or berms, silt fences, check dams, soil blankets or mats, covers for soil stock piles, etc.
<input type="checkbox"/>		Divert on-site runoff around exposed areas; divert off-site runoff around the site (e.g., swales and dikes).
<input type="checkbox"/>		Protect adjacent properties and undisturbed areas from construction impacts using vegetative buffer strips, sediment barriers or filters, dikes, mulching, or other measures as appropriate.

## Worksheet B

## C3 - Source Controls

Select appropriate source controls and identify the detail/plan sheet where these elements are shown.

Yes	Detail/Plan Sheet No.	Features that require source control measures	Source Control Measures (Refer to Local Source Control List for detailed requirements)
<input type="checkbox"/>		Storm Drain	Mark on-site inlets with the words "No Dumping! Flows to Bay" or equivalent.
<input type="checkbox"/>		Floor Drains	Plumb interior floor drains to sanitary sewer <sup>8</sup> [or prohibit].
<input type="checkbox"/>		Parking garage	Plumb interior parking garage floor drains to sanitary sewer. <sup>8</sup>
<input type="checkbox"/>		Landscaping	<ul style="list-style-type: none"> <li>▪ Retain existing vegetation as practicable.</li> <li>▪ Select diverse species appropriate to the site. Include plants that are pest- and/or disease-resistant, drought-tolerant, and/or attract beneficial insects.</li> <li>▪ Minimize use of pesticides and quick-release fertilizers.</li> <li>▪ Use efficient irrigation system; design to minimize runoff.</li> </ul>
<input type="checkbox"/>		Pool/Spa/Fountain	Provide connection to the sanitary sewer to facilitate draining. <sup>8</sup>
<input type="checkbox"/>		Food Service Equipment (non-residential)	<p>Provide sink or other area for equipment cleaning, which is:</p> <ul style="list-style-type: none"> <li>▪ Connected to a grease interceptor prior to sanitary sewer discharge.<sup>8</sup></li> <li>▪ Large enough for the largest mat or piece of equipment to be cleaned.</li> <li>▪ Indoors or in an outdoor roofed area designed to prevent stormwater run-on and run-off, and signed to require equipment washing in this area.</li> </ul>
<input type="checkbox"/>		Refuse Areas	<ul style="list-style-type: none"> <li>▪ Provide a roofed and enclosed area for dumpsters, recycling containers, etc., designed to prevent stormwater run-on and runoff.</li> <li>▪ Connect any drains in or beneath dumpsters, compactors, and tallow bin areas serving food service facilities to the sanitary sewer.<sup>8</sup></li> </ul>
<input type="checkbox"/>		Outdoor Process Activities <sup>9</sup>	Perform process activities either indoors or in roofed outdoor area, designed to prevent stormwater run-on and runoff, and to drain to the sanitary sewer. <sup>8</sup>
<input type="checkbox"/>		Outdoor Equipment/ Materials Storage	<ul style="list-style-type: none"> <li>▪ Cover the area or design to avoid pollutant contact with stormwater runoff.</li> <li>▪ Locate area only on paved and contained areas.</li> <li>▪ Roof storage areas that will contain non-hazardous liquids, drain to sanitary sewer<sup>8</sup>, and contain by berms or similar.</li> </ul>
<input type="checkbox"/>		Vehicle/ Equipment Cleaning	<ul style="list-style-type: none"> <li>▪ Roofed, pave and berm wash area to prevent stormwater run-on and runoff, plumb to the sanitary sewer<sup>8</sup>, and sign as a designated wash area.</li> <li>▪ Commercial car wash facilities shall discharge to the sanitary sewer.<sup>8</sup></li> </ul>
<input type="checkbox"/>		Vehicle/ Equipment Repair and Maintenance	<ul style="list-style-type: none"> <li>▪ Designate repair/maintenance area indoors, or an outdoors area designed to prevent stormwater run-on and runoff and provide secondary containment. Do not install drains in the secondary containment areas.</li> <li>▪ No floor drains unless pretreated prior to discharge to the sanitary sewer.<sup>8</sup></li> <li>▪ Connect containers or sinks used for parts cleaning to the sanitary sewer.<sup>8</sup></li> </ul>
<input type="checkbox"/>		Fuel Dispensing Areas	<ul style="list-style-type: none"> <li>▪ Fueling areas shall have impermeable surface that is a) minimally graded to prevent ponding and b) separated from the rest of the site by a grade break.</li> <li>▪ Canopy shall extend at least 10 ft. in each direction from each pump and drain away from fueling area.</li> </ul>
<input type="checkbox"/>		Loading Docks	<ul style="list-style-type: none"> <li>▪ Cover and/or grade to minimize run-on to and runoff from the loading area.</li> <li>▪ Position downspouts to direct stormwater away from the loading area.</li> <li>▪ Drain water from loading dock areas to the sanitary sewer.<sup>8</sup></li> <li>▪ Install door skirts between the trailers and the building.</li> </ul>
<input type="checkbox"/>		Fire Sprinklers	Design for discharge of fire sprinkler test water to landscape or sanitary sewer. <sup>8</sup>
<input type="checkbox"/>		Miscellaneous Drain or Wash Water	<ul style="list-style-type: none"> <li>▪ Drain condensate of air conditioning units to landscaping. Large air conditioning units may connect to the sanitary sewer.<sup>8</sup></li> <li>▪ Roof drains from equipment drain to landscaped area where practicable.</li> <li>▪ Drain boiler drain lines, roof top equipment, all wash water to sanitary sewer.<sup>8</sup></li> </ul>
<input type="checkbox"/>		Architectural Copper Rinse Water	<ul style="list-style-type: none"> <li>▪ Drain rinse water to landscaping, discharge to sanitary sewer<sup>8</sup>, or collect and dispose properly offsite. See flyer "Requirements for Architectural Copper."</li> </ul>

<sup>8</sup> Any connection to the sanitary sewer system is subject to sanitary district approval.

<sup>9</sup> Businesses that may have outdoor process activities/equipment include machine shops, auto repair, industries with pretreatment facilities.

## Worksheet C

### Low Impact Development – Site Design Measures

**Select Appropriate Site Design Measures** (Required for C.3 Regulated Projects; all other projects are encouraged to implement site design measures, which may be required at municipality discretion.) Projects that create and/or replace 2,500 – 10,000 sq.ft. of impervious surface, and stand-alone single family homes that create/replace 2,500 sq.ft. or more of impervious surface, must include **one of Site Design Measures a through f** (Provision C.3.i requirements).<sup>10</sup> Larger projects must also include applicable Site Design Measures g through i. Consult with municipal staff about requirements for your project.

**Select appropriate site design measures and Identify the Plan Sheet where these elements are shown. #**

Yes	Plan Sheet Number	
<input type="checkbox"/>		a. Direct roof runoff into cisterns or rain barrels and use rainwater for irrigation or other non-potable use.
<input type="checkbox"/>		b. Direct roof runoff onto vegetated areas.
<input type="checkbox"/>		c. Direct runoff from sidewalks, walkways, and/or patios onto vegetated areas.
<input type="checkbox"/>		d. Direct runoff from driveways and/or uncovered parking lots onto vegetated areas.
<input type="checkbox"/>		e. Construct sidewalks, walkways, and/or patios with pervious or permeable surfaces.
<input type="checkbox"/>		f. Construct bike lanes, driveways, and/or uncovered parking lots with pervious surfaces.
<input type="checkbox"/>		g. Limit disturbance of natural water bodies and drainage systems; minimize compaction of highly permeable soils; protect slopes and channels; and minimize impacts from stormwater and urban runoff on the biological integrity of natural drainage systems and water bodies;
<input type="checkbox"/>		h. Conserve natural areas, including existing trees, other vegetation and soils.
<input type="checkbox"/>		i. Minimize impervious surfaces.

**Regulated Projects can also consider the following site design measures to reduce treatment system sizing:**

Yes	Plan Sheet Number	
<input type="checkbox"/>		j. Self-treating area (see Section 4.2 of the C.3 Technical Guidance)
<input type="checkbox"/>		k. Self-retaining area (see Section 4.3 of the C.3 Technical Guidance)
<input type="checkbox"/>		l. Plant or preserve interceptor trees (Section 4.1, C.3 Technical Guidance)

<sup>10</sup> See MRP Provision C.3.a.i.(6) for non-C.3 Regulated Projects, C.3.c.i.(2)(a) for Regulated Projects, C.3.i for projects that create/replace 2,500 to 10,000 sq.ft. of impervious surface and stand-alone single family homes that create/replace 2,500 sq.ft. or more of impervious surface.

## Worksheet D

<b>C3 Regulated Project - Stormwater Treatment Measures</b>
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Check all applicable boxes and indicate the treatment measure(s) included in the project.

Yes										
<input type="checkbox"/> Attach Worksheet F and Calculations	<p>Is the project a <b>Special Project</b>?<sup>11</sup></p> <p>If yes, consult with municipal staff about the need to evaluate the feasibility and infeasibility of 100% LID treatment. Indicate the type of non-LID treatment to be used, the hydraulic sizing method<sup>12</sup>, and percentage of the amount of runoff specified in Provision C.3.d that is treated: (For the % not treated by non-LID measures, continue with Worksheet D-1)</p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left; border-bottom: 1px solid black;">Non-LID Treatment Measures:</th> <th style="text-align: left; border-bottom: 1px solid black;">Hydraulic sizing method<sup>12</sup></th> <th style="text-align: right; border-bottom: 1px solid black;">% of C.3.d amount of runoff treated</th> </tr> </thead> <tbody> <tr> <td><input type="checkbox"/> Media filter</td> <td><input type="checkbox"/>2.a <input type="checkbox"/>2.b <input type="checkbox"/>2.c</td> <td style="text-align: right;">____%</td> </tr> <tr> <td><input type="checkbox"/> Tree well filter</td> <td><input type="checkbox"/>2.a <input type="checkbox"/>2.b <input type="checkbox"/>2.c</td> <td style="text-align: right;">____%</td> </tr> </tbody> </table>	Non-LID Treatment Measures:	Hydraulic sizing method <sup>12</sup>	% of C.3.d amount of runoff treated	<input type="checkbox"/> Media filter	<input type="checkbox"/> 2.a <input type="checkbox"/> 2.b <input type="checkbox"/> 2.c	____%	<input type="checkbox"/> Tree well filter	<input type="checkbox"/> 2.a <input type="checkbox"/> 2.b <input type="checkbox"/> 2.c	____%
Non-LID Treatment Measures:	Hydraulic sizing method <sup>12</sup>	% of C.3.d amount of runoff treated								
<input type="checkbox"/> Media filter	<input type="checkbox"/> 2.a <input type="checkbox"/> 2.b <input type="checkbox"/> 2.c	____%								
<input type="checkbox"/> Tree well filter	<input type="checkbox"/> 2.a <input type="checkbox"/> 2.b <input type="checkbox"/> 2.c	____%								
<input type="checkbox"/> Attach Worksheet D-1 and Calculations	<p>It is <b>feasible</b> to treat the C.3.d amount of runoff using infiltration? Indicate the infiltration measures to be used, and hydraulic sizing method:</p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left; border-bottom: 1px solid black;">Infiltration Measures:</th> <th style="text-align: left; border-bottom: 1px solid black;">Hydraulic sizing method<sup>12</sup></th> </tr> </thead> <tbody> <tr> <td><input type="checkbox"/> Bioinfiltration<sup>13</sup></td> <td><input type="checkbox"/>1.a <input type="checkbox"/>1.b <input type="checkbox"/>2.c <input type="checkbox"/>3</td> </tr> <tr> <td><input type="checkbox"/> Infiltration trench</td> <td><input type="checkbox"/>1.a <input type="checkbox"/>1.b</td> </tr> <tr> <td><input type="checkbox"/> Other (specify): _____</td> <td></td> </tr> </tbody> </table>	Infiltration Measures:	Hydraulic sizing method <sup>12</sup>	<input type="checkbox"/> Bioinfiltration <sup>13</sup>	<input type="checkbox"/> 1.a <input type="checkbox"/> 1.b <input type="checkbox"/> 2.c <input type="checkbox"/> 3	<input type="checkbox"/> Infiltration trench	<input type="checkbox"/> 1.a <input type="checkbox"/> 1.b	<input type="checkbox"/> Other (specify): _____		
Infiltration Measures:	Hydraulic sizing method <sup>12</sup>									
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<input type="checkbox"/> Infiltration trench	<input type="checkbox"/> 1.a <input type="checkbox"/> 1.b									
<input type="checkbox"/> Other (specify): _____										
<input type="checkbox"/> Attach Plans showing system, connection to Recycled Water Line and/or Connection Approval Letter from Sanitary District	<p>Is the project installing and using a <b>recycled water</b> plumbing system for non-potable water use and the installation of a second non-potable water system for harvested rainwater is impractical, and considered infeasible due to cost considerations? If yes, check the box below and skip ahead to worksheet D-3 (There is no need for further evaluation of Rainwater harvesting/use.)</p> <p><u>Recycled Water Measure:</u></p> <p><input type="checkbox"/> Recycled Water System for non-potable water use will be installed and used.</p>									
<input type="checkbox"/> Attach worksheet D-2 and Calculations	<p>It is <b>feasible</b> to treat the C.3.d amount of runoff using rainwater harvesting/use?</p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left; border-bottom: 1px solid black;">Rainwater Harvesting/Use Measures:</th> <th style="text-align: left; border-bottom: 1px solid black;">Hydraulic sizing method<sup>12</sup></th> </tr> </thead> <tbody> <tr> <td><input type="checkbox"/> Rainwater Harvesting for indoor non-potable water use</td> <td><input type="checkbox"/>1.a <input type="checkbox"/>1.b</td> </tr> <tr> <td><input type="checkbox"/> Rainwater Harvesting for landscape irrigation use</td> <td><input type="checkbox"/>1.a <input type="checkbox"/>1.b</td> </tr> </tbody> </table>	Rainwater Harvesting/Use Measures:	Hydraulic sizing method <sup>12</sup>	<input type="checkbox"/> Rainwater Harvesting for indoor non-potable water use	<input type="checkbox"/> 1.a <input type="checkbox"/> 1.b	<input type="checkbox"/> Rainwater Harvesting for landscape irrigation use	<input type="checkbox"/> 1.a <input type="checkbox"/> 1.b			
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<input type="checkbox"/> Rainwater Harvesting for landscape irrigation use	<input type="checkbox"/> 1.a <input type="checkbox"/> 1.b									
<input type="checkbox"/> Attach Worksheets D-1 and D-2 and Calculations	<p>It is <b>infeasible</b> to treat the C.3.d amount of runoff using either infiltration or rainwater harvesting/use? Indicate the biotreatment measures to be used, and the hydraulic sizing method:</p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left; border-bottom: 1px solid black;">Biotreatment Measures:</th> <th style="text-align: left; border-bottom: 1px solid black;">Hydraulic sizing method<sup>12</sup></th> </tr> </thead> <tbody> <tr> <td><input type="checkbox"/> Bioretention area</td> <td><input type="checkbox"/>2.c <input type="checkbox"/>3</td> </tr> <tr> <td><input type="checkbox"/> Flow-through planter</td> <td><input type="checkbox"/>2.c <input type="checkbox"/>3</td> </tr> <tr> <td><input type="checkbox"/> Other (specify): _____</td> <td></td> </tr> </tbody> </table>	Biotreatment Measures:	Hydraulic sizing method <sup>12</sup>	<input type="checkbox"/> Bioretention area	<input type="checkbox"/> 2.c <input type="checkbox"/> 3	<input type="checkbox"/> Flow-through planter	<input type="checkbox"/> 2.c <input type="checkbox"/> 3	<input type="checkbox"/> Other (specify): _____		
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<input type="checkbox"/> Flow-through planter	<input type="checkbox"/> 2.c <input type="checkbox"/> 3									
<input type="checkbox"/> Other (specify): _____										

A copy of the long term Operations and Maintenance (O&M) Agreement and Plan for this project will be required. Please contact the NPDES Representative of the applicable municipality for an agreement template and consult the C.3 Technical Guidance at [www.flowstobay.org](http://www.flowstobay.org) for maintenance plan templates for specific facility types.

<sup>11</sup> Special Projects are smart growth, high density, or transit-oriented developments with the criteria defined in Provision C.3.e.ii.(2), (3) or (4) (see Worksheet F).

<sup>12</sup> Indicate which of the following Provision C.3.d.i hydraulic sizing methods were used. Volume based approaches: 1(a) Urban Runoff Quality Management approach, or 1(b) 80% capture approach (recommended volume-based approach). Flow-based approaches: 2(a) 10% of 50-year peak flow approach, 2(b) 2 times the 85<sup>th</sup> percentile rainfall intensity approach, or 2(c) 0.2-Inch-per-hour intensity approach (recommended flow-based approach). Combination flow and volume-based approach: 3.

<sup>13</sup> See Section 6.1 of the C.3 Technical Guidance for conditions in which bioretention areas provide bioinfiltration.

## Worksheet D-1 Feasibility of Infiltration

	Yes	No
<b>D-1.0 Infiltration Potential.</b> Based on site-specific soil report <sup>14</sup> , do site soils either:		
a. Have a saturated hydraulic conductivity (Ksat) <u>less</u> than 1.6 inches/hour), OR, if the Ksat rate is not available:	<input type="checkbox"/>	<input type="checkbox"/>
b. Consist of Type C or D soils?	<input type="checkbox"/>	<input type="checkbox"/>
➤ If Yes, infiltration is not feasible – skip to D-1.9 below.		
➤ If No, complete the Infiltration Feasibility checklist below:		
 <b>Evaluate infiltration feasibility:</b>		
D-1.1 Would infiltration facilities <sup>15</sup> at this site conflict with the location of existing or proposed underground utilities or easements, or would the siting of infiltration facilities at this site result in their placement on top of underground utilities, or otherwise oriented to underground utilities, such that they would discharge to the utility trench, restrict access, or cause stability concerns? (If yes, attach evidence documenting this condition.)	<input type="checkbox"/>	<input type="checkbox"/>
D-1.2 Is there a documented concern that there is a potential on the site for soil or groundwater pollutants to be mobilized? (If yes, attach documentation of mobilization concerns.)	<input type="checkbox"/>	<input type="checkbox"/>
D-1.3 Are geotechnical hazards present, such as steep slopes, areas with landslide potential, soils subject to liquefaction, or would an infiltration facility <sup>10</sup> need to be built less than 10 feet from a building foundation or other improvements subject to undermining by saturated soils? (If yes, attach documentation of geotechnical hazard.)	<input type="checkbox"/>	<input type="checkbox"/>
D-1.4 Do local water district or other agency's policies or guidelines regarding the locations where infiltration may occur, the separation from seasonal high groundwater, or setbacks from potential sources of pollution, prevent infiltration devices <sup>10</sup> from being implemented at this site? (If yes, attach evidence documenting this condition.)	<input type="checkbox"/>	<input type="checkbox"/>
D-1.5 Would construction of an infiltration device <sup>10</sup> require that it be located less than 100 feet away from a septic tank, underground storage tank with hazardous materials, or other potential underground source of pollution? (If yes, attach evidence documenting this claim.)	<input type="checkbox"/>	<input type="checkbox"/>
D-1.6 Is there a seasonal high groundwater table or mounded groundwater that would be within 10 feet of the base of an infiltration device <sup>10</sup> constructed on the site? (If yes, attach documentation of high groundwater.)	<input type="checkbox"/>	<input type="checkbox"/>
D-1.7 Are there land uses that pose a high threat to water quality – including but not limited to industrial and light industrial activities, high vehicular traffic (i.e., 25,000 or greater average daily traffic on a main roadway or 15,000 or more average daily traffic on any intersecting roadway), automotive repair shops, car washes, fleet storage areas, or nurseries? (If yes, attach evidence documenting this claim.)	<input type="checkbox"/>	<input type="checkbox"/>
D-1.8 Is there a groundwater production well within 100 feet of the location where an infiltration device <sup>10</sup> would be constructed? (If yes, attach map showing the well.)	<input type="checkbox"/>	<input type="checkbox"/>
 <b>Results of Feasibility Determination</b>		
D-1.9 Infiltration is <b>Infeasible</b> ? (If any answer to questions D-1.1 thru D-1.8 is “Yes” then Infiltration is Infeasible.) Continue to Worksheet D-2.	<input type="checkbox"/>	<input type="checkbox"/>
Infiltration is <b>Feasible</b> ? Do not fill out worksheet D-2. Continue to Worksheet D-3.	<input type="checkbox"/>	<input type="checkbox"/>

<sup>14</sup> If no site-specific soil report is available, refer to soil hydraulic conductivity maps in C.3 Technical Guidance Appendix I.

<sup>15</sup> For more information on infiltration facilities and devices, see Appendix E of the SMCWPPP C3TG Handbook.

## Worksheet D-2

### Feasibility of Rainwater Harvesting and Use

#### D-2.1 Potential Rainwater Capture Area

- a. Enter the total square footage of impervious surface for this site from Table I.B.1 (Total Created and Replaced Impervious Surface from I.B.1.f) \_\_\_\_\_ Sq. ft.
- b. If the existing impervious surface to be replaced (total from Column I.B.1.c in Table I.B.1) is 50% or more of the pre-project impervious surface (total from Column I.B.1.a in Table I.B.1), then enter the post-project impervious surface (total from Column I.B.1.e in Table I.B.1) in D-2.1.b. If not, enter zero in D-2.1.b. \_\_\_\_\_ Sq. ft.
- c. Convert the larger of the amounts in Items D-2.1.a and D-2.1.b from square feet to acres (divide by 43,560).  
This is the project's Potential Rainwater Capture Area, in acres. \_\_\_\_\_ Acres

#### D-2.2 Feasibility of Landscape Irrigation:

- a. Enter area of post-project onsite landscaping (see Column I.B.1.e in Table I.B.1) \_\_\_\_\_ Acres
- b. Multiply the Potential Rainwater Capture Area above (D-2.1.c) by times 3.2. \_\_\_\_\_ Acres
- c. Is the amount in D-2.2.a (onsite landscaping) LESS than the amount in D-2.2.b (the product of 3.2 times the size of the Potential Rainwater Capture Area)<sup>16</sup>?  Yes  No
- If Yes, continue to D-2.3.
  - If No, there are two options:
    1. It may be possible to meet the treatment requirements by directing runoff from impervious areas to self-retaining areas (see Section 4.3 of the C.3 Technical Guidance).
    2. It may be possible use the C.3.d amount of runoff for irrigation. Refer to Table 11 and the curves in Appendix F of the LID Feasibility Report to evaluate feasibility of harvesting and using the C.3.d amount of runoff for irrigation. Complete the calculations and attach to this worksheet. If feasible that completes Worksheet D-2 and you may move on to Worksheet D-3.

#### D-2.3 Feasibility Indoor Non-Potable Uses: (check the box for the applicable project type, then fill in the requested information and answer the question).<sup>17</sup>

- a. Residential Project
- i. Number of dwelling units (total post-project): \_\_\_\_\_ Units
  - ii. Divide the amount in (i) by Potential Rainwater Capture Area (D-2.1.c): \_\_\_\_\_ Du/ac
  - iii. Is the amount in (ii) LESS than 124?  Yes  No
- b. Commercial Project
- i. Floor area (total interior post-project square footage): \_\_\_\_\_ Sq.ft.
  - ii. Divide the amount in (i) by Potential Rainwater Capture Area (D-2.1.c): \_\_\_\_\_ Sq.ft./ac
  - iii. Is the amount in (ii) LESS than 84,000?  Yes  No
- c. School Project
- i. Floor area (total interior post-project square footage): \_\_\_\_\_ Sq.ft.
  - ii. Divide the amount in (i) by Potential Rainwater Capture Area (D-2.1.c): \_\_\_\_\_ Sq.ft./ac
  - iii. Is the amount in (ii) LESS than 27,000?  Yes  No

<sup>16</sup> Landscape areas must be contiguous and within the same Drainage Management Area to irrigate with harvested rainwater via gravity flow.

<sup>17</sup> Rainwater harvested for indoor use is typically used for toilet/urinal flushing, industrial processes, or other non-potable uses.

d. Industrial Project

- i. Estimated demand for non-potable water (gallons/day): \_\_\_\_\_ Gal./day
- ii. Is the amount in (i) LESS than 2,900?  Yes  No

e. Mixed-Use Residential/Commercial Project<sup>18</sup>

- |  | Residential  | Commercial     |
|--|--|----------------|
| i. Number of residential dwelling units and commercial floor area:   | _____ Units  | _____ Sq.ft.   |
| ii. Percentage of total interior post-project floor area serving each activity:  | _____ %  | _____ %        |
| iii. Prorated Potential Rainwater Capture Area per activity (multiply amount in D-2.1.c by the percentages in [ii]):                         | _____ Acres  | _____ Acres    |
| iv. Prorated project demand per impervious area (divide the amounts in [i] by the amounts in [iii]):   | _____ Du/ac  | _____ Sq.ft/ac |
| v. Is the amount in (iv) in the residential column <u>less</u> than 124, AND is the amount in the commercial column <u>less</u> than 84,000? | <input type="checkbox"/> Yes <input type="checkbox"/> No |                |

- If you checked "Yes" for the above question for the applicable project type, rainwater harvesting for indoor use is considered infeasible for that building. If there is only one building on the site you are done with this worksheet. If there is more than one building on the site, for each that has an individual roof area of 10,000 sq. ft. or more, complete Sections D-2.2 and D-2.3 of this form for each building, Continue to D-2.4 if a "No" is checked for any building.
- If you checked "No" for the question applicable to the type of project, rainwater harvesting for indoor use may be feasible. Continue to D-2.4:

**D-2.4 Project Information**

\*- See definitions in Glossary (Attachment 1)

- 4.1 Project Type: \_\_\_\_\_ If residential or mixed use, enter # of dwelling units: \_\_\_\_\_
- 4.2 Enter square footage of non-residential interior floor area: \_\_\_\_\_
- 4.3 Total area being evaluated (entire project or individual roof with an area > 10,000 sq.ft.): \_\_\_\_\_ sq.ft.
- 4.4 If it is a Special Project\*, indicate the percentage of LID treatment\* reduction: \_\_\_\_\_ percent  
(Item 4.4 applies only to entire project evaluations, not individual roof area evaluations.)
- 4.5 Total area being evaluated, adjusted for Special Project LID treatment reduction credit: \_\_\_\_\_ sq.ft.  
(This is the total area being evaluated that requires LID treatment.)

**D-2.5 Calculate Area of Self-Treating Areas, Self-Retaining Areas, and Areas Contributing to Self-Retaining Areas.**

- 5.1 Enter square footage of any self-treating areas\* in the area that is being evaluated: \_\_\_\_\_ sq.ft.
- 5.2 Enter square footage of any self-retaining areas\* in the area that is being evaluated: \_\_\_\_\_ sq.ft.
- 5.3 Enter the square footage of areas contributing runoff to self-retaining area\*: \_\_\_\_\_ sq.ft.
- 5.4 TOTAL of Items 5.1, 5.2, and 5.3: \_\_\_\_\_ sq.ft.

**D-2.6 Subtract credit for self-treating/self-retaining areas from area requiring treatment.**

- 6.1 Subtract the TOTAL in Item 5.4 from the area being evaluated (Item 4.5). This is the potential rainwater capture area\*. \_\_\_\_\_ sq.ft.
- 6.2 Convert the potential rainwater capture area (Item 6.1) from square feet to acres. \_\_\_\_\_ acres

<sup>18</sup> For a mixed-use project involving activities other than residential and commercial activities, follow the steps for residential/commercial mixed-use projects. Prorate the Potential Rainwater Capture Area for each activity based on the percentage of the project serving each activity.

**D-2.7 Determine feasibility of use for toilet flushing based on demand**

- |   |  |       |                                      |
|---|--|-------|--------------------------------------|
| 7.1   | Project's dwelling units per acre of potential rainwater capture area (Divide the number in 4.1 by the number in 6.2).   | _____ | dwelling<br>units/acre               |
| 7.2   | Non-residential interior floor area per acre of potential rain capture area (Divide the number in 4.2 by the number in 6.2).   | _____ | Int. non-<br>res. floor<br>area/acre |
| <br><i>Note: formulas in Items 7.1 and 7.2 are set up, respectively, for a residential or a non-residential project. Do not use these pre-set formulas for mixed use projects. For mixed use projects*, evaluate the residential toilet flushing demand based on the dwelling units per acre for the residential portion of the project (use a prorated acreage, based on the percentage of the project dedicated to residential use). Then evaluate the commercial toilet flushing demand per acre for the commercial portion of the project (use a prorated acreage, based on the percentage of the project dedicated to commercial use).</i> |  |       |                                      |
| 7.3   | Refer to the applicable countywide table in Attachment 2. Identify the number of dwelling units per impervious acre needed in your Rain Gauge Area to provide the toilet flushing demand required for rainwater harvest feasibility.                           | _____ | dwelling<br>units/acre               |
| 7.4   | Refer to the applicable countywide table in Attachment 2. Identify the square feet of non-residential interior floor area per impervious acre needed in your Rain Gauge Area to provide the toilet flushing demand required for rainwater harvest feasibility. | _____ | int. non-<br>res. floor<br>area/acre |

Check "Yes" or "No" to indicate whether the following conditions apply. If "Yes" is checked for any question, then rainwater harvesting and use is infeasible. As soon as you answer "Yes", you can skip to Item D-2.9. If "No" is checked for all items, then rainwater harvesting and use is feasible and you must harvest and use the C.3.d amount of stormwater, unless you infiltrate the **C.3.d amount of stormwater\***.

- |     |   |  |
|-----|---|--|
| 7.5 | Is the project's number of dwelling units per acre of potential rainwater capture area (listed in Item 7.1) LESS than the number identified in Item 7.3?                              | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| 7.6 | Is the project's square footage of non-residential interior floor area per acre of potential rainwater capture area (listed in Item 7.2) LESS than the number identified in Item 7.4? | <input type="checkbox"/> Yes <input type="checkbox"/> No |

**D-2.8 Determine feasibility of rainwater harvesting and use based on factors other than demand.**

- |     |   |  |
|-----|---|--|
| 8.1 | Does the requirement for rainwater harvesting and use at the project conflict with local, state, or federal ordinances or building codes?   | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| 8.2 | Would the technical requirements cause the harvesting system to exceed 2% of the <b>Total Project Cost*</b> , or has the applicant documented economic hardship in relation to maintenance costs? (If so, attach an explanation.)   | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| 8.3 | Do constraints, such as a slope above 10% or lack of available space at the site, make it infeasible to locate on the site a cistern of adequate size to harvest and use the C.3.d amount of water? (If so, attach an explanation.) | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| 8.4 | Are there geotechnical/stability concerns related to the surface (roof or ground) where a cistern would be located that make the use of rainwater harvesting infeasible? (If so, attach an explanation.)                            | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| 8.5 | Does the location of utilities, a septic system and/or <b>Heritage Trees*</b> limit the placement of a cistern on the site to the extent that rainwater harvesting is infeasible? (If so, attach an explanation.)                   | <input type="checkbox"/> Yes <input type="checkbox"/> No |

*Note: It is assumed that projects with significant amounts of landscaping will either treat runoff with landscape dispersal (self-treating and self-retaining areas) or will evaluate the feasibility of harvesting and using rainwater for irrigation using the curves in Appendix F of the LID Feasibility Report.*

\*- See definitions in Glossary (Attachment 1)

**D-2.9 Results of Feasibility Determination**

- |    |  |                          |                          |
|----|--|--------------------------|--------------------------|
|    |  | Infeasible               | Feasible                 |
| a. | Based on the results of the feasibility analysis in Items 7.5, 7.6 and Section D-2.8, rainwater harvesting/use is (check one): | <input type="checkbox"/> | <input type="checkbox"/> |

→ If "FEASIBLE" is indicated for Item D-2.9.a the amount of stormwater requiring treatment must be treated with harvesting/use, unless it is infiltrated into the soil.

→ If "INFEASIBLE" is checked for Item D-2.9.a, then the applicant may use appropriately designed *bioretention*\* facilities (\*see definitions in Glossary – Attachment 1) for compliance with C.3 treatment requirements. If  $K_{sat} > 1.6$  in./hr., and infiltration is unimpeded by subsurface conditions, then the bioretention facilities are predicted to infiltrate 80% or more average annual runoff. If  $K_{sat} < 1.6$ , maximize infiltration of stormwater by using bioretention if site conditions allow, and remaining runoff will be discharged to storm drains via facility underdrains. If site conditions preclude infiltration, a lined bioretention area or flow-through planter may be used.

## Worksheet E

### Hydromodification Management

#### E-1 Is the project a Hydromodification Management<sup>19</sup> (HM) Project?

E-1.1 Is the total impervious area increased over the pre-project condition?

- Yes. Continue to E-1.2
- No. The project is NOT required to incorporate HM Measures.  
Go to Item E-1.4 and check "No."

E-1.2 Is the site located in an HM Control Area per the HM Control Areas map (Appendix H of the C.3 Technical Guidance)?

- Yes. Continue to E-1.3
- No. Attach map, indicating project location. The project is NOT required to incorporate HM Measures.  
Skip to Item E-1.4 and check "No."

E-1.3 Has an engineer or qualified environmental professional determined that runoff from the project flows only through a hardened channel or enclosed pipe along its entire length before emptying into a waterway in the exempt area?

- Yes. Attach map of facility. Go to Item E-1.4 and check "Yes."
- No. Attach map, indicating project location. The project is NOT required to incorporate HM Measures.  
Skip to Item E-1.4 and check "No."

E-1.4 Is the project a Hydromodification Management Project?

- Yes. The project is subject to HM requirements in Provision C.3.g of the Municipal Regional Stormwater Permit.
- No. The project is EXEMPT from HM requirements.

- If the project is subject to the HM requirements, incorporate in the project flow duration control measures designed such that post-project discharge rates and durations match pre-project discharge rates and durations.
- The Bay Area Hydrology Model (BAHM) has been developed to help size flow duration controls. See [www.bayareahydrologymodel.org](http://www.bayareahydrologymodel.org). Guidance is provided in Chapter 7 of the C.3 Technical Guidance.

#### E-2 Incorporate HM Controls (if required)

Are the applicable items provided with the Plans?

Yes	No	NA	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Site plans with pre- and post-project impervious surface areas, surface flow directions of entire site, locations of flow duration controls and site design measures per HM site design requirement
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Soils report or other site-specific document showing soil type(s) on site
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	If project uses the Bay Area Hydrology Model (BAHM), a list of model inputs and outputs.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	If project uses custom modeling, a summary of the modeling calculations with corresponding graph showing curve matching (existing, post-project, and post-project with HM controls curves), goodness of fit, and (allowable) low flow rate.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	If project uses the Impracticability Provision, a listing of all applicable costs and a brief description of the alternative HM project (name, location, date of start up, entity responsible for maintenance).
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	If the project uses alternatives to the default BAHM approach or settings, a written description and rationale.

<sup>19</sup> Hydromodification is the change in a site's runoff hydrograph, including increases in flows and durations that results when land is developed (made more impervious). The effects of hydromodification include, but are not limited to, increased bed and bank erosion of receiving streams, loss of habitat, increased sediment transport and/or deposition, and increased flooding. Hydromodification control measures are designed to reduce these effects.

## Worksheet F Special Projects

Complete this worksheet for projects that appear to meet the definition of “Special Project”, per Provision C.3.e.ii of the Municipal Regional Stormwater Permit (MRP). The form assists in determining whether a project meets Special Project criteria, and the percentage of low impact development (LID) treatment reduction credit. Special Projects that implement less than 100% LID treatment must provide a narrative discussion of the feasibility or infeasibility of 100% LID treatment. See Appendix J of the C.3 Technical Guidance Handbook (download at [www.flowstobay.org](http://www.flowstobay.org)) for more information.

### F.1 “Special Project” Determination (Check the boxes to determine if the project meets any of the following categories.)

#### Special Project Category “A”

Does the project have ALL of the following characteristics?

- Located in a municipality’s designated central business district, downtown core area or downtown core zoning district, neighborhood business district or comparable pedestrian-oriented commercial district, or historic preservation site and/or district<sup>20</sup>;
  - Creates and/or replaces 0.5 acres or less of impervious surface;
  - Includes no surface parking, except for incidental parking for emergency vehicle access, ADA access, and passenger or freight loading zones;
  - Has at least 85% coverage of the entire site by permanent structures. The remaining 15% portion of the site may be used for safety access, parking structure entrances, trash and recycling service, utility access, pedestrian connections, public uses, landscaping and stormwater treatment.
- No (continue)
- Yes – Complete Section F.2 below

#### Special Project Category “B”

Does the project have ALL of the following characteristics?

- Located in a municipality’s designated central business district, downtown core area or downtown core zoning district, neighborhood business district or comparable pedestrian-oriented commercial district, or historic preservation site and/or district<sup>20</sup>;
  - Creates and/or replaces an area of impervious surface that is greater than 0.5 acres, and no more than 2.0 acres;
  - Includes no surface parking, except for incidental parking for emergency access, ADA access, and passenger or freight loading zones;
  - Has at least 85% coverage of the entire site by permanent structures. The remaining 15% portion of the site may be used for safety access, parking structure entrances, trash and recycling service, utility access, pedestrian connections, public uses, landscaping and stormwater treatment;
  - Minimum density of either 50 dwelling units per acre (for residential projects) or a Floor Area Ratio (FAR) of 2:1 (for commercial or mixed use projects)
- No (continue)
- Yes – Complete Section F-2 below

#### Special Project Category “C”

Does the project have ALL of the following characteristics?

- At least 50% of the project area is within 1/2 mile of an existing or planned transit hub<sup>21</sup> or 100% within a planned Priority Development Area<sup>22</sup>;
  - The project is characterized as a non-auto-related use<sup>23</sup>; and
  - Minimum density of either 25 dwelling units per acre (for residential projects) or a Floor Area Ratio (FAR) of 2:1 (for commercial or mixed use projects)
- No (continue)
- Yes – Complete Section F-2 below

<sup>20</sup> And built as part of a municipality’s stated objective to preserve/enhance a pedestrian-oriented type of urban design.

<sup>21</sup> “Transit hub” is defined as a rail, light rail, or commuter rail station, ferry terminal, or bus transfer station served by three or more bus routes. (A bus stop with no supporting services does not qualify.)

<sup>22</sup> A “planned Priority Development Area” is an infill development area formally designated by the Association of Bay Area Government’s / Metropolitan Transportation Commission’s FOCUS regional planning program.

<sup>23</sup> Category C specifically excludes stand-alone surface parking lots; car dealerships; auto and truck rental facilities with onsite surface storage; fast-food restaurants, banks or pharmacies with drive-through lanes; gas stations; car washes; auto repair and service facilities; or other auto-related project unrelated to the concept of transit oriented development.

**F.2 LID Treatment Reduction Credit Calculation**

(If more than one category applies, choose only one of the applicable categories and fill out the table for that category.)

Category	Impervious Area Created/Replaced (sq. ft.)	Site Coverage (%)	Project Density or FAR	Density/Criteria	Allowable Credit (%)	Applied Credit (%)
A			N.A.	N.A.	100%	
B				Res ≥ 50 DU/ac or FAR ≥ 2:1	50%	
				Res ≥ 75 DU/ac or FAR ≥ 3:1	75%	
				Res ≥ 100 DU/ac or FAR ≥ 4:1	100%	
C				<b>Location credit (select one)<sup>24</sup>:</b>		
				Within ¼ mile of transit hub	50%	
				Within ½ mile of transit hub	25%	
				Within a planned PDA	25%	
				<b>Density credit (select one):</b>		
				Res ≥ 30 DU/ac or FAR ≥ 2:1	10%	
				Res ≥ 60 DU/ac or FAR ≥ 4:1	20%	
				Res ≥ 100 DU/ac or FAR ≥ 6:1	30%	
				<b>Parking credit (select one):</b>		
				≤ 10% at-grade surface parking <sup>25</sup>	10%	
No surface parking	20%					
<b>TOTAL TOD CREDIT =</b>						

**F.3 Narrative Discussion of the Feasibility/Infeasibility of 100% LID Treatment:**

If project will implement less than 100% LID, prepare a discussion of the feasibility or infeasibility of 100% LID treatment, as described in Appendix K of the C.3 Technical Guidance.

**F.4 Select Certified Non-LID Treatment Measures:**

If the project will include non-LID treatment measures, select a treatment measure certified for “Basic” General Use Level Designation (GULD) by the Washington State Department of Ecology’s Technical Assessment Protocol – Ecology (TAPE). Guidance is provided in Appendix K of the C.3 Technical Guidance (download at [www.flowstobay.org](http://www.flowstobay.org)).<sup>26</sup>

<sup>24</sup> To qualify for the location credit, at least 50% of the project’s site must be located within the ¼ mile or ½ mile radius of an existing or planned transit hub, as defined on page 1, footnote 2. A planned transit hub is a station on the MTC’s Regional Transit Expansion Program list, per MTC’s Resolution 3434 (revised April 2006), which is a regional priority funding plan for future transit stations in the San Francisco Bay Area. To qualify for the PDA location credit, 100% of the project site must be located within a PDA, as defined on page 1, footnote 3.

<sup>25</sup> The at-grade surface parking must be treated with LID treatment measures.

<sup>26</sup> TAPE certification is used in order to satisfy Special Project’s reporting requirements in the MRP.

## Worksheet G (For municipal staff use only)

**G-1 Alternative Certification:** Were the treatment and/or HM control sizing and design reviewed by a qualified third-party professional that is not a member of the project team or agency staff?

Yes     No    Name of Reviewer \_\_\_\_\_

**G-2 High Priority Site:** High Priority Sites can include those located in or within 100 feet of a sensitive habitat, Area of Special Biological Significance (ASBS), body of water, or on sites with slopes (subject to monthly inspections from Oct 1 to April 30.)

Yes     No    If yes, then add site to Staff's Monthly Rainy Season Construction Site Inspection List

### Operations and Maintenance (O&M) Submittals

**G-3** Stormwater Treatment Measure and/HM Control Owner or Operator's Information:

Name: \_\_\_\_\_

Address: \_\_\_\_\_

Phone: \_\_\_\_\_ Email: \_\_\_\_\_

➤ Applicant must call for inspection and receive inspection within 45 days of installation of treatment measures and/or hydromodification management controls.

The following questions apply to C.3 Regulated Projects and Hydromodification Management Projects.

	Yes	No	N/A
G-3.1 Was maintenance plan submitted?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
G-3.2 Was maintenance plan approved?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
G-3.3 Was maintenance agreement submitted? (Date executed: _____)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

➤ Attach the executed maintenance agreement as an appendix to this checklist.

**G-4 Annual Operations and Maintenance (O&M) Submittals (for municipal staff use only):**

For C.3 Regulated Projects and Hydromodification Management Projects, indicate the dates on which the Applicant submitted annual reports for project O&M:

\_\_\_\_\_

**G-5 Comments (for municipal staff use only):**

#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#
#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#
#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#
#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#
#	#	#	#	#	#	#	#	#	#	#	#	#	#	#	#

**G-6 NOTES (for municipal staff use only):**

Section I Notes: \_\_\_\_\_

Worksheet A Notes: \_\_\_\_\_

Worksheet B Notes: \_\_\_\_\_

Worksheet C Notes: \_\_\_\_\_

Worksheet D-1 Notes: \_\_\_\_\_

Worksheet D-2 Notes: \_\_\_\_\_

Worksheet E Notes: \_\_\_\_\_

Worksheet F Notes: \_\_\_\_\_

**G-7 Project Close-Out (for municipal staff use only):**

	<b>Yes</b>	<b>No</b>	<b>NA</b>
7.1 Were final Conditions of Approval met?	<input type="checkbox"/>	<input type="checkbox"/>	
7.2 Was initial inspection of the completed treatment/HM measure(s) conducted? (Date of inspection: _____)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7.3 Was maintenance plan submitted? (Date executed: _____)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7.4 Was project information provided to staff responsible for O&M verification inspections? (Date provided to inspection staff: _____)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

#

**G-8 Project Close-Out (Continued -- for municipal staff use only):**

Name of staff confirming project is closed out: \_\_\_\_\_

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Name of O&M staff receiving information: \_\_\_\_\_

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

**City of Atherton  
Hydromodification Management (HM)  
Control Area Boundary for Selected Areas \*  
Map 1 of 1**



\* This map series includes only areas where the HM control area boundary does NOT follow major roadways.

**Legend**

County Assessor Parcel	— Creek or Engineered Channel
Subject to HM Requirements	— Underground culvert or storm drain
Exempt Area	

Map Revised August 2010

## **APPENDIX E**

### **DRAINAGE CALCULATIONS FROM 2001 TOWN-WIDE DRAINAGE STUDY**

Contents:

1. Memo
2. Atherton Channel Drainage Basins, sheets 1, 2 & 3 with drainage calculations
3. Ridgeview & Stockbridge/Selby Drainage Basins with drainage calculations
4. Selby/El Camino System Drainage Basins with drainage calculations
5. Middlefield/Marsh/Bay System Drainage Basins with drainage calculations
6. Supplemental information (hydraulic calculation charts and tables)

## MEMORANDUM

**TO:** **DATE:** February 7, 2001

**FROM:** **PROJ #:** SJ0709

**SUBJECT:** Summary of Drainage Calculations

---

### Design Criteria

- 10-year event – Prevent flooding of streets and private property. Runoff from these storms should be collected and conveyed by storm drainage inlets, pipes and ditches. At this level standing water and surface flow of runoff should be minimized.
- 25-year event – Prevent flooding of intersections and collector streets.
- 100-year event – Prevent flooding from Atherton Creek.
- Runoff from storms in excess of the 10-year event, up through the 100 year event should be managed using established and maintained overland flow paths that prevent damage to the community.

### Rational Method

The rational method was used for calculation of runoff for the Town of Atherton. The total drainage area is 4,760 acres. This area on the high side of what is normal for the use of rational method. The calculated peak flow using the rational method was verified using the Corp of Engineers HEC1 hydrology computer program.

The hydraulic calculations for the rational method were based on the Caltrans District 04 procedures, maps and charts.

**Drainage Areas.** The areas are defined based on the interpretation of the existing topographic information data. Major flow paths and drainage features were selected and the drainage areas that are tributary to these paths were defined.

**Rainfall.** The design rainfall intensity of 1.25 per hour for the one hour, 1-in-100 year isohyet was taken from the District 04 Map “I”, dated September 1974. The Design Rainfall Variations Map “V” was used with Chart “K” to determine the intensity variations as a function of duration and frequency. Within the project limit, a subzone B2 was determined for use in subsequent

calculations of rainfall intensities for various return periods. Related charts used to determine the rainfall intensities are presented in the supplemental Information portion of this Appendix D.

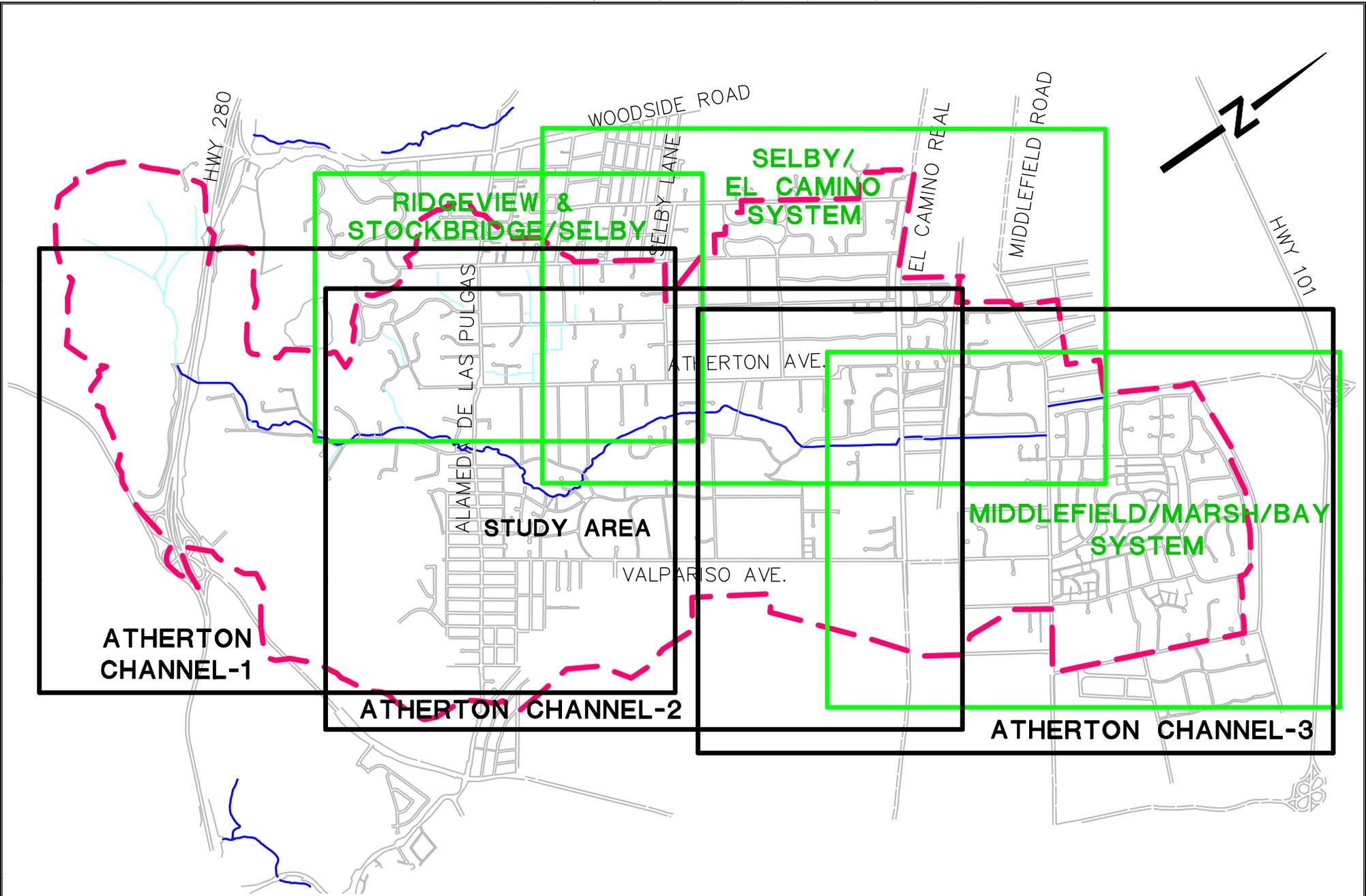
**Runoff Coefficients.** The runoff coefficient is a factor used to assess the amount of rainfall that leaves an area after it has fallen on the area. The steepness of the area, the amount of surface ponding that may occur, vegetative cover and the ability of the surface to absorb water affect this factor. While the runoff coefficient is used as a constant in the calculation, this value will vary throughout the year reflecting the ability of the soil to absorb moisture and the state of the vegetative cover that exists. It is well known that the amount of runoff from the hills increases through the course of the rainy season. The maximum runoff occurs when the soil has become saturated and is no longer capable of absorbing water. The conservative value for runoff coefficient assumed for this study is 0.50.

The runoff coefficient was verified by comparing different methods of calculating this value. The first method was based on values which conformed to those listed in the Caltrans “Highway Design Manual – 5<sup>th</sup> Edition”, Chapter 800, “Santa Clara County Drainage Manual”, and drainage calculations performed by other engineers for this area. The second method calculated the average runoff coefficient for a 1-acre and a 2-acre parcel. The last method calculated the percentage of growth in the community to estimate the change in C value from historic runoff calculations. Table 1 presents the summary of the comparison:

**Table 1. Runoff Coefficient Comparison**

	Method Used to Derive “C” Value		
	Caltrans/CSC/Stanford/BKF	One & Two Acre Lots	% Growth Factor
“C” Value	0.50	0.495	0.41

**Time of Concentration.** The time of concentration for the rainfall is the time for the rainfall to flow across the area and through the gutters or pipes to the lowest point in the area for which the flow is being calculated. The initial time of concentration for each area is calculated using Figure 816.6A of the Caltrans Highway Design Manual for channel and/or pipe travel time. A minimum time of concentration of 10 minutes is used. The travel time along the flow path analyzed is added to this initial time of concentration for subsequent downstream areas.



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## TOWN WIDE DRAINAGE STUDY KEY MAP STUDY AREA

PREPARED FOR: TOWN OF ATHERTON

DATE SUBMITTED:

SHEET NUMBER

OF SHEETS

JOB NUMBER  
SJ0709

JOB TITLE: **STORM SEWER DESIGN** LOCATION: **CITY: ATHERTON COUNTY: SAN MATEO** RAINFALL CURVES: **SOURCE: CALTRANS** TIME OF CONCENTRATION (UNIMP): **DRAINAGE MANUAL**

DES.: **R/NFE DATE:** LAND USE: **DEVELOPED** TIME OF CONCENTRATION (IMP) PIPE TYPE: **n= 0.02 & 0.035**  
 CHK.: **NFE DATE:** WEIGHTED COEFFICIENT: **0.50** GUTTER TIME MIN. **TOTAL INLET TIME MIN. fps**

Line Designation or Street	Description		Incremental Area, A (Acres)	Runoff Coefficient, C	Product, Area x Coefficient	Sum of Products, Area x Coefficients	Duration, Min. Time of Concentration	Intensity (100-Year, Tc) Chart "K",	10-year Intensity Ratio (Chart	25-year Intensity Ratio (Chart	Rainfall Intensity, I (inches/Hour)	Runoff, cfs Q=CIA	Length, Feet	Pipe Dia. Inches	Slope, Per Cent	Depth of Flow, Inches	Velocity, fps	Flow Time, Min.	Fall, Feet	Invert Elevation		Remarks
	From	To																		In	Out	
<b>Atherton Channel Drainage Areas (100 Year Event)</b>																						
<b>AREA A</b>		1	321.8	0.50	161	160.9	54.4	1.31	0.000	0.00	1.31	210.8										
<b>AREA B</b>		1	116.2	0.50	58.1	58.1	45.9	1.43	0.000	0.00	1.43	83.1										
		1				219.0	54.4	1.31	0.000	0.00	1.31	286.9										
	1	1A					58.1						2316		2.59%	36.5	10.4	3.7	60.0	220.0	160.0	Channel - Junipero to Walsh
<b>AREA C</b>		1A	104.2	0.50	52.1	52.1	51.9	1.35	0.000	0.00	1.35	70.3										
<b>AREA D</b>		1A	113.6	0.50	56.8	56.8	45.4	1.44	0.000	0.00	1.44	81.8										
		1A				327.9	58.1	1.27	0.000	0.00	1.27	416.4										
	1A	2					61.1						1553		1.16%	55.1	8.6	3.02	18.0	160.0	142.0	Channel - Walsh to Reservoir
<b>AREA F</b>		2	29.2	0.50	14.6	14.6	21.7	2.07	0.000	0.00	2.07	30.2										
		2				342.5	61.1	1.24	0.000	0.00	1.24	423.0										
	2	3					63.4						924		0.65%	64.4	6.9	2.22	6.0	142.0	136.0	Channel - Reservoir to Bellbro
<b>AREA E</b>		3	69.4	0.50	34.7	34.7	37.9	1.58	0.000	0.00	1.58	54.8										
<b>AREA G</b>		3	272.3	0.50	136	136.2	60.6	1.24	0.000	0.00	1.24	168.8										
		3				513.4	63.4	1.22	0.000	0.00	1.22	626.3										
	3	4					63.9						362		1.93%	59.6	11.5	0.53	7.0	136.0	129.0	Channel - Bellbrook to Walsh (
<b>AREA I</b>		4	16.7	0.50	8.35	8.4	19.8	2.19	0.000	0.00	2.19	18.3										
		4				521.7	63.9	1.21	0.000	0.00	1.21	631.3										

JOB TITLE: **STORM SEWER DESIGN** LOCATION: **CITY: ATHERTON** RAINFALL CURVES: SOURCE: **CALTRANS** TIME OF CONCENTRATION (UNIMP):  
COUNTY: **SAN MATEO** **DRAINAGE MANUAL** FREQUENCY:  
**LAND USE: DEVELOPED** TIME OF CONCENTRATION (IMP) PIPE TYPE:  
DES.: **R/NFE DATE:** GUTTER TIME MIN. n= 0.02 & 0.035  
CHK.: **NFE DATE:** WEIGHTED COEFFICIENT: 0.50 TOTAL INLET TIME MIN. **fps**

Line Designation or Street	Description		Incremental Area, A (Acres)	Runoff Coefficient, C	Product, Area x Coefficient	Sum of Products, Area x Coefficients	Duration, Min. Time of Concentration	Intensity (100-Year, Tc) Chart "K",	10-year Intensity Ratio (Chart	25-year Intensity Ratio (Chart	Rainfall Intensity, I (inches/Hour)	Runoff, cfs Q=CIA	Length, Feet	Pipe Dia. Inches	Slope, Per Cent	Depth of Flow, Inches	Velocity, fps	Flow Time, Min.	Fall, Feet	Invert Elevation		Remarks
	From	To																		In	Out	
	4	4A					65.5					764		0.65%	78.7	7.7	1.66	5.0	129.0	124.0	Channel - Walsh (Court) to Ta	
<b>AREA H</b>		4A	68.6	0.50	34.3	34.3	36.1	1.61	0.000	0.00	1.61	55.2										
		4A				556.0	65.5	1.19	0.000	0.00	1.19	661.6										
	4A	5					68.6					1252		0.48%	86.7	6.9	3.01	6.0	124.0	118.0	Channel - Tallwood to Broadacr	
<b>AREA K</b>		5	55.5	0.50	27.8	27.8	29.3	1.79	0.000	0.00	1.79	49.7										
		5				583.8	68.6	1.16	0.000	0.00	1.16	677.2										
	5	6					70.0					447		0.22%	106	5.2	1.43	1.0	118.0	117.0	Channel - Broadacres to Alamed	
<b>AREA J</b>		6	18.8	0.50	9.4	9.4	25.3	1.92	0.000	0.00	1.92	18.0										
		6				593.2	70.0	1.15	0.000	0.00	1.15	682.1										
	6	7					71.4					1309		1.30%	51.7	15.4	1.42	17.0	117.0	100.0	Channel - Alameda to Camino Al	
<b>AREA E1</b>		7A	175.9	0.50	88	88.0	44.1	1.47	0.000	0.00	1.47	129.3										
		7A				88.0	44.1	1.47	0.000	0.00	1.47	129.3										
	7A	7B					51.9					2628		0.38%	78.1	5.7	7.72	10.0	130.0	120.0	Box culvert 3.5'X3.5'	
<b>AREA L</b>		7B	120.4	0.50	60.2	60.2	34.5	1.65	0.000	0.00	1.65	99.3										
		7B				148.2	51.9	1.35	0.000	0.00	1.35	200.0										

JOB TITLE: **STORM SEWER DESIGN** LOCATION: **CITY: ATHERTON** RAINFALL CURVES: SOURCE: **CALTRANS** TIME OF CONCENTRATION (UNIMP):  
COUNTY: **SAN MATEO** **DRAINAGE MANUAL** FREQUENCY:  
**RUNOFF COEFFICIENTS:** LAND USE: **DEVELOPED** TIME OF CONCENTRATION (IMP) PIPE TYPE:  
DES.: **R/NFE DATE:** GUTTER TIME MIN. n= 0.02 & 0.035  
CHK.: **NFE DATE:** WEIGHTED COEFFICIENT: 0.50 TOTAL INLET TIME MIN. **fps**

Line Designation or Street	Description		Incremental Area, A (Acres)	Runoff Coefficient, C	Product, Area x Coefficient	Sum of Products, Area x Coefficients	Duration, Min. Time of Concentration	Intensity (100-year, Ic) Chart "K",	10-year Intensity Ratio (Chart	25-year Intensity Ratio (Chart	Rainfall Intensity, I (inches/Hour)	Runoff, cfs Q=CIA	Length, Feet	Pipe Dia. Inches	Slope, Per Cent	Depth of Flow, Inches	Velocity, fps	Flow Time, Min.	Fall, Feet	Invert Elevation		Remarks
	From	To																		In	Out	
	7B	7					54.2					1865		1.07%	42.8	13.4	2.33	20.0	120.0	100.0	Ex. 60" cmp	
<b>AREA N</b>		7	44.0	0.50	22	22.0	34.1	1.66	0.000	0.00	1.66	36.5										
		7				763.3	71.4	1.14	0.000	0.00	1.14	870.2										
		7					73.6					1599		0.56%	72.5	12.0	2.23	9.0	100.0	91.0	Channel - Camino Al Lago to Co	
<b>AREA M</b>		8	84.0	0.50	42	42.0	63.1	1.22	0.000	0.00	1.22	51.2										
		8				805.3	73.6	1.13	0.000	0.00	1.13	910.0										
		8					74.5					661		0.61%	72.6	12.5	0.88	4.0	91.0	87.0	Channel - Cowell to Monte Vist	
<b>AREA D1</b>		9A	144.7	0.50	72.4	72.4	65.5	1.20	0.000	0.00	1.20	86.8										
		9A				72.4	65.5	1.20	0.000	0.00	1.20	86.8										
		9A					69.5					2474		0.61%	34.3	10.3	3.99	15.0	102.0	87.0	Ex. 42" @ 1% assumed	
<b>AREA P</b>		9	57.2	0.50	28.6	28.6	55.9	1.29	0.000	0.00	1.29	36.9										
		9				906.3	74.5	1.12	0.000	0.00	1.12	1015.0										
		9					78.9					3226		0.56%	70.8	12.4	4.34	18.0	87.0	69.0	Channel - Monte Vista to Barry	
<b>AREA O</b>		10	57.2	0.50	28.6	28.6	69.3	1.16	0.000	0.00	1.16	33.2										
		10				934.9	78.9	1.09	0.000	0.00	1.09	1019.0										
		10					81.1					903		0.11%	106	6.6	2.28	1.0	69.0	68.0	Channel - Barry to Elena	



JOB TITLE: **STORM SEWER DESIGN** LOCATION: **CITY: ATHERTON** RAINFALL CURVES: SOURCE: **CALTRANS** TIME OF CONCENTRATION (UNIMP):  
COUNTY: **SAN MATEO** **DRAINAGE MANUAL** FREQUENCY:  
**RUNOFF COEFFICIENTS:** TIME OF CONCENTRATION (IMP) PIPE TYPE:  
DES.: **R/NFE DATE:** LAND USE: **DEVELOPED** GUTTER TIME MIN. n= 0.02 & 0.035  
CHK.: **NFE DATE:** WEIGHTED COEFFICIENT: **0.50** TOTAL INLET TIME MIN. **fps**

Line Designation or Street	Description		Incremental Area, A (Acres)	Runoff Coefficient, C	Product, Area x Coefficient	Sum of Products, Area x Coefficients	Duration, Min. Time of Concentration	Intensity (100-year, Tc) Chart "K",	10-year Intensity Ratio (Chart	25-year Intensity Ratio (Chart	Rainfall Intensity, I (inches/Hour)	Runoff, cfs Q=CIA	Length, Feet	Pipe Dia. Inches	Slope, Per Cent	Depth of Flow, Inches	Velocity, fps	Flow Time, Min.	Fall, Feet	Invert Elevation		Remarks
	From	To																		In	Out	
	11C	11					84.0					4431		0.43%	30.4	10.8	6.84	19.0	87.00	68.00	Assume 48" pipe, S=0.5%	
<b>AREA R</b>		11	185.0	0.50	92.5	92.5	90.6	1.01	0.000	0.00	1.01	93.4										
		11				1163.2	90.6	1.01	0.000	0.00	1.01	1174.8										
	11	12					93.9					1668		0.18%	102	8.4	3.3	3.0	68.0	65.0	Channel -Elena to Isabella	
<b>AREA S</b>		12	66.1	0.50	33.1	33.1	88.1	1.03	0.000	0.00	1.03	34.0										
		12				1196.3	93.9	0.99	0.000	0.00	0.99	1184.3										
	12	13					97.3					2290		0.39%	84.1	11.3	3.39	9.0	65.0	56.0	Channel -Isabella to ECR	
<b>AREA A1</b>		13B	138.3	0.50	69.2	69.2	104.0	0.94	0.000	0.00	0.94	65.0										
		13B				69.2	104.0	0.94	0.000	0.00	0.94	65.0										
	13B	13C					110.2					1759		0.45%	8.9	4.7	6.2	8.0	69.0	61.0	Gutter - ECR	
<b>AREA T</b>		13A	63.1	0.50	31.6	31.6	59.5	1.26	0.000	0.00	1.26	39.8										
		13A				31.6	59.5	1.26	0.000	0.00	1.26	39.8										
<b>AREA V</b>		13C	90.4	0.50	45.2	45.2	75.5	1.12	0.000	0.00	1.12	50.6										
		13C				145.9	110.2	0.91	0.000	0.00	0.91	132.8										
	13C	13					113.1					1024		0.49%	11.4	5.8	2.92	5.0	61.0	56.0	Gutter - Alejandra	
<b>AREA U</b>		13	69.8	0.50	34.9	34.9	76.1	1.11	0.000	0.00	1.11	38.7										

JOB TITLE: **STORM SEWER DESIGN** LOCATION: **CITY: ATHERTON** RAINFALL CURVES: SOURCE: **CALTRANS** TIME OF CONCENTRATION (UNIMP):  
COUNTY: **SAN MATEO** **DRAINAGE MANUAL** FREQUENCY:  
**RUNOFF COEFFICIENTS:** TIME OF CONCENTRATION (IMP) PIPE TYPE:  
DES.: **R/NFE DATE:** LAND USE: **DEVELOPED** GUTTER TIME MIN. n= 0.02 & 0.035  
CHK.: **NFE DATE:** WEIGHTED COEFFICIENT: **0.50** TOTAL INLET TIME MIN. **fps**

Line Designation or Street	Description		Incremental Area, A (Acres)	Runoff Coefficient, C	Product, Area x Coefficient	Sum of Products, Area x Coefficients	Duration, Min. Time of Concentration	Intensity (100-year, Tc) Chart "K",	10-year Intensity Ratio (Chart	25-year Intensity Ratio (Chart	Rainfall Intensity, I (inches/Hour)	Runoff, cfs Q=CIA	Length, Feet	Pipe Dia. Inches	Slope, Per Cent	Depth of Flow, Inches	Velocity, fps	Flow Time, Min.	Fall, Feet	Invert Elevation		Remarks
	From	To																		In	Out	
		13				1377.1	113.1	0.90	0.000	0.00	0.90	1238.0										
	13	14					115.5						983		0.10%	120	6.8	2.4	1.0	56.0	55.0	Channel -ECR to Main Line
<b>AREA F1</b>		14A	21.5	0.50	10.8	10.8	54.4	1.31	0.000	0.00	1.31	14.1										
		14A				10.8	54.4	1.31	0.000	0.00	1.31	14.1										
	14A	14B					57.0						810		0.49%	17.3	5.2	2.58	4.0	50.0	46.0	EX. 27" pipe
<b>AREA G1</b>		14B	12.5	0.50	6.25	6.3	42.0	1.50	0.000	0.00	1.50	9.4										
		14B				17.0	57.0	1.30	0.000	0.00	1.30	22.1										
	14B	14					59.1						758		0.53%	24.2	5.9	2.14	4.0	46.0	42.0	Ex. 27" pipe
<b>AREA W</b>		14	66.9	0.50	33.5	33.5	94.1	0.99	0.000	0.00	0.99	33.1										
		14				1427.5	115.5	0.89	0.000	0.00	0.89	1263.3										
	14	15					118.3						2340		0.64%	76.6	13.8	2.83	15.0	55.0	40.0	Channel -Mian Line to Middelfi
<b>AREA Y</b>		15	283.4	0.50	142	141.7	107.4	0.92	0.000	0.00	0.92	130.4										
		15				1569.2	118.3	0.87	0.000	0.00	0.87	1365.2										
	15	16					119.7						644		0.16%	175	7.8	1.38	1.0	40.0	39.0	Box -Middlefield
<b>AREA X</b>		16	18.5	0.50	9.25	9.3	46.1	1.43	0.000	0.00	1.43	13.2										
		16				1578.5	119.7	0.87	0.000	0.00	0.87	1373.3										

JOB TITLE: **STORM SEWER DESIGN**      LOCATION: **CITY: ATHERTON**      RAINFALL CURVES: **SOURCE: CALTRANS**      TIME OF CONCENTRATION (UNIMP):  
COUNTY: **SAN MATEO**      **DRAINAGE MANUAL**  
FREQUENCY:  
RUNOFF COEFFICIENTS:      TIME OF CONCENTRATION (IMP) PIPE TYPE:  
DES.: **R/NFE DATE:**      LAND USE: **DEVELOPED**      GUTTER TIME      MIN.      n= 0.02 & 0.035  
CHK.: **NFE DATE:**      WEIGHTED COEFFICIENT:      0.50      TOTAL INLET TIME MIN.      **fps**

Line Designation or Street	Description		Incremental Area, A (Acres)	Runoff Coefficient, C	Product, Area x Coefficient	Sum of Products, Area x Coefficients	Duration, Min. Time of Concentration	Intensity (100-year, Ic) Chart "k",	10-year Intensity Ratio (Chart	25-year Intensity Ratio (Chart	Rainfall Intensity, I (inches/Hour)	Runoff, cfs Q=CIA	Length, Feet	Pipe Dia. Inches	Slope, Per Cent	Depth of Flow, Inches	Velocity, fps	Flow Time, Min.	Fall, Feet	Invert Elevation		Remarks	
	From	To																		In	Out		
	16	17					124.0						3078		0.45%	76.4	12.0	4.28	14.0	39.0	25.0	Box -Middlefield to End on Mar	
<b>AREA Z</b>		17	191.6	0.50	95.8	95.8	102.6	0.95	0.000	0.00	0.95	91.0											
<b>TOTAL</b>		17	3348.5			1674.3	124.0	0.85	0.000	0.00	0.85	1423.1											Total discharge for area

	A	B	C	D	E	F	G
1	Area	C	L (ft)	Top Elev. (ft)	Bottom Elev. (ft)	S (ft/ft)	Tc (min)
2	Atherton Channel Drainage Areas						
3	A	0.5	5557	400	220	0.032	54.41
4	B	0.5	4531	400	220	0.040	45.90
5	C	0.5	4743	300	160	0.030	51.85
6	D	0.5	4046	300	160	0.035	45.42
7	E	0.5	2890	240	136	0.036	37.89
8	F	0.5	1443	240	142	0.068	21.66
9	G	0.5	6377	320	136	0.029	60.58
10	H	0.5	3519	320	124	0.056	36.14
11	I	0.5	1614	300	129	0.106	19.76
12	J	0.5	1630	200	117	0.051	25.34
13	K	0.5	2660	300	118	0.068	29.34
14	L	0.5	3214	300	120	0.056	34.48
15	M	0.5	3406	125	91	0.010	63.07
16	N	0.5	2047	160	100	0.029	34.14
17	O	0.5	5574	110	72	0.007	91.62
18	P	0.5	2520	110	87	0.009	55.89
19	Q	0.5	3204	91	69	0.007	69.29
20	R	0.5	5199	101	68	0.006	90.61
21	S	0.5	3240	76	65	0.003	88.12
22	T	0.5	2289	84	69	0.007	59.49
23	U	0.5	3383	75	56	0.006	76.14
24	V	0.5	3205	78	61	0.005	75.53
25	W	0.5	3861	69	55	0.004	94.11
26	X	0.5	1488	50	39	0.007	46.07
27	Y	0.5	5707	65	40	0.004	107.43
28	Z	0.5	5401	50	25	0.005	102.61
29	A1	0.5	5118	90	69	0.004	103.98
30	B1	0.5	1445	110	95	0.010	40.55
31	C1	0.5	5556	150	87	0.011	77.20
32	D1	0.5	6591	260	102	0.024	65.51
33	E1	0.5	4416	320	130	0.043	44.13
34	O1	0.5	1858	110	97	0.007	52.44
35	O2	0.5	2252	100	79	0.009	52.46
36	O3	0.5	2352	80	72	0.003	75.03
37	F1	0.5	1515	57	50	0.005	54.38
38	G1	0.5	972	57	52	0.005	42.02

JOB TITLE: **STORM SEWER DESIGN** LOCATION: **CITY: ATHERTON COUNTY: SAN MATEO**

RAINFALL CURVES: **SOURCE: CALTRANS** TIME OF CONCENTRATION (UNIMP): **DRAINAGE MANUAL**

FREQUENCY:

DES.: **NFE DATE:** RUNOFF COEFFICIENTS: LAND USE: **DEVELOPED** TIME OF CONCENTRATION (IMP): **GUTTER TIME MIN. n= 0.015**

CHK.: **NFE DATE:** WEIGHTED COEFFICIENT: **0.50** TOTAL INLET TIME MIN. **fps**

Line Designation or Street	Description		Incremental Area, A (Acres)	Runoff Coefficient, C	Product, Area x Coefficient	Sum of Products, Area x Coefficients	Duration, Min. Time of Concentration	Intensity (100-year, Tc) Chart "K", 10-Year	Intensity Ratio (Chart "K", Sub 2) 25-Year	Intensity Ratio (Chart "R")	Rainfall Intensity, I (inches/Hour)	Runoff, cfs Q=CIA	Length, Feet	Pipe Dia. Inches	Slope, Per Cent	Depth of Flow, Inches	Velocity, fps	Flow Time, Min.	Fall, Feet	Invert Elevation		Remarks
	From	To																		In	Out	
<b>Atherton and Elena Drainage Areas (10 year event)</b>																						
<b>AREA 01</b>		11D	48.6	0.50	24.3	24.3	52.4	1.34	0.691		0.93	22.5										
		11D				24.3	52.4	1.34	0.691		0.93	22.5										
		11D					58.1						1962		0.92%	22.2	5.8	5.65	18.0	97.00	79.00	Assume 30" pipe, S=0.5%
<b>AREA 02</b>		11E	43.5	0.50	21.8	21.8	52.5	1.34	0.691		0.93	20.1										
		11E				46.1	58.1	1.26	0.693		0.87	40.2										
		11E					63.7						2208		0.32%	29	6.6	5.58	7.0	79.00	72.00	Assume 36" pipe, S=0.5%
<b>AREA 03</b>		11A	15.1	0.50	7.55	7.6	75.0	1.11	0.689		0.76	5.8										
		11A				53.6	75.0	1.11	0.689		0.76	41.0										

	A	B	C	D	E	F	G
1	Area	C	L (ft)	Top Elev. (ft)	Bottom Elev. (ft)	S (ft/ft)	Tc (min)
2	El Camino/Selby Drainage Area						
3	O1	0.5	1858	110	97	0.007	52.44
4	O2	0.5	2252	100	79	0.009	52.46
5	O3	0.5	2352	80	72	0.003	75.03

JOB TITLE:		LOCATION										RAINFALL CURVES				TIME OF CONCENTRATION (UNIMP)					
STORM SEWER DESIGN		CITY: <b>ATHERTON</b> COUNTY: <b>SAN MATEO</b>										SOURCE: <b>CALTRANS</b>				<b>DRAINAGE MANUAL</b>					
		RUNOFF COEFFICIENTS:										FREQUENCY:				TIME OF CONCENTRATION (IMP) PIPE TYPE:					
DES.: R/NFE DATE:		LAND USE: <b>DEVELOPED</b>										GUTTER TIME MIN.				n= 0.02 & 0.035					
CHK.: NFE DATE:		WEIGHTED COEFFICIENT: 0.50										TOTAL INLET TIME MIN.				fps					
Line Designation or Street	Description		Incremental Area, A (Acres)	Runoff Coefficient, C	Product, Area x Coefficient	Sum of Products, Area x Coefficients	Duration, Min. Time of Concentration	Intensity (100-year, Tc) Chart "K",	10-year Intensity Ratio (Chart 25-year Intensity Ratio (Chart "R"))	Rainfall Intensity, I (inches/Hour)	Runoff, cfs Q=CIA	Length, Feet	Pipe Dia. Inches	Slope, Per Cent	Depth of Flow, Inches	Velocity, fps	Flow Time, Min.	Fall, Feet	Invert Elevation		Remarks
	From	To																	In	Out	
<b>Station Drainage Areas (10 year event)</b>																					
<b>AREA F1</b>		14A	21.5	0.50	10.8	10.8	54.4	1.31	0.691	0.00	0.90	9.7									
		14A				10.8	54.4	1.31	0.691	0.00	0.90	9.7									
		14A	14B				57.2					810	0.49%	13.7	4.8	2.81	4.0	50.0	46.0	Ex. 27" pipe	
<b>AREA F1</b>		14B	12.5	0.50	6.25	6.3	42.0	1.50	0.692	0.00	1.04	6.5									
		14B				17.0	57.2	1.31	0.691	0.00	0.90	15.4									
		14B	14				59.8					758	0.53%	13.7	4.8	2.63	4.0	46.0	42.0	Ex. 27" pipe	
<b>Station Drainage Areas (25 year event)</b>																					
<b>AREA F1</b>		14A	21.5	0.50	10.8	10.8	54.4	1.31	0.691	0.8155	1.07	11.5									
		14A				10.8	54.4	1.31	0.691	0.8155	1.07	11.5									
		14A	14B				57.1					810	0.49%	15.2	5.0	2.7	4.0	50.0	46.0	Ex. 27" pipe	
<b>AREA F1</b>		14B	12.5	0.50	6.25	6.3	42.0	1.50	0.692	0.8165	1.22	7.7									
		14B				17.0	57.1	1.30	0.691	0.8155	1.06	18.0									
		14B	14				59.4					758	0.53%	21	5.4	2.33	4.0	46.0	42.0	Ex. 27" pipe	







JOB TITLE:		LOCATION										RAINFALL CURVES				TIME OF CONCENTRATION (UNIMP)					
STORM SEWER DESIGN		CITY: <b>ATHERTON</b> COUNTY: <b>SAN MATEO</b>										SOURCE: <b>CALTRANS</b>				<b>DRAINAGE MANUAL</b>					
		RUNOFF COEFFICIENTS:										FREQUENCY:				TIME OF CONCENTRATION (IMP) PIPE TYPE:					
DES.: <b>RBR</b> DATE:		LAND USE: <b>DEVELOPED</b>										GUTTER TIME MIN.				n= 0.015					
CHK.: <b>NFE</b> DATE:		WEIGHTED COEFFICIENT:										0.50				TOTAL INLET TIME MIN. fps					
Line Designation or Street	Description		Incremental Area, A (Acres)	Runoff Coefficient, C	Product, Area x Coefficient	Sum of Products, Area x Coefficients	Duration, Min. Time of Concentration	Intensity (100 year, Tc) Chart "K", Zone C	10-year Intensity Ratio (Chart "K", Sub-2)	Rainfall Intensity, I (inches/Hour)	Runoff, cfs Q=CIA	Length, Feet	Pipe Dia. Inches	Slope, Per Cent	Depth of Flow, Inches	Velocity, fps	Flow Time, Min.	Fall, Feet	Invert Elevation		Remarks
	From	To																	In	Out	
<b>Stockbridge/Selby Drainage Areas (10 Year Event)</b>																					
<b>AREA K</b>	4A		8.4	0.50	4.2	4.2	16.5	2.40	0.699	1.68	7.0										
	4A				4.2	16.5	2.40	0.699	1.68	7.0											
	4A	4					22.7				2184		4.81%	2.6	5.9	6.15	105.0	230.00	125.00	Gutter - On Fletcher Ridgeview	
<b>AREA I</b>	4		62.9	0.50	31.5	31.5	32.8	1.69	0.694	1.17	36.9										
	4				35.7	32.8	1.69	0.694	1.17	41.8											
	4	5					36.0				915		0.87%	7	4.9	3.13	8.0	125.00	117.00	Gutter - Ridgeview to Alameda Assume gutter flow pipe under	
<b>AREA H</b>	5		38.7	0.50	19.4	19.4	23.7	2.00	0.696	1.39	26.9										
	5				55.0	36.0	1.61	0.693	1.12	61.4											
	5	6					36.5				270		2.59%	6.6	8.1	0.56	7.0	117.00	110.00	Gutter - on Alameda Fletcher t Assume gutter flow pipe under	
<b>AREA G</b>	6		29.8	0.50	14.9	14.9	21.9	2.08	0.697	1.45	21.6										
	6				69.9	36.5	1.60	0.694	1.11	77.6											
	6	7					38.4				624		0.80%	9	5.5	1.89	5.0	110.00	105.00	Gutter Alameda to Mulberry	
<b>AREA F</b>	7		9.9	0.50	4.95	5.0	25.9	1.90	0.695	1.32	6.5										
	7				74.9	38.4	1.57	0.693	1.09	81.4											
	7	2A					46.9				2552		0.59%	9.7	5.0	8.54	15.0	105.00	90.00	Gutter - Mulberry to Selby	
<b>AREA J</b>	2A		31.3	0.50	15.7	15.7	42.9	1.49	0.692	1.03	16.1										
	2A				90.5	46.9	1.41	0.692	0.98	88.2											
	2A	2					50.9				1365		0.81%	9.4	5.7	3.98	11.0	90.00	79.00	Gutter - Mulberry to Selby	

JOB TITLE:		LOCATION										RAINFALL CURVES				TIME OF CONCENTRATION (UNIMP)						
STORM SEWER DESIGN		CITY: <b>ATHERTON</b> COUNTY: <b>SAN MATEO</b>										SOURCE: <b>CALTRANS</b>				<b>DRAINAGE MANUAL</b>						
		RUNOFF COEFFICIENTS:										FREQUENCY:				TIME OF CONCENTRATION (IMP) PIPE TYPE:						
DES.: <b>RBR</b> DATE:		LAND USE: <b>DEVELOPED</b>										GUTTER TIME MIN.				n= 0.015						
CHK.: <b>NFE</b> DATE:		WEIGHTED COEFFICIENT:										0.50				TOTAL INLET TIME MIN. fps						
Line Designation or Street	Description		Incremental Area, A (Acres)	Runoff Coefficient, C	Product, Area x Coefficient	Sum of Products, Area x Coefficients	Duration, Min. Time of Concentration	Intensity (100 year, Tc) Chart "K", Zone C	10-year Intensity Ratio (Chart "K", Sub-2)		Rainfall Intensity, I (Inches/Hour)	Runoff, cfs Q=CIA	Length, Feet	Pipe Dia. Inches	Slope, Per Cent	Depth of Flow, Inches	Velocity, fps	Flow Time, Min.	Fall, Feet	Invert Elevation		Remarks
	From	To																		In	Out	
<b>AREA A</b>	1		67.2	0.50	33.6	33.6	38.5	1.55	0.693	1.07	36.1											
	1				33.6	38.5	1.55	0.693		1.07	36.1											
	1	2					41.6					1141		1.84%	5.8	6.2	3.06	21.0	100.00	79.00	Gutter - Greenways to Stck@ Ma Assume gutter flow pipe under	
<b>AREA B</b>	2		10.9	0.50	5.45	5.5	31.8	1.71	0.694	1.19	6.5											
<b>AREA C</b>	2		53.8	0.50	26.9	26.9	41.5	1.50	0.692	1.04	27.9											
	2				156.5	50.9	1.36	0.691		0.94	147.0											
	2	3					57.0					2076		0.58%	12.2	5.7	6.04	12.0	79.00	67.00	Gutter - on Stck Marymont to E Assume gutter flow pipe under	
<b>AREA E</b>	8		69.4	0.50	34.7	34.7	60.7	1.25	0.690	0.86	29.9											
	8				34.7	60.7	1.25	0.690		0.86	29.9											
	8	3					70.3					1796		0.33%	7.4	3.1	9.59	6.0	73.00	67.00	Gutter on Selby - Coghlan to S Assume gutter flow pipe under	
<b>AREA D</b>	3		72.6	0.50	36.3	36.3	67.0	1.18	0.689	0.81	29.5											
<b>TOTAL</b>					227.5	70.3	1.15	0.689		0.79	180.2											

JOB TITLE:		LOCATION										RAINFALL CURVES				TIME OF CONCENTRATION (UNIMP)					
STORM SEWER DESIGN		CITY: <b>ATHERTON</b> COUNTY: <b>SAN MATEO</b>										SOURCE: <b>CALTRANS</b> <b>DRAINAGE MANUAL</b> FREQUENCY:									
DES.:		RBR DATE:		LAND USE: <b>DEVELOPED</b>										TIME OF CONCENTRATION (IMP) PIPE TYPE:							
CHK.:		NFE DATE:		WEIGHTED COEFFICIENT:										0.50				GUTTER TIME MIN. n= 0.015 TOTAL INLET TIME MIN. fps			
Line Designation or Street	Description	Incremental Area, A (Acres)	Runoff Coefficient, C	Product, Area x Coefficient	Sum of Products, Area x Coefficients	Duration, Min. Time of Concentration	Intensity (100-year, Ic) Chart "K", Zone-c	10-year Intensity Ratio (Chart "K", Sub-2)	25-year Intensity Ratio (Chart "R")	Rainfall Intensity, I (Inches/Hour)	Runoff, cfs Q=CIA	Length, Feet	Pipe Dia. Inches	Slope, Per Cent	Depth of Flow, Inches	Velocity, fps	Flow Time, Min.	Fall, Feet	Invert Elevation		Remarks
																			In	Out	
<b>Stockbridge/Selby Drainage Areas (25 Years Event)</b>																					
<b>AREA K</b>	4A	8.4	0.50	4.2	4.2	16.5	2.40	0.699	0.8205	1.97	8.3										
	4A				4.2	16.5	2.40	0.699	0.8205	1.97	8.3										
	4A	4				22.4					2184		4.81%	2.8	6.2	5.89	105.0	230.00	125.00	Gutter - On Fletcher Ridgeview	
<b>AREA I</b>	4	62.9	0.50	31.5	31.5	32.8	1.69	0.694	0.8174	1.38	43.4										
	4				35.7	32.8	1.69	0.694	0.8174	1.38	49.2										
	4	5				35.8					915		0.87%	7.5	5.1	3.00	8.0	125.00	117.00	Gutter - Ridgeview to Alameda Assume gutter flow pipe under	
<b>AREA H</b>	5	38.7	0.50	19.4	19.4	23.7	2.00	0.696	0.8186	1.64	31.7										
	5				55.0	35.8	1.61	0.693	0.8171	1.32	72.4										
	5	6				36.4					270		2.59%	7	8.4	0.53	7.0	117.00	110.00	Gutter - on Alameda Fletcher Assume gutter flow pipe under	
<b>AREA G</b>	6	29.8	0.50	14.9	14.9	21.9	2.08	0.697	0.8190	1.70	25.4										
	6				69.9	36.4	1.60	0.694	0.8176	1.31	91.4										
	6	7				38.2					624		0.80%	9.6	5.7	1.81	5.0	110.00	105.00	Gutter Alameda to Mulberry	
<b>AREA F</b>	7	9.9	0.50	4.95	5.0	25.9	1.90	0.695	0.8183	1.55	7.7										
	7				74.9	38.2	1.57	0.693	0.8168	1.28	96.0										
	7	2A				46.4					2552		0.59%	10.3	5.2	8.2	15.0	105.00	90.00	Gutter - Mulberry to Selby	
<b>AREA J</b>	2A	31.3	0.50	15.7	15.7	42.9	1.49	0.692	0.8163	1.22	19.0										
	2A				90.5	46.4	1.41	0.692	0.8160	1.15	104.1										

JOB TITLE: **STORM SEWER DESIGN** LOCATION: **CITY: ATHERTON** RAINFALL CURVES: SOURCE: **CALTRANS** TIME OF CONCENTRATION (UNIMP):  
 COUNTY: **SAN MATEO** **DRAINAGE MANUAL** FREQUENCY:

DES.: **RBR** DATE: LAND USE: **DEVELOPED** TIME OF CONCENTRATION (IMP) PIPE TYPE: GUTTER TIME MIN. n= 0.015  
 CHK.: **NFE** DATE: WEIGHTED COEFFICIENT: 0.50 TOTAL INLET TIME MIN. fps

Line Designation or Street	Description		Incremental Area, A (Acres)	Runoff Coefficient, C	Product, Area x Coefficient	Sum of Products, Area x Coefficients	Duration, Min. Time of Concentration	Intensity (100-year, Ic)	Zone	10-year Intensity Ratio (Chart "K", Sub. 2)	25-year Intensity Ratio (Chart "R")	Rainfall Intensity, I (Inches/Hour)	Runoff, cfs Q=CIA	Length, Feet	Pipe Dia. Inches	Slope, Per Cent	Depth of Flow, Inches	Velocity, fps	Flow Time, Min.	Fall, Feet	Invert Elevation		Remarks	
	From	To																			In	Out		
	2A	2					50.2							1365		0.81%	10	6.0	3.82	11.0	90.00	79.00	Gutter - Mulberry to Selby	
<b>AREA A</b>		1	67.2	0.50	33.6	33.6	38.5	1.55	0.693	0.8168	1.27	42.5												
		1			33.6	38.5	1.55	0.693	0.8168	1.27	42.5													
	1	2					41.5							1141		1.84%	6.1	6.5	2.93	21.0	100.00	79.00	Gutter - Greenways to Stck@ M; Assume gutter flow pipe under	
<b>AREA B</b>		2	10.9	0.50	5.45	5.5	31.8	1.71	0.694	0.8175	1.40	7.6												
<b>AREA C</b>		2	53.8	0.50	26.9	26.9	41.5	1.50	0.692	0.8165	1.22	32.9												
		2			156.5	50.2	1.38	0.691	0.8157	1.13	176.1													
	2	3					56.0							2076		0.58%	13	6.0	5.77	12.0	79.00	67.00	Gutter - on Stck Marymont to ; Assume gutter flow pipe under	
<b>AREA E</b>		8	69.4	0.50	34.7	34.7	60.7	1.25	0.690	0.8151	1.02	35.3												
		8			34.7	60.7	1.25	0.690	0.8151	1.02	35.3													
	8	3					69.9							1796		0.33%	7.9	3.3	9.21	6.0	73.00	67.00	Gutter on Selby - Coghlan to ; Assume gutter flow pipe under	
<b>AREA D</b>		3	72.6	0.50	36.3	36.3	67.0	1.18	0.689	0.8146	0.96	34.9												
<b>TOTAL</b>			<b>454.9</b>			<b>227.5</b>	<b>69.9</b>	<b>1.15</b>	<b>0.689</b>	<b>0.8145</b>	<b>0.94</b>	<b>213.0</b>												

	A	B	C	D	E	F	G
1	Area	C	L (ft)	Top Elev. (ft)	Bottom Elev. (ft)	S (ft/ft)	Tc (min)
2	Stockbridge/Selby Drainage Area						
3	A	0.5	3122	220	100	0.038	38.52
4	B	0.5	1444	110	79	0.021	31.81
5	C	0.5	2604	140	79	0.023	41.50
6	D	0.5	3134	90	67	0.007	67.03
7	E	0.5	3133	104	73	0.010	60.66
8	F	0.5	1128	136	105	0.027	25.90
9	G	0.5	1533	220	110	0.072	21.92
10	H	0.5	1760	240	117	0.070	23.70
11	I	0.5	3254	340	125	0.066	32.83
12	J	0.5	2580	144	90	0.021	42.89
13	K	0.5	1092	340	230	0.101	16.53

JOB TITLE: **STORM SEWER DESIGN** LOCATION: **CITY: ATHERTON COUNTY: SAN MATEO** RAINFALL CURVES: SOURCE: **CALTRANS** TIME OF CONCENTRATION (UNIMP): **DRAINAGE MANUAL**

DES.: **RBR** DATE: LAND USE: **DEVELOPED** TIME OF CONCENTRATION (IMP) PIPE TYPE: GUTTER TIME MIN. n= 0.015

CHK.: **NFE** DATE: WEIGHTED COEFFICIENT: **0.50** TOTAL INLET TIME MIN. **fps** FREQUENCY:

Line Designation or Street	Description		Incremental Area, A (Acres)	Runoff Coefficient, C	Product, Area x Coefficient	Sum of Products, Area x Coefficients	Duration, Min. Time of Concentration	Intensity (100 year, Tc)	Chart "K", Zone C	10-year Intensity Ratio (Chart "K", Sub. 2)	25-year Intensity Ratio (Chart "R")	Rainfall Intensity, I (inches/Hour)	Runoff, cfs Q=CIA	Length, Feet	Pipe Dia. Inches	Slope, Per Cent	Depth of Flow, Inches	Velocity, fps	Flow Time, Min.	Fall, Feet	Invert Elevation		Remarks
	From	To																			In	Out	
<b>Ridgeview Drainage Areas (10 year event)</b>																							
<b>AREA B</b>	1	12.4	0.50	6.2	6.2	19.4	2.20	0.697		1.53	9.5												
	1				6.2	19.4	2.20	0.697		1.53	9.5												
	1	3					22.0						860		3.14%	3.2	5.5	2.63	27.0	217.00	190.00	Gutter - Fletcher to Sutherland	
<b>AREA C</b>	3	16.0	0.50	8	8.0	13.2	2.68	0.700		1.87	15.0												
	3				14.2	22.0	2.07	0.696		1.44	20.5												
	3	4					25.0						1369		4.89%	3.9	7.8	2.93	67.0	190.00	123.00	Gutter - Sutherland to Walsh	
<b>AREA D</b>	4	20.0	0.50	10	10.0	21.4	2.10	0.697		1.46	14.6												
<b>AREA E</b>	4	20.2	0.50	10.1	10.1	20.5	2.15	0.697		1.50	15.1												
<b>TOTAL</b>					34.3	25.0	1.95	0.696		1.36	46.5												

	A	B	C	D	E	F	G
1	Area	C	L (ft)	Top Elev. (ft)	Bottom Elev. (ft)	S (ft/ft)	Tc (min)
2	Ridgeview Drainage						
3							
4	B	0.5	1290	320	217	0.080	19.41
5	C	0.5	890	320	190	0.146	13.18
6	D	0.5	1885	320	123	0.105	21.45
7	E	0.5	1763	315	123	0.109	20.46



JOB TITLE: **STORM SEWER DESIGN** LOCATION: **CITY: ATHERTON COUNTY: SAN MATEO** RAINFALL CURVES: **SOURCE: CALTRANS DRAINAGE MANUAL** TIME OF CONCENTRATION (UNIMP): **FREQUENCY:**

DES.: **RBR DATE:** RUNOFF COEFFICIENTS: LAND USE: **DEVELOPED** TIME OF CONCENTRATION (IMP): **GUTTER TYPE: MIN. n= 0.015** PIPE TYPE: **MIN. n= 0.015**  
 CHK.: **NFE DATE:** WEIGHTED COEFFICIENT: **0.50** TOTAL INLET TIME: **MIN. fps**

Line Designation or Street	Description		Incremental Area, A (Acres)	Runoff Coefficient, C	Product, Area x Coefficient	Sum of Products, Area x Coefficients	Duration, Min. Time of Concentration	Intensity (100-year, Tc) Chart "K", Zone C	Intensity Ratio (Chart "K", Sub 2) 10-Year	Intensity Ratio (Chart "R") 25-Year	Rainfall Intensity, I (inches/Hour)	Runoff, cfs Q=CIA	Length, Feet	Pipe Dia. Inches	Slope, Per Cent	Depth of Flow, Inches	Velocity, fps	Flow Time, Min.	Fall, Feet	Invert Elevation		Remarks
	From	To																		In	Out	
<b>El Camino Real and Selby Drainage Areas (10 year event)</b>																						
<b>AREA A</b>	1		96.9	0.50	48.5	48.5	75.4	1.11	0.689		0.76	37.0										
	1				48.5	75.4	1.11	0.689			0.76	37.0										
	1	2					82.6						1470		0.20%	27.9	3.4	7.18	3.0	49.00	46.00	Assume v-ditch 2:1 side slope
<b>AREA F</b>	6		52.2	0.50	26.1	26.1	78.5	1.09	0.689		0.75	19.6										
	6				26.1	78.5	1.09	0.689			0.75	19.6										
	6	7					81.4						787		0.64%	17.7	4.5	2.91	5.0	63.00	58.00	Assume v-ditch 2:1 side slope
<b>AREA G</b>	7		47.5	0.50	23.8	23.8	78.5	1.09	0.689		0.75	17.8										
	7				49.9	81.4	1.07	0.688			0.74	36.7										
	7	2					91.0						2648		0.45%	23.9	4.6	9.55	12.0	58.00	46.00	Assume v-ditch 2:1 side slope
<b>AREA B</b>	2		95.7	0.50	47.9	47.9	80.9	1.07	0.688		0.74	35.2										
	2				146.2	91.0	1.01	0.687			0.69	101.5										
	2	3					94.6						1070		0.28%	38.3	5.0	3.58	3.0	46.00	43.00	Assume v-ditch 2:1 side slope
<b>AREA H</b>	8		53.5	0.50	26.8	26.8	83.5	1.06	0.688		0.73	19.5										
	8				26.8	83.5	1.06	0.689			0.73	19.5										
	8	3					94.7						2772		0.51%	18.4	4.1	11.19	14.0	57.00	43.00	Assume v-ditch 2:1 side slope
<b>AREA C</b>	3		66.1	0.50	33.1	33.1	75.5	1.11	0.689		0.76	25.3										
	3				206.0	94.7	0.98	0.687			0.67	138.7										
	3	4					98.2						1221		0.33%	41.7	5.7	3.55	4.0	43.00	39.00	Assume v-ditch 2:1 side slope

JOB TITLE: STORM SEWER DESIGN LOCATION: CITY: **ATHERTON** COUNTY: **SAN MATEO**

RAINFALL CURVES: SOURCE: **CALTRANS** DRAINAGE MANUAL

TIME OF CONCENTRATION (UNIMP): FREQUENCY:

DES.: RBR DATE: LAND USE: **DEVELOPED** TIME OF CONCENTRATION (IMP): PIPE TYPE: n= 0.015

CHK.: NFE DATE: WEIGHTED COEFFICIENT: 0.50 GUTTER TIME MIN. TOTAL INLET TIME MIN. fps

Line Designation or Street	Description		Incremental Area, A (Acres)	Runoff Coefficient, C	Product, Area x Coefficient	Sum of Products, Area x Coefficients	Duration, Min. Time of Concentration	Intensity (100-year, Tc) Chart "K", 10-Year	Intensity Ratio (Chart "K", Sub 2) 25-Year	Intensity Ratio (Chart "R")	Rainfall Intensity, I (inches/Hour)	Runoff, cfs Q=CIA	Length, Feet	Pipe Dia. Inches	Slope, Per Cent	Depth of Flow, Inches	Velocity, fps	Flow Time, Min.	Fall, Feet	Invert Elevation		Remarks		
	From	To																		In	Out			
<b>AREA D</b>		4	114.7	0.50	57.4	57.4	92.9	1.00	0.687		0.69	39.4												
		4				263.3	98.2	0.96	0.687		0.66	173.7												
	4	5					99.5						670		0.90%	37.6	8.8	1.26	6.0	39.00	33.00	Assume v-ditch 2:1 side slope		
<b>AREA E</b>		5	16.8	0.50	8.4	8.4	49.5	1.38	0.691		0.95	8.0												
<b>TOTAL</b>		5				271.7	99.5	0.96	0.687		0.66	178.2												

JOB TITLE: **STORM SEWER DESIGN** LOCATION: **CITY: ATHERTON** RAINFALL CURVES: SOURCE: **CALTRANS** TIME OF CONCENTRATION (UNIMP):  
**COUNTY: SAN MATEO** DRAINAGE MANUAL FREQUENCY:  
 RUNOFF COEFFICIENTS: LAND USE: **DEVELOPED** TIME OF CONCENTRATION (IMP): PIPE TYPE:  
 DES.: **RBR** DATE: GUTTER TIME MIN. n= 0.015  
 CHK.: **NFE** DATE: WEIGHTED COEFFICIENT: 0.50 TOTAL INLET TIME MIN. fps

Line Designation or Street	Description		Incremental Area, A (Acres)	Runoff Coefficient, C	Product, Area x Coefficient	Sum of Products, Area x Coefficients	Duration, Min. Time of Concentration	Intensity (IUU year, Tc) Chart "K", 10-year	Intensity Ratio (Chart "K", Sub 2)	Intensity Ratio (Chart "R")	Rainfall Intensity, I (inches/Hour)	Runoff, cfs Q=CIA	Length, Feet	Pipe Dia. Inches	Slope, Per Cent	Depth of Flow, Inches	Velocity, fps	Flow Time, Min.	Fall, Feet	Invert Elevation		Remarks
	From	To																		In	Out	
<b>El Camino Real and Selby Drainage Areas (25 year event)</b>																						
<b>AREA A</b>		1	96.9	0.50	48.5	48.5	75.4	1.11	0.689	0.8143	0.90	43.8										
		1				48.5	75.4	1.11	0.689	0.8143	0.90	43.8										
	1	2					82.3						1470		0.20%	29.8	3.6	6.88	3.0	49.00	46.00	Assume v-ditch 2:1 side slope
<b>AREA F</b>		6	52.2	0.50	26.1	26.1	78.5	1.09	0.689	0.8147	0.89	23.2										
		6				26.1	78.5	1.09	0.689	0.8147	0.89	23.2										
	6	7					81.3						787		0.64%	18.9	4.7	2.79	5.0	63.00	58.00	Assume v-ditch 2:1 side slope
<b>AREA G</b>		7	47.5	0.50	23.8	23.8	78.5	1.09	0.689	0.8147	0.89	21.1										
		7					81.3															
	7	2					90.5						2648		0.45%	25.5	4.8	9.18	12.0	58.00	46.00	Assume v-ditch 2:1 side slope
<b>AREA B</b>		2	95.7	0.50	47.9	47.9	80.9	1.07	0.688	0.8140	0.87	41.7										
		2				146.2	90.5	1.01	0.687	0.8135	0.82	120.1										
	2	3					93.9						1070		0.28%	40.8	5.2	3.43	3.0	46.00	43.00	Assume v-ditch 2:1 side slope
<b>AREA H</b>		8	53.5	0.50	26.8	26.8	83.5	1.06	0.688	0.8138	0.86	23.1										
		8				26.8	83.5	1.06	0.689	0.8145	0.86	23.1										
	8	3					94.2						2772		0.51%	19.6	4.3	10.72	14.0	57.00	43.00	Assume v-ditch 2:1 side slope
<b>AREA C</b>		3	66.1	0.50	33.1	33.1	75.5	1.11	0.689	0.8142	0.90	29.9										

JOB TITLE: **STORM SEWER DESIGN**      LOCATION: **CITY: ATHERTON**      RAINFALL CURVES: **SOURCE: CALTRANS**      TIME OF CONCENTRATION (UNIMP):  
**COUNTY: SAN MATEO**      **DRAINAGE MANUAL**  
 FREQUENCY:  
 RUNOFF COEFFICIENTS:      TIME OF CONCENTRATION (IMP):      PIPE TYPE:  
 DES.: **RBR DATE:**      LAND USE: **DEVELOPED**      GUTTER TIME      MIN.      n= 0.015  
 CHK.: **NFE DATE:**      WEIGHTED COEFFICIENT: **0.50**      TOTAL INLET TIME      MIN.      **fps**

Line Designation or Street	Description		Incremental Area, A (Acres)	Runoff Coefficient, C	Product, Area x Coefficient	Sum of Products, Area x Coefficients	Duration, Min. Time of Concentration	Intensity (IUU year, Tc) Chart "K", 10-year	Intensity Ratio (Chart "K", Sub 2)	Intensity Ratio (Chart "R")	Rainfall Intensity, I (inches/Hour)	Runoff, cfs Q=CIA	Length, Feet	Pipe Dia. Inches	Slope, Per Cent	Depth of Flow, Inches	Velocity, fps	Flow Time, Min.	Fall, Feet	Invert Elevation		Remarks
	From	To																		In	Out	
		3				206.0	94.2	0.99	0.687	0.8135	0.81	165.9										
	3	4					97.6						1221		0.33%	44.6	6.0	3.40	4.0	43.00	39.00	Assume v-ditch 2:1 side slope
<b>AREA D</b>		4	114.7	0.50	57.4	57.4	92.9	1.00	0.687	0.8135	0.81	46.7										
		4				263.3	97.6	0.98	0.687	0.8133	0.80	209.9										
	4	5					98.8						670		0.90%	40.4	9.3	1.21	6.0	39.00	33.00	Assume v-ditch 2:1 side slope
<b>AREA E</b>		5	16.8	0.50	8.4	8.4	49.5	1.38	0.691	0.8157	1.13	9.5										
<b>TOTAL</b>		5	543.4			271.7	98.8	0.97	0.687	0.8132	0.79	214.3										

	A	B	C	D	E	F	G
1	Area	C	L (ft)	Top Elev. (ft)	Bottom Elev. (ft)	S (ft/ft)	Tc (min)
2	El Camino/Selby Drainage Area						
3	A	0.5	3547	71	49	0.006	75.42
4	B	0.5	3785	67	46	0.006	80.86
5	C	0.5	2963	57	43	0.005	75.48
6	D	0.5	4795	64	39	0.005	92.92
7	E	0.5	1623	44	33	0.007	49.53
8	F	0.5	2921	75	63	0.004	78.52
9	G	0.5	3192	73	58	0.005	78.48
10	H	0.5	3344	71	57	0.004	83.48

JOB TITLE: **STORM SEWER DESIGN** LOCATION: **CITY: ATHONTON** RAINFALL CURVES: SOURCE: **CALTRANS** TIME OF CONCENTRATION (UNIMP):  
COUNTY: **SAN MATEO** **DRAINAGE MANUAL** FREQUENCY:  
**RUNOFF COEFFICIENTS:** LAND USE: **DEVELOPED** TIME OF CONCENTRATION (IMP) PIPE TYPE:  
DES.: **R/NFE DATE:** GUTTER TIME MIN. n= 0.02 & 0.035  
CHK.: **NFE DATE:** WEIGHTED COEFFICIENT: 0.50 TOTAL INLET TIME MIN. **fps**

Line Designation or Street	Description		Incremental Area, A (Acres)	Runoff Coefficient, C	Product, Area x Coefficient	Sum of Products, Area x Coefficients	Duration, Min. Time of Concentration	Intensity (100-year, Ic) Chart "K",	10-year Intensity Ratio (Chart	25-year Intensity Ratio (Chart	Rainfall Intensity, I (inches/Hour)	Runoff, cfs Q=CIA	Length, Feet	Pipe Dia. Inches	Slope, Per Cent	Depth of Flow, Inches	Velocity, fps	Flow Time, Min.	Fall, Feet	Invert Elevation		Remarks
	From	To																		In	Out	
<b>Station West Drainage Areas (10 year event)</b>																						
<b>AREA I</b>	1A	29.7	0.50	14.9	14.9	49.6	1.38	0.691	0.00	0.95	14.2											
	1A				14.9	49.6	1.38	0.691	0.00	0.95	14.2											
	1A	2A				53.6						1195		0.50%	20.2	5.0	3.97	6.0	35.0	29.0	Ex. 12" pipe (UNDER CAPACITY) Need 24" pipe	
<b>AREA J</b>	2A	31.0	0.50	15.5	15.5	62.9	1.22	0.690	0.00	0.84	13.0											
	2A				30.4	62.9	1.22	0.690	0.00	0.84	25.5											
<b>Station West Drainage Areas (25 year event)</b>																						
<b>AREA I</b>	1A	29.7	0.50	14.9	14.9	49.6	1.38	0.691	0.82	1.12	16.7											
	1A				14.9	49.6	1.38	0.691	0.82	1.12	16.7											
	1A	2A				53.3						1195		0.50%	16	5.5	3.63	6.0	35.0	29.0	Ex. 12" pipe (UNDER CAPACITY) Need 36" pipe	
<b>AREA J</b>	2A	31.0	0.50	15.5	15.5	62.9	1.22	0.690	0.82	0.99	15.4											
	2A				30.4	62.9	1.22	0.690	0.82	0.99	30.2											

JOB TITLE: **STORM SEWER DESIGN** LOCATION: **CITY: ATHONTON** RAINFALL CURVES: SOURCE: **CALTRANS** TIME OF CONCENTRATION (UNIMP):  
COUNTY: **SAN MATEO** **DRAINAGE MANUAL** FREQUENCY:  
**RUNOFF COEFFICIENTS:** LAND USE: **DEVELOPED** TIME OF CONCENTRATION (IMP) PIPE TYPE:  
DES.: **R/NFE DATE:** GUTTER TIME MIN. n= 0.02 & 0.035  
CHK.: **NFE DATE:** WEIGHTED COEFFICIENT: 0.50 TOTAL INLET TIME MIN. **fps**

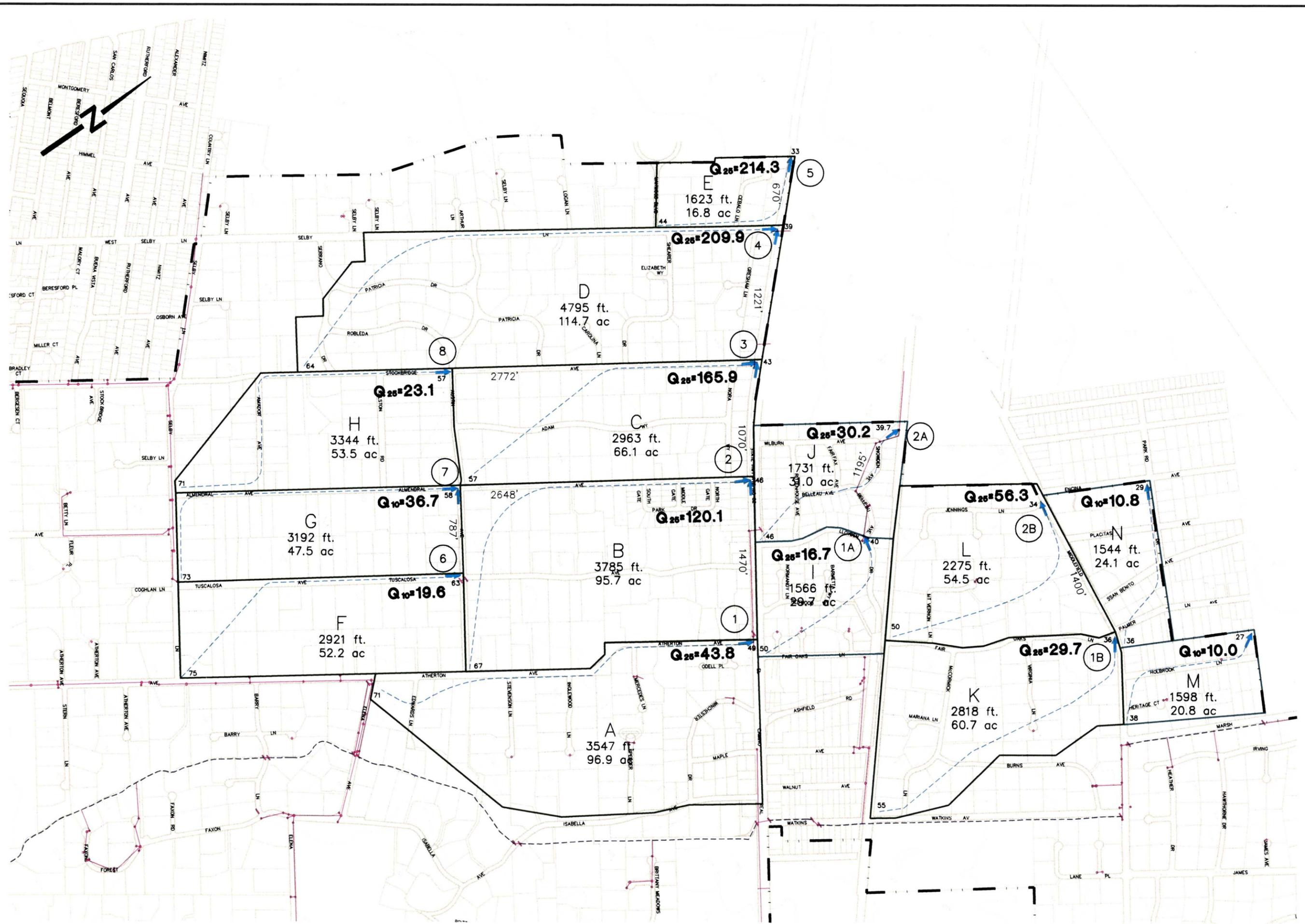
Line Designation or Street	Description		Incremental Area, A (Acres)	Runoff Coefficient, C	Product, Area x Coefficient	Sum of Products, Area x Coefficients	Duration, Min. Time of Concentration	Intensity (100-year, Tc) Chart "K",	10-year Intensity Ratio (Chart	25-year Intensity Ratio (Chart	Rainfall Intensity, I (inches/Hour)	Runoff, cfs Q=CIA	Length, Feet	Pipe Dia. Inches	Slope, Per Cent	Depth of Flow, Inches	Velocity, fps	Flow Time, Min.	Fall, Feet	Invert Elevation		Remarks
	From	To																		In	Out	
<b>Middlefield West Drainage Areas (10 year event)</b>																						
<b>AREA K</b>	1B	60.7	0.50	30.4	30.4	65.4	1.20	0.690	0.00	0.83	25.1											
	1B				30.4	65.4	1.20	0.690	0.00	0.83	25.1											
	1B	2B					72.3					1400		0.14%	23.2	3.4	6.94	2.0	36.0	34.0	Ditch	
<b>AREA L</b>	2B	54.5	0.50	27.3	27.3	57.9	1.27	0.690	0.00	0.88	23.9											
	2B				57.6	72.3	1.20	0.690	0.00	0.83	47.7											
<b>Middlefield West Drainage Areas (25 year event)</b>																						
<b>AREA K</b>	1B	60.7	0.50	30.4	30.4	65.4	1.20	0.690	0.82	0.98	29.7											
	1B				30.4	65.4	1.20	0.690	0.82	0.98	29.7											
	1B	2B					72.0					1400		0.14%	24.7	3.5	6.65	2.0	36.0	34.0	Ditch	
<b>AREA L</b>	2B	54.5	0.50	27.3	27.3	57.9	1.27	0.690	0.82	1.04	28.2											
	2B				57.6	72.0	1.20	0.690	0.82	0.98	56.3											

JOB TITLE: **STORM SEWER DESIGN** LOCATION: **CITY: AThERTON** RAINFALL CURVES: SOURCE: **CALTRANS** TIME OF CONCENTRATION (UNIMP):  
COUNTY: **SAN MATEO** **DRAINAGE MANUAL** FREQUENCY:  
**RUNOFF COEFFICIENTS:** LAND USE: **DEVELOPED** TIME OF CONCENTRATION (IMP) PIPE TYPE:  
DES.: **R/NFE DATE:** GUTTER TIME MIN. n= 0.02 & 0.035  
CHK.: **NFE DATE:** WEIGHTED COEFFICIENT: 0.50 TOTAL INLET TIME MIN. **fps**

Line Designation or Street	Description		Incremental Area, A (Acres)	Runoff Coefficient, C	Product, Area x Coefficient	Sum of Products, Area x Coefficients	Duration, Min. Time of Concentration	Intensity (100-year, Ic) Chart "K",	10-year Intensity Ratio (Chart	25-year Intensity Ratio (Chart	Rainfall Intensity, I (inches/Hour)	Runoff, cfs Q=CIA	Length, Feet	Pipe Dia. Inches	Slope, Per Cent	Depth of Flow, Inches	Velocity, fps	Flow Time, Min.	Fall, Feet	Invert Elevation		Remarks
	From	To																		In	Out	
<b>Park Rd Drainage Areas (10 year event)</b>																						
<b>AREA M</b>		M	20.8	0.50	10.4	10.4	48.9	1.39	0.691	0.00	0.96	10.0										
		M				10.4	48.9	1.39	0.691	0.00	0.96	10.0										
<b>Park Rd Drainage Areas (25 year event)</b>																						
<b>AREA M</b>		M	20.8	0.50	10.4	10.4	48.9	1.39	0.691	0.82	1.13	11.8										
		M				10.4	48.9	1.39	0.691	0.82	1.13	11.8										
<b>Holbrook Drainage Areas (10 year event)</b>																						
<b>AREA N</b>		N	24.1	0.50	12.1	12.1	55.2	1.30	0.691	0.00	0.90	10.8										
		N				12.1	55.2	1.30	0.691	0.00	0.90	10.8										
<b>Holbrook Drainage Areas (25 year event)</b>																						
<b>AREA N</b>		N	24.1	0.50	12.1	12.1	55.2	1.30	0.691	0.82	1.06	12.8										
		N				12.1	55.2	1.30	0.691	0.82	1.06	12.8										

	A	B	C	D	E	F	G
1	Area	C	L (ft)	Top Elev. (ft)	Bottom Elev. (ft)	S (ft/ft)	Tc (min)
2	North East El camino Drainage Areas						
3	I	0.5	1566	50	40	0.006	49.63
4	J	0.5	1731	46	39.7	0.004	62.93
5	K	0.5	2818	55	36	0.007	65.38
6	L	0.5	2275	50	34	0.007	57.93
7	M	0.5	1598	38	27	0.007	48.90
8	N	0.5	1544	36	29	0.005	55.24

DATE: 02/01/11 TIME: 11:11 AM DRAWING NAME: ET-SJ0709.DWG  
 PLOTTER: PLOTTER SERVICE DATE: 02/01/11  
 PLOTTER: PLOTTER SERVICE DATE: 02/01/11



NO.	DATE	BY	REVISION

**TOWN WIDE DRAINAGE STUDY**  
**SELBY/EL CAMINO SYSTEM**  
**DRAINAGE BASINS**

PREPARED FOR: TOWN OF ATHERTON      DATE SUBMITTED:

**NOTE**

**BEYOND ENGINEERING**  
 1731 NORTH FIRST STREET, SUITE A  
 SAN JOSE, CA 95128  
 408-992-2200 TEL 408-992-0701 FAX  
 WWW.BEYONDE.COM

SHEET NUMBER: \_\_\_\_\_ OF \_\_\_\_\_ SHEETS

VERTICAL SCALE: 1" = 1'  
 HORIZONTAL SCALE: 1" = 600'

JOB NUMBER: SJ0709

The engineer, planner, or contractor responsible for this plan shall not be held responsible for, or liable for, unanticipated changes to the plan or for any damage or injury that may result from the use of this plan.

JOB TITLE:		LOCATION										RAINFALL CURVES				TIME OF CONCENTRATION (UNIMP)						
STORM SEWER DESIGN		CITY: <b>ATHERTON</b> COUNTY: <b>SAN MATEO</b>										SOURCE: <b>CALTRANS</b>				<b>DRAINAGE MANUAL</b>						
		RUNOFF COEFFICIENTS:										FREQUENCY:				TIME OF CONCENTRATION (IMP) PIPE TYPE:						
DES.: <b>RBR</b> DATE:		LAND USE: <b>DEVELOPED</b>										GUTTER TIME MIN. n= 0.013										
CHK.: <b>NFE</b> DATE:		WEIGHTED COEFFICIENT: <b>0.50</b>										TOTAL INLET TIME MIN. <b>fps</b>										
Line Designation or Street	Description		Incremental Area, A (Acres)	Runoff Coefficient, C	Product, Area x Coefficient	Sum of Products, Area x Coefficients	Duration, Min. Time of Concentration	Intensity (100 year, Tc) Chart "K", Zone C	10-year Intensity Ratio (Chart "K", Sub. 2)	25-year Intensity Ratio (Chart "R")	Rainfall Intensity, I (inches/Hour)	Runoff, cfs Q=CIA	Length, Feet	Pipe Dia. Inches	Slope, Per Cent	Depth of Flow, Inches	Velocity, fps	Flow Time, Min.	Fall, Feet	Invert Elevation		Remarks
	From	To																		In	Out	
<b>Marsh/Bay Drainage Areas (10 Year Event)</b>																						
<b>AREA A</b>		1	44.9	0.50	22.5	22.5	76.5	1.11	0.689	0.76	17.2											
		1			22.5	76.5	1.11	0.689	0.76	17.2												
	1	2					78.3					544		0.30%	17.4	5.1	1.78	1.6	25.00	23.37	Existing 24" RCP under capacity Assume 36" RCP @ 0.3% slope	
<b>AREA B</b>		2	148.0	0.50	74	74.0	86.7	1.03	0.688	0.71	52.4											
		2			96.5	86.7	1.03	0.688	0.71	68.3												
	2	3					91.4					2027		0.30%	29.2	7.2	4.70	6.1	23.37	17.29	Existing 24" RCP under capacity Assume 60" RCP @ 0.3% slope	
<b>AREA C</b>		3	63.5	0.50	31.7	31.7	62.9	1.22	0.690	0.84	26.7											
		3			128.2	91.4	1.01	0.687	0.69	89.0												
	3	4					94.0					1215		0.30%	34.3	7.7	2.64	3.7	17.29	13.64	Existing 24" RCP under capacity Assume 60" RCP @ 0.3% slope	
<b>AREA D</b>		4	70.9	0.50	35.4	35.4	67.1	1.19	0.689	0.82	29.1											
		4			163.6	94.0	0.99	0.687	0.68	111.3												
	4	5					97.5					1669		0.30%	39.9	8.0	3.46	5.0	13.64	8.64	Existing 24" RCP under capacity Assume 72" RCP @ 0.3% slope	
<b>AREA E</b>		5	49.9	0.50	25	25.0	67.9	1.19	0.689	0.82	20.5											
<b>TOTAL</b>		5			188.6	97.5	0.97	0.687	0.67	125.7												

JOB TITLE: **STORM SEWER DESIGN** LOCATION: **CITY: AATHERTON** RAINFALL CURVES: SOURCE: **CALTRANS** TIME OF CONCENTRATION (UNIMP):  
COUNTY: **SAN MATEO** **DRAINAGE MANUAL** FREQUENCY:  
RUNOFF COEFFICIENTS: TIME OF CONCENTRATION (IMP) PIPE TYPE:  
DES.: **RBR** DATE: LAND USE: **DEVELOPED** GUTTER TIME MIN. n= 0.013  
CHK.: **NFE** DATE: WEIGHTED COEFFICIENT: 0.50 TOTAL INLET TIME MIN. fps

Line Designation or Street	Description		Incremental Area, A (Acres)	Runoff Coefficient, C	Product, Area x Coefficient	Sum of Products, Area x Coefficients	Duration, Min. Time of Concentration	Intensity (100-year, To) Chart "K", 10-year	Intensity Ratio (Chart "K", Sub 2)	Intensity Ratio (Chart "R")	Rainfall Intensity, I (inches/Hour)	Runoff, cfs Q=CIA	Length, Feet	Pipe Dia. Inches	Slope, Per Cent	Depth of Flow, Inches	Velocity, fps	Flow Time, Min.	Fall, Feet	Invert Elevation		Remarks
	From	To																		In	Out	
<b>Marsh/Bay Drainage Areas (25 year event)</b>																						
<b>AREA A</b>	1		44.9	0.50	22.5	22.5	76.5	1.11	0.689	0.8142	0.90	20.3										
	1					22.5	76.5	1.11	0.689	0.8142	0.90	20.3										
	1	2					78.2						544		0.30%	19.2	5.3	1.71	1.6	25.00	23.37	Existing 24" RCP under capacit Assume 36" RCP @ 0.3% slope
<b>AREA B</b>	2		148.0	0.50	74	74.0	86.7	1.03	0.688	0.8138	0.84	62.0										
	2					96.5	86.7	1.03	0.688	0.8138	0.84	80.8										
	2	3					91.2						2027		0.30%	32.3	7.5	4.51	6.1	23.37	17.29	Existing 24" RCP under capacit Assume 60" RCP @ 0.3% slope
<b>AREA C</b>	3		63.5	0.50	31.7	31.7	62.9	1.22	0.690	0.8150	0.99	31.6										
	3					128.2	91.2	1.01	0.687	0.8135	0.82	105.3										
	3	4					93.7						1215		0.30%	38.3	8.0	2.55	3.7	17.29	13.64	Existing 24" RCP under capacit Assume 60" RCP @ 0.3% slope
<b>AREA D</b>	4		70.9	0.50	35.4	35.4	67.1	1.19	0.689	0.8147	0.97	34.4										
	4					163.6	93.7	0.99	0.687	0.8134	0.81	131.8										
	4	5					97.0						1669		0.30%	38.9	8.5	3.29	5.0	13.64	8.64	Existing 24" RCP under capacit Assume 72" RCP @ 0.3% slope
<b>AREA E</b>	5		49.9	0.50	25	25.0	67.9	1.18	0.689	0.8147	0.96	24.0										
<b>TOTAL</b>	5		377.2			188.6	97.0	0.97	0.687	0.8133	0.78	148.0										

	A	B	C	D	E	F	G
1	Area	C	L (ft)	Top Elev. (ft)	Bottom Elev. (ft)	S (ft/ft)	Tc (min)
2	Marsh/Bay Drainage Areas						
3	A	0.5	3972	53	25	0.007	76.48
4	B	0.5	4480	53	27	0.006	86.66
5	C	0.5	2853	46	24	0.008	62.91
6	D	0.5	3024	46	25	0.007	67.07
7	E	0.5	2822	40	23	0.006	67.93

JOB TITLE: STORM SEWER DESIGN LOCATION: CITY: ATHERTON RAINFALL CURVES: SOURCE: CALTRANS TIME OF CONCENTRATION (UNIMP):  
 COUNTY: SAN MATEO FREQUENCY: DRAINAGE MANUAL

DES.: NFE DATE: RUNOFF COEFFICIENTS: LAND USE: DEVELOPED TIME OF CONCENTRATION (IMP): PIPE TYPE:  
 CHK.: NFE DATE: WEIGHTED COEFFICIENT: 0.50 GUTTER TIME MIN. n= 0.015  
 TOTAL INLET TIME MIN. fps

Line Designation or Street	Description		Incremental Area, A (Acres)	Runoff Coefficient, C	Product, Area x Coefficient	Sum of Products, Area x Coefficients	Duration, Min. Time of Concentration	Intensity (100-year, Tc) Chart "K", 10-Year	Intensity Ratio (Chart "K", Sub 2) 25-year	Intensity Ratio (Chart "R")	Rainfall Intensity, I (inches/Hour)	Runoff, cfs Q=CIA	Length, Feet	Pipe Dia. Inches	Slope, Per Cent	Depth of Flow, Inches	Velocity, fps	Flow Time, Min.	Fall, Feet	Invert Elevation		Remarks
	From	To																		In	Out	
<b>Watkins and Middlefield Drainage Areas (25 year event)</b>																						
<b>AREA A</b>	1		122.1	0.50	61.1	61.1	89.6	1.02	0.688	0.8136	0.83	50.7										
	1				61.1	89.6	1.02	0.688	0.8136	0.83	50.7											
	1	2					95.0						1085		0.28%	9.3	3.3	5.41	3.0	49.00	46.00	Assume gutter
<b>AREA B</b>	2		65.6	0.50	32.8	32.8	65.4	1.19	0.689	0.8147	0.97	31.8										
	2				93.9	95.0	0.98	0.687	0.8135	0.80	74.8											
	2	3					101.8						1663		0.36%	10.3	4.1	6.84	6.0	46.00	40.00	Assume gutter
<b>AREA C</b>	3		95.9	0.50	48	48.0	68.3	1.18	0.689	0.8147	0.96	45.9										
<b>TOTAL</b>	3				141.8	101.8	0.95	0.687	0.8132	0.77	109.5											

	A	B	C	D	E	F	G
1	Area	C	L (ft)	Top Elev. (ft)	Bottom Elev. (ft)	S (ft/ft)	Tc (min)
2	Watkins/Middlefield						
3	A	0.5	4280	70	49	0.005	89.58
4	B	0.5	2818	65	46	0.007	65.38
5	C	0.5	3032	60	40	0.007	68.32

JOB TITLE:		LOCATION										RAINFALL CURVES				TIME OF CONCENTRATION (UNIMP)							
STORM SEWER DESIGN		CITY: <b>ATHERTON</b> COUNTY: <b>SAN MATEO</b>										SOURCE: <b>CALTRANS</b>				<u>DRAINAGE MANUAL</u>							
DES.:		RUNOFF COEFFICIENTS:										TIME OF CONCENTRATION (IMP)				PIPE TYPE:							
CHK.:		LAND USE: <b>DEVELOPED</b>										GUTTER TIME				MIN. n= 0.015							
		WEIGHTED COEFFICIENT:										0.50				TOTAL INLET TIME				MIN. fps			
Line Designation or Street	Description		Incremental Area, A (Acres)	Runoff Coefficient, C	Product, Area x Coefficient	Sum of Products, Area x Coefficients	Duration, Min. Time of Concentration	Intensity (100-year, Tc) Chart "K", Zone C	10-Year Intensity Ratio (Chart "K", Sub 2)	25-Year Intensity Ratio (Chart "R")	Rainfall Intensity, I (inches/Hour)	Runoff, cfs Q=CIA	Length, Feet	Pipe Dia. Inches	Slope, Per Cent	Depth of Flow, Inches	Velocity, fps	Flow Time, Min.	Fall, Feet	Invert Elevation		Remarks	
	From	To																		In	Out		
<b>Middlefield East Drainage Areas (25 year event)</b>																							
<b>AREA D</b>		1	35.8	0.50	17.9	17.9	92.9	1.00	0.687	0.8135	0.81	14.6											
		1				17.9	92.9	1.00	0.687	0.8135	0.81	14.6											
	1	2					96.3						917	0.33%	16.7	4.6	3.36	3.0	57.00	54.00	Assume 36" PIPE		
<b>TOTAL</b>		2				17.9	96.3	0.98	0.687	0.8131	0.79	14.2											

	A	B	C	D	E	F	G
1	Area	C	L (ft)	Top Elev. (ft)	Bottom Elev. (ft)	S (ft/ft)	Tc (min)
2	Middlefield East						
3	D	0.5	2304	61	57	0.002	92.93

JOB TITLE:		LOCATION										RAINFALL CURVES				TIME OF CONCENTRATION (UNIMP)									
STORM SEWER DESIGN		CITY: <b>ATHERTON</b> COUNTY: <b>SAN MATEO</b>										SOURCE: <b>CALTRANS</b> <b>DRAINAGE MANUAL</b> FREQUENCY:													
DES.:		NFE DATE:		RUNOFF COEFFICIENTS:										TIME OF CONCENTRATION (IMP)				PIPE TYPE:							
CHK.:		NFE DATE:		LAND USE: <b>DEVELOPED</b>										GUTTER TIME				MIN. n= 0.015							
				WEIGHTED COEFFICIENT:										0.50				TOTAL INLET TIME				MIN. fps			
Line Designation or Street	Description		Incremental Area, A (Acres)	Runoff Coefficient, C	Product, Area x Coefficient	Sum of Products, Area x Coefficients	Duration, Min. Time of Concentration	Intensity (100-year, Tc) Chart "K", 10-Year	Intensity Ratio (Chart "K", Sub 2) 25-Year	Intensity Ratio (Chart "R")	Rainfall Intensity, I (inches/Hour)	Runoff, cfs Q=CIA	Length, Feet	Pipe Dia. Inches	Slope, Per Cent	Depth of Flow, Inches	Velocity, fps	Flow Time, Min.	Fall, Feet	Invert Elevation		Remarks			
	From	To																		In	Out				
<b>Heather Drainage Areas (10 year event)</b>																									
<b>AREA F</b>		1	22.0	0.50	11	11.0	68.8	1.16	0.689	0.80	8.8														
		1				11.0	68.8	1.16	0.689	0.80	8.8														
	1	2					73.9					1205		0.33%	16	4.0	5.06	4.0	39.00	35.00	Assume 24" pipe				
<b>AREA G</b>		2	16.0	0.50	8	8.0	50.8	1.36	0.691	0.94	7.5														
<b>TOTAL</b>		2				19.0	73.9	1.13	0.689	0.78	14.8											Assume 36" pipe			

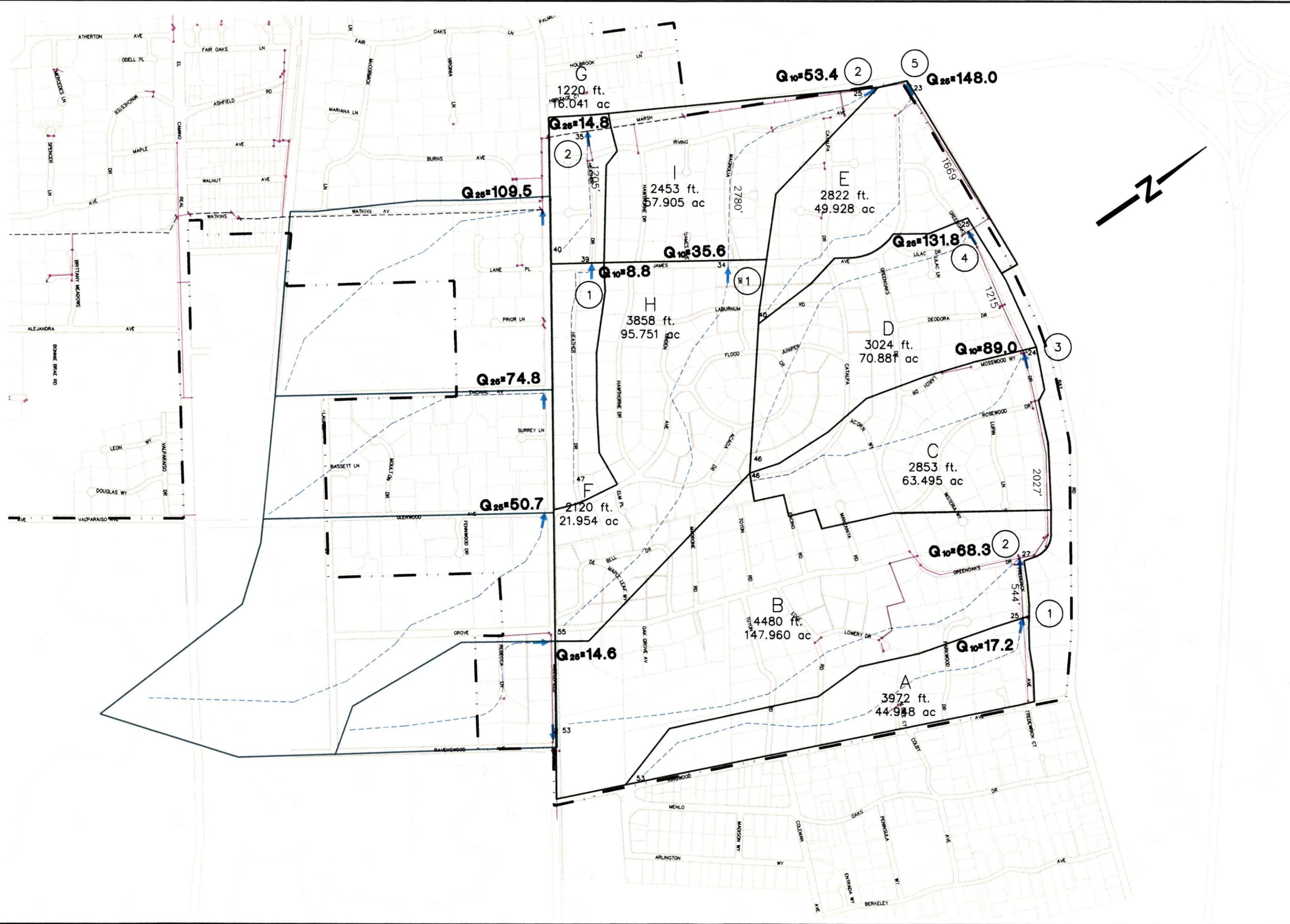
	A	B	C	D	E	F	G
1	Area	C	L (ft)	Top Elev. (ft)	Bottom Elev. (ft)	S (ft/ft)	Tc (min)
2	Heather						
3	F	0.5	2120	47	39	0.004	68.81
4	G	0.5	1220	40	35	0.004	50.78

JOB TITLE: **STORM SEWER DESIGN** LOCATION: **CITY: ATHERTON** RAINFALL CURVES: SOURCE: **CALTRANS** TIME OF CONCENTRATION (UNIMP):  
COUNTY: **SAN MATEO** FREQUENCY: **DRAINAGE MANUAL**  
RUNOFF COEFFICIENTS: TIME OF CONCENTRATION (IMP) PIPE TYPE: n = 0.02 & 0.035  
DES.: R/NFE DATE: LAND USE: **DEVELOPED** GUTTER TIME MIN. n = 0.02 & 0.035  
CHK.: NFE DATE: WEIGHTED COEFFICIENT: 0.50 TOTAL INLET TIME MIN. **fps**

Line Designation or Street	Description		Incremental Area, A (Acres)	Runoff Coefficient, C	Product, Area x Coefficient	Sum of Products, Area x Coefficients	Duration, Min. Time of Concentration	Intensity (100-year, Tc) Chart "K",	10-year Intensity Ratio (Chart	25-year Intensity Ratio (Chart	Rainfall Intensity, I (inches/Hour)	Runoff, cfs Q=CIA	Length, Feet	Pipe Dia. Inches	Slope, Per Cent	Depth of Flow, Inches	Velocity, fps	Flow Time, Min.	Fall, Feet	Invert Elevation		Remarks
	From	To																		In	Out	
<b>Valparaiso Drainage Areas (10 year event)</b>																						
<b>AREA D1</b>	9A	144.7	0.50	72.4	72.4	65.5	1.20	0.690	0.00	0.83	59.9											
	9A				72.4	65.5	1.20	0.690	0.00	0.83	59.9											
<b>Valparaiso Drainage Areas (25 year event)</b>																						
<b>AREA D1</b>	9A	144.7	0.50	72.4	72.4	65.5	1.20	0.690	0.815	0.98	70.7											
	9A				72.4	65.5	1.20	0.690	0.815	0.98	70.7											

DATE: 08/20/14 TIME: 12:50 PM DRAWING NAME: ET-ARLINGTON  
 SERVER: S:\S\SPRINK\DRN\_PLOT\DRN\_PLOT.dwg PLOTTER: HP-2000  
 PAPER: 24x36 (ANSI) PLOT SCALE: 1"=800'

PROJECT: 2014-01-01, 100% ARS, AHERTON, MSH-BAY, 1700-100



NO.	DATE	BY	REVISION

**TOWN WIDE DRAINAGE STUDY**  
**MIDDLEFIELD/MARSH/BAY SYSTEM**  
**DRAINAGE BASINS**

PREPARED FOR: TOWN OF AHERTON      DATE SUBMITTED: \_\_\_\_\_

NOTE

**BEYOND ENGINEERING**  
 SAN JOSE, CA 95128  
 WWW.BEYONDE.COM

721 NORTH FIRST STREET, SUITE A  
 408.992.2000 TEL 408.992.0701 FAX

SHEET NUMBER

OF \_\_\_\_\_ SHEETS

SCALE

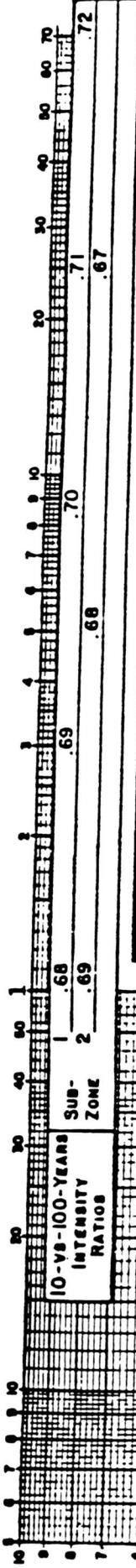
VERTICAL: 1" = 1'  
 HORIZONTAL: 1" = 800'

JOB NUMBER  
**SJ0709**

The engineer preparing these plans will not be responsible for, or liable for, unauthorized changes to these plans. Any such changes must be approved by the engineer who prepared these plans.

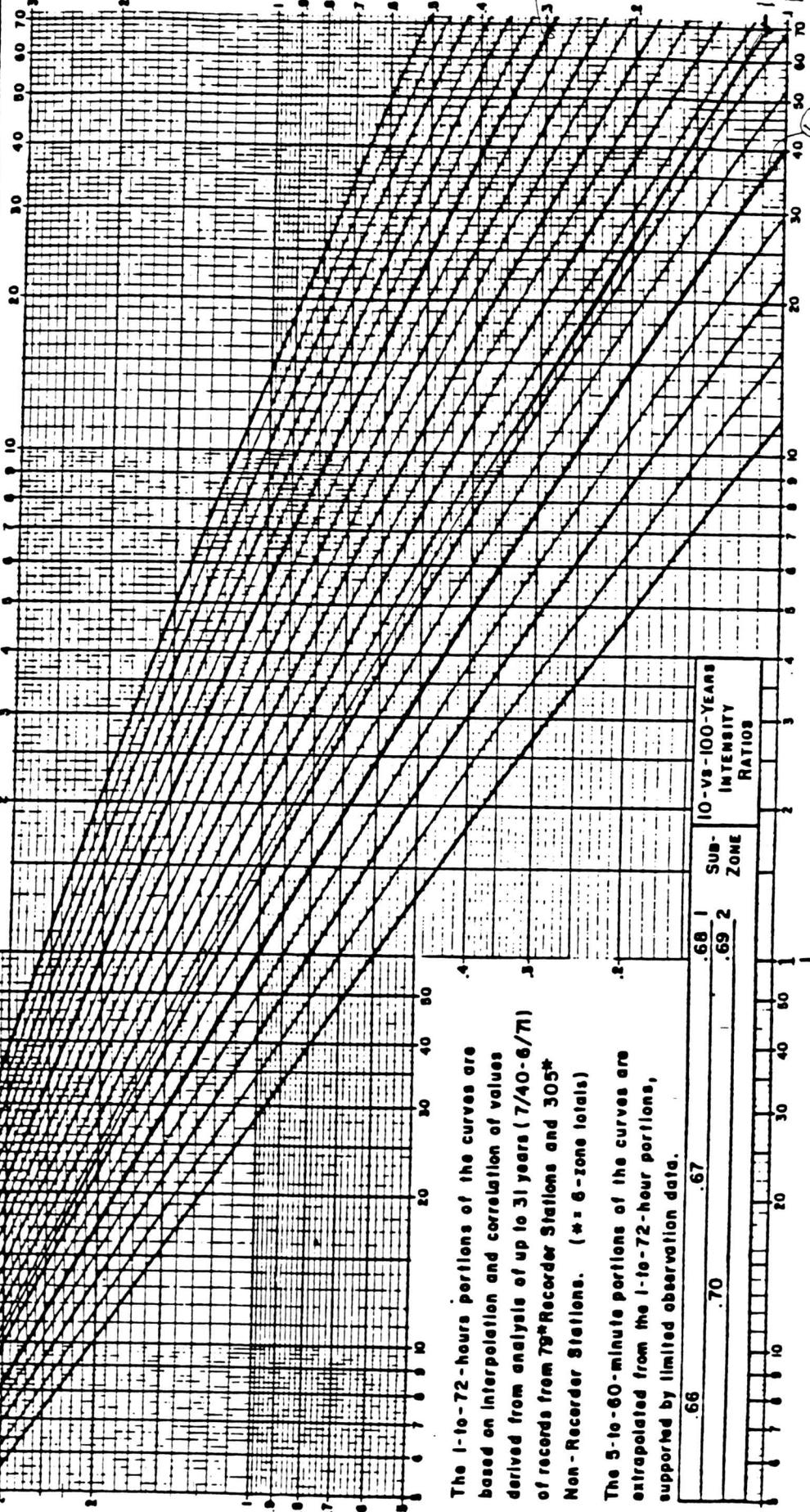
**ATHERTON DRAINAGE STUDY  
IDF - COMPARISON**

	County of Santa Clara	City of San Mateo	Bohley/Maley Associates	Caltrans
t (min) or (hr) assumed	0.38	0.38	23.00	23.00
K			9.14	
k	1.4			
n	0.49			
C	0.55	0.55	0.55	0.55
l	2.24	2.10	1.91	2.02
A	558.3	558.3	558.3	558.3
<b>Q</b>	<b>687.71</b>	<b>644.84</b>	<b>585.21</b>	<b>620.27</b>
<b>Use Caltrans District 04 methods, maps and chart, dated October 1974.</b>				
Map I - Isohyet = 1.25 in/hr				
Zone = B2				



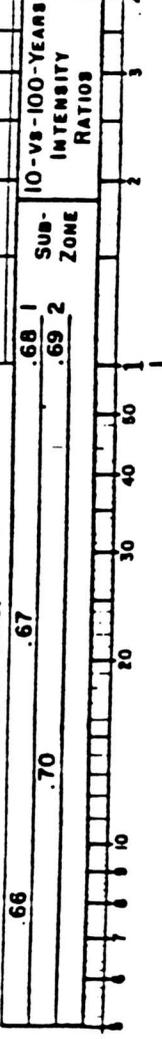
STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION (CALTRANS) - DISTRICT 4  
 1-in-100-years DESIGN RAINFALL INTENSITY DURATION CURVES,  
 and 10-vs-100-years DESIGN INTENSITY RATIOS, ZONE B  
 from: "1941-71 RAINFALL INTENSITY - DURATION - FREQUENCY ANALYSIS"

INTENSITY - INCHES PER HOUR



The 1-to-72-hours portions of the curves are based on interpolation and correlation of values derived from analysis of up to 31 years (7/40-6/71) of records from 79\* Recorder Stations and 305\* Non-Recorder Stations. (\* = 6-zone totals)

The 5-to-60-minute portions of the curves are extrapolated from the 1-to-72-hour portions, supported by limited observation data.



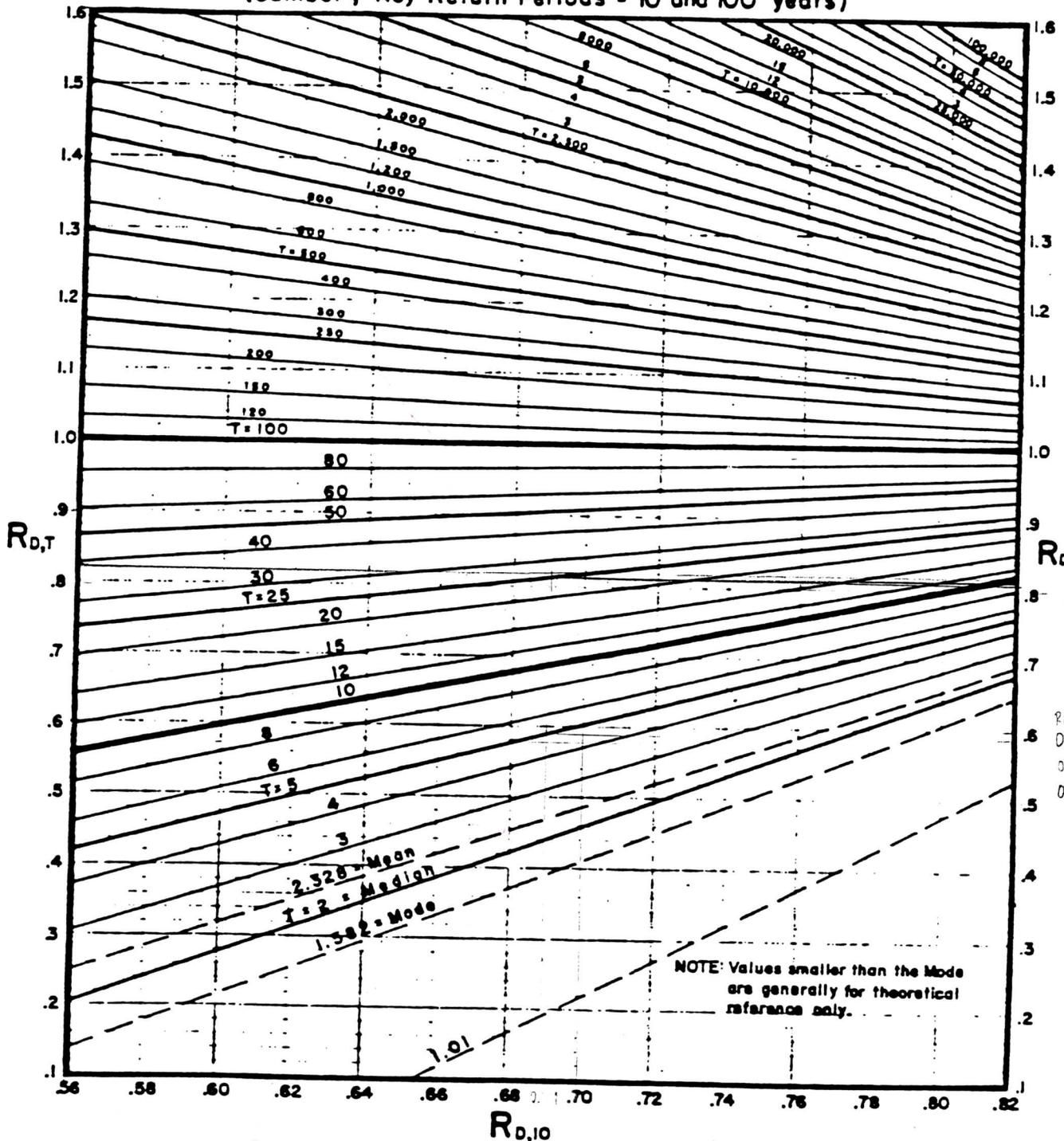
MINUTES - DURATION - HOURS

CHART "K", ZONE B

EK/ERR  
9/74

1.25 (100 yr)  
1.50 HYET

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION (CALTRANS) - DISTRICT 4  
**FREQUENCY DISTRIBUTION RATIOS CHART "R"**  
 (Gumbel ; Key Return Periods = 10 and 100 years)



EQUATIONS SEE "1941-71 RAINFALL INTENSITY - DURATION - FREQUENCY ANALYSIS"

(29)  $R_{D,T} = I_{D,T} / I_{D,100}$ , where  
 (31)  $I_{D,T} = I_{D,100} \left\{ 1 + \left[ \frac{(1 - R_{D,10})}{(y_{100} - y_{10})} \right] (y_T - y_{100}) \right\}$  and  
 (4)  $y_T = - \ln \left[ - \ln (1 - 1/T) \right]$

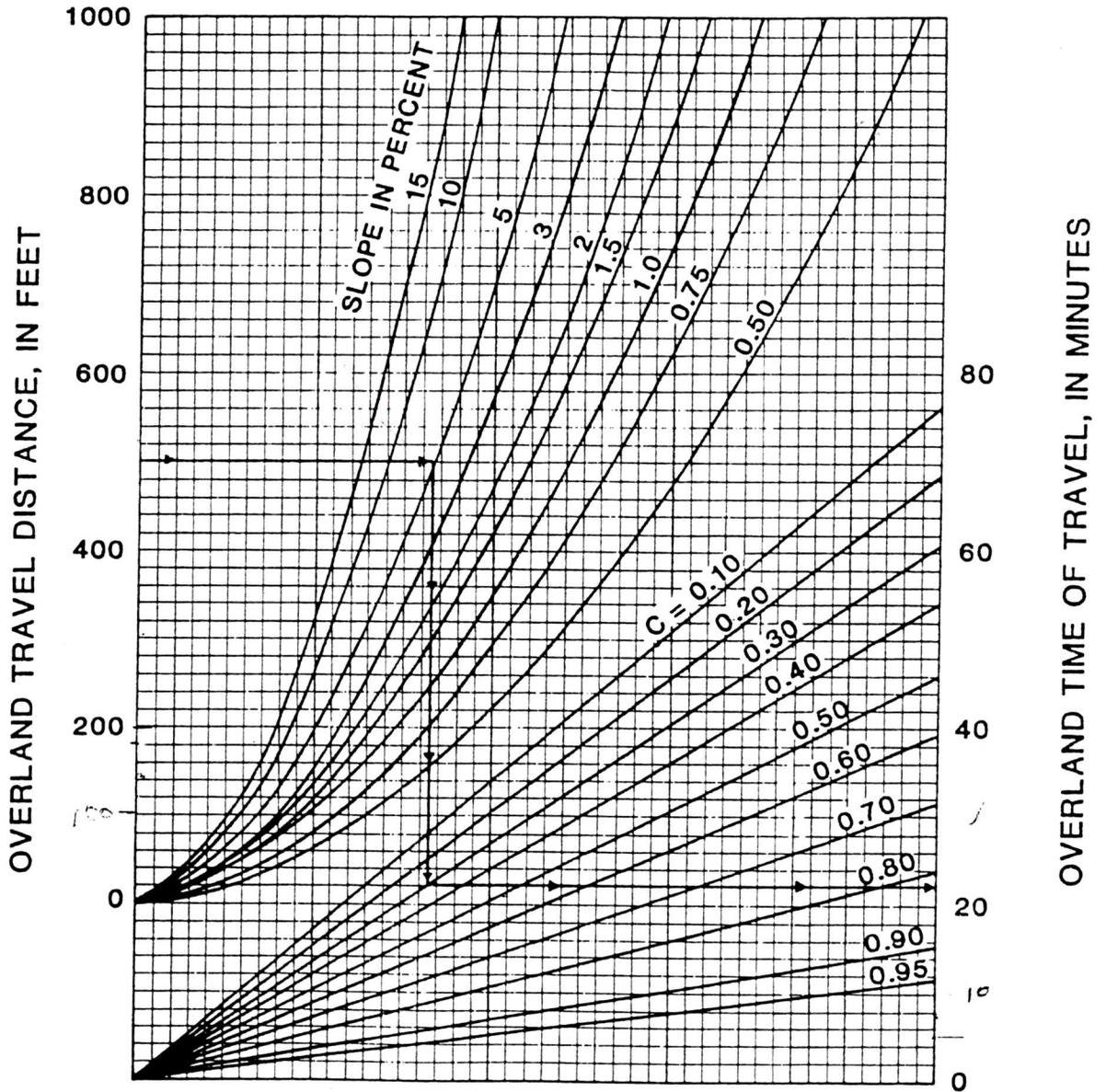
T = Return Period, Years  
 R = Ratio  
 $I_D$  = Intensity (For a given duration D),  
 Inches/Hr.

Other parameters, such as discharge rate (Q) may be substituted for  $I_D$ .

Town of Atherton  
Runoff Coefficient

	Year 2000					1960 "C"
	Caltrans Undeveloped Areas	Caltrans Developed Areas	CSC	Stanford	BKF	Ed Smith
Relief	0.12		0.1			
Soil Infiltration	0.1		0.125			
Vegetal Cover	0.1		0.1			
Surface Storage	0.1		0.15			
Suburban		0.4				
Single-family areas		0.5				
Hill side				0.5		
Undeveloped				0.4		
$C_{avg} =$	0.42	0.45	0.48	0.45	0.55	0.29
$C_{avg(2000)} =$	0.47					
$C_{avg(used)} =$	<b>0.50</b>					
Factor =	1.72					
One acre lot	C	AREA	C*A			
Impervious (ft <sup>2</sup> )	1	8000	8000			
Undeveloped (ft <sup>2</sup> )	0.4	35560	14224			
			22224			
		$C_{avg} =$	0.51			
		Factor =	1.76			
Two acre lot	C	AREA	C*A			
Impervious (ft <sup>2</sup> )	1	12000	12000			
Undeveloped (ft <sup>2</sup> )	0.4	75120	30048			
			42048			
		$C_{avg} =$	0.48			
		Factor =	1.66			
Growth - Hillside	1961 USGS	Present	Factor			
No. of houses	8	13	1.63			
	22	26	1.18			
	47	58	1.23			
			1.35			
Growth - Lower side			1.5			

Figure 816.6A  
Overland Time of Concentration Curves



$$T_o = \frac{1.8(1.1-C)(L)^{1/2}}{[S(100)]^{1/3}}$$

Where:

- C = Runoff Coefficient
- L = Overland Travel Distance in feet
- S = Slope in ft./ft.
- T<sub>o</sub> = Time in minutes

**APPENDIX F**

**ATHERTON DETENTION STORAGE INVENTORY (BY BKF)**



**APPENDIX G**

**PRIORITIZED RECOMMENDED IMPROVEMENTS**

**ATHERTON TOWNWIDE DRAINAGE STUDY UPDATE RECOMMENDED IMPROVEMENTS**  
**Prioritized to restore up to 7 year capacity in Atherton Channel**

ID No.	Description	2014 Project Cost	Tier**	Problem Priorities					
				Health & Safety Issues	Building Flooding	Public R/W Flooding	Private Flooding	New Storm Drain Sys.	Upgrade Ex. SD/Channel
H	SF Water line/Reservoir Channel Reline & Erosion Control	\$ 2,360,000	1	X					X
Q	Alameda De Las Pulgas/Camino Al Lago Upgrade Ex. Channel	\$ 1,467,000	1	X-School	X	X	X		X
II1	Reline Channel Sides (Upstream of Alameda de las Pulgas)	\$ 2,000,000	1	X					X
JJ1	Reline Channel Bottom (Upstream of Alameda de las Pulgas)	\$ 310,000	1	X					X
	<b>Tier 1 Subtotal:</b>	<b>\$ 6,137,000</b>							
II2	Reline Channel Sides (Alameda de las Pulgas to El Camino Real)	\$ 2,000,000	2	X					X
JJ2	Reline Channel Bottom (Alameda de las Pulgas to El Camino Real)	\$ 310,000	2	X					X
U1	Barry/Elena Upgrade Channel	\$ 2,300,820	2		X	X	X		X
E2	Mandarin SD System	\$ 322,000	2				X	X	
M6	El Camino (PA101)	\$ 254,000	2			X	X		
DD1	Euclid/Parker Ditch (PA 102)	\$ 2,179,000	2				X		
LL1	Clay Drive (PA108)	\$ 52,000	2			X	X		
N	Almendra Concrete Swale and Regrade	\$ 437,000	2		X	X	X		
O	Stockbridge Concrete Swale and Regrade	\$ 697,000	2			X	X		
LL2	Monte Vista (PA105)	\$ 68,000	2				X		
	<b>Tier 2 Subtotal:</b>	<b>\$ 8,619,820</b>							
U2	Barry/Elena Upgrade Channel	\$ 1,700,000	3		X	X	X		X
HH1	Watkins South Channel & Culvert	\$ 625,000	3						X
B1	Belbrook/Walsh SD System & Swale	\$ 79,000	3			X		X	
Z2	Heather SD System and Upgrade	\$ 473,000	3			X		X	X
GG1	James/Hawthorne (PA107)	\$ 131,000	3			X			X
HH3	Reservoir Rd (PA109)	\$ 58,000	3			X			X
C1	Sutherland/Ridgeview (PA 98)	\$ 34,000	3			X			X
R	Linda Vista/Camino Al Lago Regrade Intersection	\$ 23,000	3			X			
	<b>Tier 3 Subtotal:</b>	<b>\$ 3,123,000</b>							
<b>LONG TERM PROJECTS:</b>									
HH2	Watkins/Middlefield Channel & Culvert	\$ 5,734,000	4						X
U3	Barry/Elena Upgrade Channel	\$ 2,300,820	4		X	X	X		X
M1	El Camino Real SD System	\$ 2,348,000	4			X	X	X	X
M5	El Camino Real SD Force Main & Pump Station	\$ 5,163,000	4			X	X	X	X
M2	Fair Oaks Lane SD System	\$ 138,000	4			X			
W2	Mac Bain/Alejandra/Brittany SD System and Upgrade	\$ 713,000	4			X	X	X	X
B2	Belbrook/Walsh Upgrade Culvert w/ Erosion Control	\$ 338,000	4			X			X
I	Selby/Stockbridge Upgrade SD System	\$ 2,371,000	4			X			X
FF2	Middlefield East Upgrade Ex. SD System	\$ 629,000	4			X			X
FF3	East Middlefield (PA 31,39 still an issue)	\$ 17,000	4			X			X
V	Por Los Arboles/Valparaiso Regrade Intersection	\$ 22,000	4			X			
EE1	Alejandra (PA 104)	\$ 32,000	4				X		
KK1	Polhemus/Fleur (PA100)	\$ 87,000	4			X			
	<b>Tier 4 Subtotal:</b>	<b>\$ 19,892,820</b>							
E1 (Not done but no observed issue)	Alameda/Mulberry/Polhemus Upgrade Boxes & Ex. SD System	\$ 1,254,000	5			X	X		X
G (Not done but no observed issue)	Broadacres Upgrade Culvert	\$ 350,000	5		X	X			X
CC2 (Not done but no observed issue)	Greenoak Upgrade SD System	\$ 1,191,000	5			X			X
CC3 (Not done but no observed issue)	Bay Road Upgrade SD System	\$ 710,000	5			X			X
P (Not done but no observed issue)	Virginia/Fair Oaks Regrade Intersection	\$ 17,000	5			X			
Z1 (Not done but no observed issue)	Heather Swale	\$ 22,000	5			X			
CC1 (Not done but no observed issue)	Greenoak Swale	\$ 24,000	5			X			
EE (Not done but no observed issue)	Catalpa/Acorn Regrade Intersection	\$ 21,000	5			X			
	<b>Tier 5, Subtotal:</b>	<b>\$ 3,589,000</b>							
<b>Tier</b>									
** 1 = Health and Safety, life threatening to the masses									
2 = Avoid Damage to Private Property									
3 = Public (no downstream influence)									
4 = Public (downstream connection under capacity)									
5 = Listed in 2001 Drainage Study but no observed issues									

**ATHERTON TOWNWIDE DRAINAGE STUDY UPDATE  
RECOMMENDED IMPROVEMENTS  
Project Cost Details**

Problem								Total	Existing	Proposed
ID No.	No.	Description	Improvement	Quantity	Unit	2014 Unit Cost	2014 Cost	2014 Cost	System	System
B1	52	Belbrook/Walsh SD System & Swale	New	136	L.F.	310	\$ 42,160	\$ 79,000		15" & Swale
			Manholes	1	E.A.	8000	\$ 8,000			
			Inlets	2	E.A.	5000	\$ 10,000			
			Swale	155	L.F.	120	\$ 18,630			
B2	Under Capacity	Belbrook/Walsh Upgrade Culvert w/ Erosion Control	Upgrade BX	135	L.F.	2500	\$ 337,500	\$ 338,000	72" CMP	2-72" & Erosion Control
E1	1, 21	Alameda/Mulberry/Polhemus Upgrade Boxes & Ex. SD System	Upgrade SD	1394	L.F.	310	\$ 432,032	\$ 1,254,000	24", 36" & 31"x 50"	2-3'x2' bx, 2-36" culvert & 48"
			Manholes	4	E.A.	11000	\$ 44,000			
			Inlets	8	E.A.	5000	\$ 40,000			
			Upgrade BX	295	L.F.	2500	\$ 737,500			
E2	40,106	Mandarin SD System	New	862	L.F.	310	\$ 267,220	\$ 322,000		24"
			Manholes	3	E.A.	8000	\$ 24,000			
			Inlets	6	E.A.	5000	\$ 30,000			
G	Under Capacity	Broadacres Upgrade Culvert	Upgrade BX	140	L.F.	2500	\$ 350,000	\$ 350,000	6'x5' box	12'x6' Box
H	Reline	SF Water line/Reservoir Channel Reline & Erosion Control	Reline	1180	L.F.	2000	\$ 2,360,000	\$ 2,360,000		Reline & Erosion Control
I	42	Selby/Stockbridge Upgrade SD System	Upgrade SD	6496	L.F.	310	\$ 2,013,779	\$ 2,371,000	24", 27", 36" & 48"	36" to 60" & Swale
			Manholes	17	E.A.	11000	\$ 187,000			
			Inlets	34	E.A.	5000	\$ 170,000			
M1	8,15, 25, 78, 79, 89,99	El Camino Real SD System	New	6420	L.F.	310	\$ 1,990,265	\$ 2,348,000	12", Ditch, Culvert & 42"	24" to 72"
			Manholes	17	E.A.	11000	\$ 187,000			
			Inlets	34	E.A.	5000	\$ 170,000			
M2	22, 27,113	Fair Oaks Lane SD System	New	386	L.F.	310	\$ 119,660	\$ 138,000	Dry well	18"
			Manholes	1	E.A.	8000	\$ 8,000			
			Inlets	2	E.A.	5000	\$ 10,000			
M5	M1	El Camino Real SD Force Main & Pump Station	New	6334	L.F.	310	\$ 1,963,540	\$ 5,163,000		60" @ 10 ft/sec (90,000 gpm) & Pump Station
			Access MH	7	E.A.	11000	\$ 77,000			
			Valves	7	E.A.	3100	\$ 21,700			
			Pump Station	1	E.A.	3100000	\$ 3,100,000			
M6	79,101	Lloyden SD	New	769	L.F.	310	\$ 238,390	\$ 254,000		18"
			Inlets	3	E.A.	5000	\$ 15,000			
N	41, 45, 46, 48	Almendral Concrete Swale and Regrade	Swale	388	L.F.	120	\$ 46,558	\$ 437,000		Swale & Crown
			Crown	1774	L.F.	220	\$ 390,265			
O	55, 71, 77	Stockbridge Concrete Swale and Regrade	Swale	1341	L.F.	120	\$ 160,940	\$ 697,000		Swale & Crown
			Crown	2433	L.F.	220	\$ 535,262			
P	47	Virginia/Fair Oaks Regrade Intersection	Swale	140	L.F.	120	\$ 16,822	\$ 17,000		Swale
Q	30, 76	Alameda De Las Pulgas/Camino Al Lago Upgrade	Ex. Channel					\$ 1,467,000	10'x5' Metal Arch & Channel	12'x6' Box & Channel
			New SD	1200	L.F.	310	\$ 372,000			
			Inlets	2	E.A.	5000	\$ 10,000			
			Block Wall	1689	S.F.	50	\$ 84,450	\$ 84,450		
			Upgrade CH	500	L.F.	2000	\$ 1,000,000			
R	23	Linda Vista/Camino Al Lago Regrade Intersection	Swale	188	L.F.	120	\$ 22,606	\$ 23,000		Swale
U	11, 37, 69	Barry/Elena Upgrade Channel	Upgrade CH 10yr	850	L.F.	2000	\$ 1,700,000	\$ 6,302,000	14'x5' box, 12'x6' box & Channel	2-10'x7', 2-10'x7' Boxes & Channel
U1			Reline	2301	L.F.	2000	\$ 4,601,640	\$ 1,700,000		
U2, U3								\$ 2,300,820		
V	67	Por Los Arboles/Valparaiso Regrade Intersection	Swale	179	L.F.	120	\$ 21,499	\$ 22,000		Swale
W2	16, 20, 83	Mac Bain/Alejandra/Brittany SD System and Upgrade	New	1518	L.F.	310	\$ 470,623	\$ 713,000	12" & 18" @ discharge pt.	18" to 36"
			Manholes	4	E.A.	8000	\$ 32,000			
			Inlets	8	E.A.	5000	\$ 40,000			
			Upgrade SD	412	L.F.	310	\$ 127,584			
			Manholes	2	E.A.	11000	\$ 22,000			
			Inlets	4	E.A.	5000	\$ 20,000			
Z1	2	Heather Swale	Swale	180	L.F.	120	\$ 21,541	\$ 22,000		Swale
Z2	2	Heather SD System and Upgrade	New	1019	L.F.	310	\$ 315,834	\$ 473,000	12" discharge	24" to 36" SD
			Manholes	3	E.A.	8000	\$ 24,000			
			Inlets	6	E.A.	5000	\$ 30,000			

**ATHERTON TOWNWIDE DRAINAGE STUDY UPDATE  
RECOMMENDED IMPROVEMENTS  
Project Cost Details**

Problem								Total	Existing	Proposed
ID No.	No.	Description	Improvement	Quantity	Unit	2014 Unit Cost	2014 Cost	2014 Cost	System	System
			Upgrade SD	263	L.F.	310	\$ 81,533			
			Manholes	1	E.A.	11000	\$ 11,000			
			Inlets	2	E.A.	5000	\$ 10,000			
CC1	60	Greenoak Swale	Swale	199	L.F.	120	\$ 23,856	\$ 24,000		Swale
CC2	Under Capacity	Greenoak Upgrade SD System	Upgrade SD	3231	L.F.	310	\$ 1,001,526	\$ 1,191,000	12" & 24"	36" to 48"
			Manholes	9	E.A.	11000	\$ 99,000			
			Inlets	18	E.A.	5000	\$ 90,000			
CC3	85, 95	Bay Road Upgrade SD System	Upgrade SD	1950	L.F.	310	\$ 604,506	\$ 710,000	21" discharge pipe	60" SD
			Manholes	5	E.A.	11000	\$ 55,000			
			Inlets	10	E.A.	5000	\$ 50,000			
DD1	102	Reline Euclid Ditch and Upgrade SD Pipe.	Upgrade SD	396	L.F.	310	\$ 122,760	\$ 2,179,000	Open Ditch and Pipe	Reline ditch and Upgrade Pipe
			Reline Sides	890	L.F.	2000	\$ 1,780,000			
			Reline Bottom	890	L.F.	310	\$ 275,900			
EE	87	Catalpa/Acorn Regrade Intersection	Swale	170	L.F.	120	\$ 20,441	\$ 21,000		Swale
EE1	104	Alejandra Swale	Swale	262	L.F.	120	\$ 31,440	\$ 32,000		Swale
FF2	Under Capacity	Middlefield East Upgrade Ex. SD System	Upgrade SD	1687	L.F.	310	\$ 523,103	\$ 629,000	12", 24" & Ditch	36" SD
			Manholes	5	E.A.	11000	\$ 55,000			
			Inlets	10	E.A.	5000	\$ 50,000			
FF3	31,39 (Still an issue from 01' Study)	Middlefield East Barriers and Backflow Preventers on Properties Adjacent to SD System	Barrier	92	L.F.	40	\$ 3,680	\$ 17,000		Backflow Prevention Valves & Barriers
			Backflow Valves	6	E.A.	2200	\$ 13,200			
GG1	107	James SD	New	362	L.F.	310	\$ 112,220	\$ 131,000		18" SD
			Manholes	1	E.A.	8000	\$ 8,000			
			Inlets	2	E.A.	5000	\$ 10,000			
HH1	110, Channel Under Capacity	Watkins South Channel & Culvert	Upgrade BX	248	L.F.	2500	\$ 619,088	\$ 625,000	2-8'x6' boxes	2-12'x6' Box
			Inlets	1	E.A.	5000	\$ 5,000			
HH2	Under Capacity	Watkins/Middlefield Channel & Culvert	Upgrade BX	700	L.F.	1800	\$ 1,260,000	\$ 5,734,000	Channel and 12'x6', 12'x6' boxes	Channel 13.5'x7.5' and 8'x6' Boxes w/wall (keep exist box)
			Upgrade CH	2237	L.F.	2000	\$ 4,474,000			
HH3	109	Reservoir Road SD System	New	153	L.F.	310	\$ 47,430	\$ 58,000	Concrete Lined Swale	18" SD
			Inlets	2	E.A.	5000	\$ 10,000			
II	Reline	Reline Channel Sides (Includes both phases, II1 and II2)	Reline	2000	L.F.	2000	\$ 4,000,000	\$ 4,000,000		Reline
JJ	Reline	Reline Channel Bottom (Includes both phases, JJ1 and JJ2)	Reline	2000	L.F.	310	\$ 620,000	\$ 620,000		Reline
C1	98	SD System	New	50	L.F.	310	\$ 15,500	\$34,000		18" SD
			Manholes	1	E.A.	8000	\$ 8,000			
			Inlets	2	E.A.	5000	\$ 10,000			
KK1	100	Monte Vista Swale Improvement & Perforated Underdrain Pipe	Swale	724	L.F.	120	\$86,880	\$87,000		Swale & Perforated Underdrain
LL1	108	Ckay Dr SD System and Barrier	New	127	L.F.	310	\$39,370	\$52,000		18" SD & Barrier
			Inlets	2	E.A.	5000	\$10,000			
			Barrier	50	L.F.	40	\$2,000			
LL2	105	Monte Vista Swale	Swale	566	L.F.	120	\$67,920	\$68,000		Swale
								\$ 41,362,000		