California State University Monterey Bay

Stormwater Master Plan

February 2006

Schaaf & Wheeler
CONSULTING CIVIL ENGINEERS

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Appendices

EXECUTIVE SUMMARY

INTRODUCTION

This Stormwater Master Plan (SWMP) provides a framework and workable tool to allow California State University at Monterey Bay (CSUMB) to predict, plan, guide and implement the necessary capital improvements to meet the campus stormwater collection system needs. In 2004, CSUMB updated its *Campus Master Plan* (2004 CMP). The stormwater collection, conveyance, discharge and percolation facilities identified in the SWMP encompass the 2004 CMP Planning Horizons through Year 2025, Planning Horizon III.

Developed concurrent with this Stormwater Master Plan is CSUMB's Stormwater Management Plan. The Management Plan describes "source-control" BMPs that minimize the mobilization of pollutants into CSUMB's stormwater system, as well as "treatment-control" BMPs to remove or reduce pollutants once mobilized in stormwater.

The 1300+ acre CSUMB campus, which opened in 1994, is located within the cantonment area of the former Fort Ord (see Figure ES-1). It is served by an existing regional stormdrain system constructed by the United States Army (USA). The portion of that storm drainage collection system located within the Campus boundaries is owned and operated by CSUMB.

This SWMP **reflects the major ongoing changes in stormwater** discharge practices for the former Fort Ord mandated by the *Fort Ord Reuse Plan* and being implemented by the Fort Ord Reuse Authority (FORA). Specifically:

> …no further discharges will occur to the Monterey Bay Marine Sanctuary or to the coastal dune habitat within the future Fort Ord State Park west of Highway 1. This means that all redevelopment in the former cantonment area must provide adequate on-site infiltration of stormwater runoff and that existing impervious surfaces be modified or the runoff managed and redirected to suitable infiltration facilities.

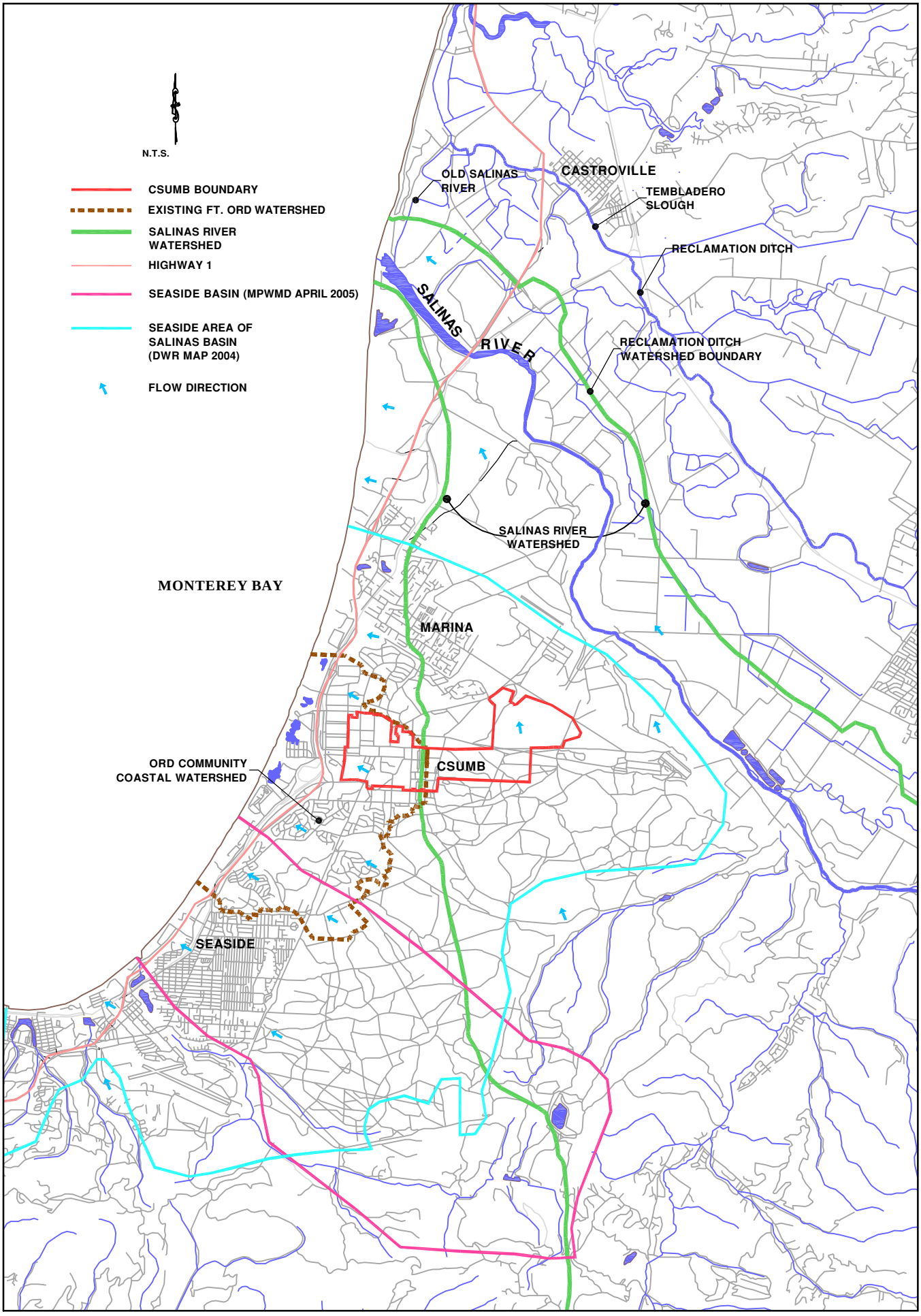
The primary CSUMB stormwater **goals and objectives** addressed by this SWMP are to:

- Contain and percolate all stormwater on-site, and
- Provide permanent structural flood protection and drainage solutions to address the range of potential impacts resulting from the multiple use sites.

The SWMP **scope of work** was carried out to:

- Provide an overview of the study area characteristics including the hydrologic and environmental setting, land use, and existing storm drainage system and rights,
- Establish flood protection and drainage criteria,
- Analyze the existing stormdrain system,
- Identify, develop and recommend stormwater protection and drainage improvements necessary to support implementation of the 2004 CMP and meet the mandate of the Fort Ord Reuse Plan that no stormwater be discharged to the Monterey Bay Marine Sanctuary and that stormwater be infiltrated on-site within each jurisdictions boundaries,

Figure ES-1



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- Develop an implementation strategy that corresponds to the proposed changes in the regional systems and to the implementation of 2004 CMP Planning Horizons,
- Provide engineering planning documents (mapping and a report) summarizing findings and recommendations, and
- Obtain CSUMB staff and public participation through workshops and coordination meetings.

STUDY AREA CHARACTERISTICS

The CSUMB campus, located about 1.5 miles east of the Monterey Bay coastline, has a **hydrologic and environmental setting** characterized by:

- Cool moist winters and cool dry summers with strong onshore winds, low clouds and fog,
- A mean annual precipitation of about 15 inches with most occurring November through April,
- Highly permeable dune sands and topography of the former Fort Ord result in minimal flooding and very little natural runoff, and
- Type A Hydrologic Soil Group with infiltration rates of 6 to 20 inches per hour.

The CSUMB campus straddles the southern boundary of the Salinas River **Watershed**, at about 8th Avenue (see Figure ES-1.) East of 8th Avenue, stormwater runoff is infiltrated locally into existing depressions and percolation basins.

Campus runoff originating west of 8th and intercepted by the existing regional storm drain system is conveyed to percolation basins west of Highway 1. FORA constructed three percolation basins in 2004 to replace three failing ocean outfalls, thus eliminating stormwater discharges to Monterey Bay for most of the former Fort Ord including the CSUMB campus. Existing depressions and the City of Marina percolation basin at the intersection of 8th Street and 5th Avenue also allow percolation of significant runoff.

The **existing regional stormdrain system** was built by the USA over a period of about 60 years and is reaching the end of its useful life. It will require major repair and/or replacement for long term use. Much of the system will become the unnecessary as the former Fort Ord is redeveloped and the Fort Ord Reuse Plan mandate of no stormwater discharges to the Monterey Bay Marine Sanctuary is implemented. Portions of the existing system are or will be retained by each jurisdiction to infiltrate stormwater on-site within its boundaries. However, until local percolation of stormwater runoff is fully implemented, portions of the existing system will be necessary.

While other utilities on the former Fort Ord have been conveyed to others, the existing regional stormdrain system will be treated differently. The present approach used by FORA and the USA for **future rights** to the existing stormdrains is understood to be as follows:

- When property is conveyed to a reuser such as CSUMB, the existing stormdrain system within its boundaries is also to be conveyed and becomes the responsibility of the property owner,
- That responsibility includes operation, maintenance, repair and replacement,
- Conveyance agreements between the reusers and the USA are to address the issue
- Basic California Drainage Laws are to govern.

An engineering review of **California Drainage Law** made for this SWMP indicates that upstream properties dependent on the existing regional system components transferred to CSUMB, for example, have the right to continue to convey historical flow into and through that system. It is assumed that the historical flows cannot increase in velocity or volume, *Locklin v. City of Lafayette* (Calif. Supreme Court 1994).

Since 1994 the USA, FORA, CSUMB and others have been developing reuse plans for future **land use** on the former Fort Ord. The *Fort Ord Reuse Plan*, adopted in June 1997, provides the framework for that redevelopment.

The campus is described by five zones:

- Central Campus, houses the primary academic and student support services,
- West Campus, primarily sports and recreation,
- North Campus, student, faculty/staff and family housing with some campus and student support services,
- East Campus Open Space, and
- East Campus Housing, redeveloped military residential areas

METHODOLOGIES

The SWMP is an engineering planning-level tool that incorporates published and available development plans, stormwater master plans, policies, practices and standards applicable to the former Fort Ord. It capitalizes on the unique combination of weather, highly permeable soils, the dune topography, and the extensive redevelopment activities planned and underway on the former Fort Ord provide meet the mandate of the Fort Ord Reuse Plan that no stormwater be discharged to the Monterey Bay Marine Sanctuary.

The **system analysis and data sources** included:

- The USA Corps of Engineers (USACOE) Hydrologic Engineering Hydrograph Package (HEC-1),
- The Monterey County Department of Public Works Plate 25, Rainfall Intensities Chart,
- The Department of Agriculture Soil Survey of Monterey County,
- USACOE Stormdrain Maps for Fort Ord, and
- Recent As-Builts for CSUMB

This SWMP proposes flood protection and **drainage criteria** with levels of protection at the 10- and 25- year for roadways and 100-year for containment on the Campus. All appropriate or corresponding areas of the drainage systems within CSUMB are planned to meet these criteria upon implementation of the SWMP. The 100-year flood is the Federal Emergency Management Agency (FEMA) base flood, a national standard.

To contain and percolate runoff resulting from the 100-year storm event within the Campus boundaries, the approach used for **development of alternatives relies on** smaller, shallower basins/retention facilities located throughout the campus. Use of smaller basins allows for less and smaller conveyance infrastructure.

CSUMB representatives preferred the use of smaller basins. Additionally:

- Schaaf & Wheeler staff accompanied CSUMB staff to locate the basins,
- Each basin was sized according to its particular drainage area and future land use, and
- A basin's final size and drainage area will depend on Campus improvements such as the grading and percent imperviousness of the final campus product, and
- Use was made of localized infiltration/retention facilities upstream of the basin.

The development of the campus buildings and facilities in some locations may increase impervious surfaces, increasing the potential for contaminated runoff. However, infiltration of runoff at or near its source, use of properly designed and constructed basins, and implementation of best management practices (BMPs) and maintenance of facilities is expected to significantly reduce contaminants. Also, planned asphalt, building and building pad removal will result in an overall decrease of impervious surfaces and contaminated runoff. Regular monitoring of the operation of the percolation basins and their effective maintenance is being programmed into the implementation to the Stormwater Management and Master Plans,

The SWMP **water quality enhancements** focus on using low maintenance "structural treatment control" BMPs that CSUMB can implement as they continue to develop the campus. Specifically:

- Each subwatershed will have an infiltration facility, preferably a percolation basin.
- Vegetated swales are the preferred drainage system to capture runoff and convey it to its pond while filtering trash, oils and sediments.
- Where vegetated swales are not feasible, mechanical separators such as vortex separators should be used.
- The SWMP provides structural and non-structural "source control" BMPs intended to reduce the quantity of pollutants that could mobilize in stormwater.

The BMPs are intended to keep CSUMB in compliance with locally adopted ordinances at a minimum, and assist CSUMB's goal of being an environmental steward with respect to water quality issues.

PHYSICAL CONDITION AND ORGANIZATION OF EXISTING STORMDRAIN SYSTEMS

This SWMP did not include assessing the condition of the existing CSUMB stormdrain systems. Field reviews, discussions with CSUMB representatives and the Schaaf & Wheeler experience with the former Fort Ord stormdrain system over the past ten years did lead to several generalized observations listed below.

- Stormdrain system installed by the USA since the 1940's does not appear to follow an organized stormwater master plan,
- Underground drainage does not necessarily follow the natural grades of the land,
- Many inlets and manholes are clogged by sand and/or vegetation,
- Some inlets and manholes were not found but are most likely covered by either sand, vegetation and or asphalt,
- The USA plans do not accurately portray several areas of the existing stormdrain system,

- No hydraulic deficiencies were identified for the stormdrain system in the East Campus portion of CSUMB, constructed in the mid 1980s,
- Some stormdrain grates were found to be missing and should be replaced to reduce the risk of injury,
- Development of new stormdrain systems should take advantage of the grading of open space to maximize local infiltration opportunities,
- Existing stormdrain facilities, including inlets and manholes, that will continue to be used should be assessed to determine their size, condition and capacity. Stormdrain pipes should be cleaned and videoed, and
- Finally, regular maintenance of gutters, stormdrain inlets, manholes and pipes including removal of sand and sediment from percolation faculties should be incorporated into the campus maintenance plan.

RECOMMENDED CAPITAL IMPROVEMENTS

Approximately $15 million dollars in stormdrain capital improvements were identified in the SWMP. A guide for implementation was developed and included in the SWMP. It attempts to match projects with the 2004 CMP Planning Horizons, where applicable, but the proposed stormdrain improvements often encompass many 2004 CMP projects. Figure ES–2 shows the location of each project, its subwatershed boundary, and associated Planning Horizon.

There are 31 projects grouped into four phases for the four small watersheds of the main campus and the single East Campus watershed. The phasing of a project denotes its order of importance as summarized below.

- Phase I, 20 Projects: most critical, stand alone (no predecessor) projects,
- Phase II, 4 Projects: rely on implementation of one or more Phase I projects,
- Phase III, 5 Projects: require implementation of one or more Phase II projects, and
- Phase IV, 2 Projects: dependent on implementation of one or more Phase III projects.

Several other key points on the SWMP recommended capital improvements are listed below.

- A consequence of not implementing a project's upstream predecessor is that the project may not provide 100-year protection until predecessor projects are constructed,
- A significant share of the estimated $15 million in capital costs, about 35 percent, is related directly to pavement removal, and
- Each subwatershed is considered a separate capital improvement project. All improvements are sized for future build-out conditions of the 2004 CMP.

Finally, the SWMP project descriptions provide CSUMB with master plan level capital improvement cost estimates and give the design engineer guidance and information to develop project designs. Final costs of a project will depend on site specific conditions, final project scope, competitive market conditions, and actual labor and materials costs. While many alternatives are possible, the recommended approach takes advantage of the unique soil conditions on the CSUMB campus as well as the opportunities afforded by the ongoing former Fort Ord conversion to civilian uses.

54" PERCOLATION POND

NORTH / SOUTH 48" PERCOLATION POND

MONTEREY BAY

POTENTIAL DRAINAGE EASEMENT

EXISTING 54" SD

HIGHWAY 1

POTENTIAL DRAINAGE EASEMENT

EXISTING NORTH 48" SD

UNIVERSITY VILLAGES

CITY OF MARINA

CITY OF SEASIDE

EXISTING SOUTH 48" SD

POTENTIAL DRAINAGE EASEMENT

CITY OF SEASIDE GATEWAY

MAIN PARKWAY

CITY OF MARINA

MONTEREY COUNTY

0-ft 500 1,000 1,500

2ND AVE

-B1-
(NONE)

-C1-
(NONE)

-B2-
(C2, C3, C4)

-C2-
(C3, C4)

-B3- (NONE)

3RD ST

-B4-
(A9, C3, C5-C9)

-C3-
(A9, C5-C9)

-C4-
(NONE)

-D1-
(D3, D5, D6, D7)

INTER-GARRISON RD.

MONTEREY COUNTY

CSUMB

-D2-
(D3)

7TH AVE

8TH AVE

1ST ST

-C5-
(NONE)

-D3-
(NONE)

POTENTIAL DRAINAGE EASEMENT FOR ARMY

-D4-
(NONE)

-A2-
(A3, A4, A7, B4, C3)
(C5-C9)

GENERAL JIM MOORE BLVD

-A6-
(NONE)

-A3-
(NONE)

-A7-
(NONE)

-C6-
(D5- D9)

-A8-

-D5-

-C7-
(NONE)

-D6-
(NONE)

-A1-

LIGHTFIGHTER DR.

-A5-

-A4-

-D7-

COL. DURHAM AVE.

-A8-
(SEASIDE, C8, C9)

-C8-

-D8-

-C9-

-D9-

-C8-
(SEASIDE, C9)

-D5-
(NONE)

CITY OF SEASIDE

MONTEREY COUNTY

LEGEND

FUNDED HORIZON I PROJECT (2005-2015)*	HORIZON III PROJECT (2025 +)*
REMAINING HORIZON I PROJECT (2005-2015)*	FLOATABLE PROJECT*
HORIZON II PROJECT (2015-2025)*	NON-CSUMB PROJECT/EXISTING SUBBASIN*
CSUMB BOUNDARY	PROPOSED CSUMB PERCOLATION POND
-B3- PROJECT / SUBWATERSHED	EXIST REGIONAL / EXIST PERCOLATION POND
(C2, C3, C4) UPSTREAM PREDECESSOR PROJECT / SUBWATERSHED	

* ALL PROJECTS ARE PROPOSED. THEY ARE NOT APPROVED TO DATE.

CALIFORNIA STATE UNIVERSITY Monterey Bay
REVISED FEBRUARY 10, 2004

STORMWATER MASTER PLAN
FIGURE ES-2: IMPLEMENTATION PLAN

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MARINA, CA 93933
(831) 883-4848

This map is intended to be used with Table ES-1 of the CSUMB Stormwater Master Plan. There are 31 projects grouped into four phases for the four small watersheds of the main campus and the single East Campus watershed (not shown). The phasing of a project denotes its order of importance is as follows.

- Phase I, 20 Projects: most critical, stand alone (no predecessor) projects,
- Phase II, 4 Projects: rely on implementation of one or more Phase I projects (at least one predecessor),
- Phase III, 5 Projects: require implementation of one or more Phase II projects (at least two predecessors), and
- Phase IV, 2 Projects: dependent on implementation of one or more Phase III projects (at least three predecessors).

ALL PROJECTS* AGAINST CSUMB PLANNING HORIZONS
*EXCLUSIVE OF EAST CAMPUS

11/21/05
SCALE: AS NOTED
DESIGN: MJW
DRAWN: MJW
CHECKED: DAF

FIGURE ES-2

LANDSCAPE AND MAINTENANCE RECOMMENDATIONS

The performance and maintenance requirements of percolation facilities are very dependent on the sediment load of the influent water. Sediment, which can rapidly reduce the permeability of the basin materials, will require periodic removal by scraping the sediment from the bottom and sides of the percolation facility. Initially, annual maintenance should include sediment, debris and trash removal.

Percolation rates will decrease over time unless facility maintenance is performed. It is recommended that percolation testing be performed at least once every five years on the undisturbed bottom of each basin to determine if the design percolation rates are being maintained. No topsoil should be placed in the percolation basins or in areas with a propensity to erode into the basins.

Stormdrain maintenance for CSUMB should incorporate the following practices into the campus maintenance program:

- Street and parking lot cleaning at regular intervals to reduce sediment build-up and deposition to the stormdrain systems,
- Annual inspection and cleaning of drainage inlets before the rain season begins,
- Implementation of source control best management practices (BMPs) for maintaining work, fueling, trash, and vehicle wash areas to reduce grease and sediment loading,
- Roof runoff controls to settle sediments before they can enter the stormdrain inlets,
- Vegetating open ground, and
- Planting appropriate native vegetation in and on the perimeters of the percolation basins.

All storm pipes being reused should be cleaned before they are connected to the proposed systems herein.

An **annual operation and maintenance budget** of about $300,000, equivalent to 3% of the non-pavement removal portion of the projected SWMP capital improvement costs (approximately $10 million dollars) is recommended. Two thirds or $200,000 of this should be specific to the percolation basins. It would be used to operate and maintain the SWMP percolation basins and associated stormdrain piping, water treatment devices and landscaping. There will be a 5- to 10-year transition period while pavement is removed and the present CSUMB stormwater facilities, dominated by pipelines, are replaced with onsite percolation basins. Considerable fluctuation in annual operation and maintenance costs makes necessary the establishment of a reserve fund to cover major repair costs such as cleanup and repair after a storm. The 3% of capital improvement costs should be indexed to a standard such as the Engineering News Record Construction Cost Index to allow an annual review and adjustment.

The SWMP includes **guidelines for campus landscaping** where lawns and native grasses, plants, and shrubs are used to implement the Planting Palette for the Master Plan Update while maintaining acceptable porosities. They are not intended for use on percolation basins and other primary drainage facilities.

CHAPTER 1: INTRODUCTION

BACKGROUND

This Stormwater Master Plan (SWMP) has been developed to provide a framework and workable tool to allow California State University at Monterey Bay (CSUMB) to predict, plan, guide and implement the necessary capital improvements to meet the campus stormwater collection system needs and water quality requirements.

In 2004, CSUMB updated its *Campus Master Plan (2004 CMP)* to accommodate anticipated growth at the university. This SWMP establishes a detailed plan for stormwater collection, conveyance, and discharge to encompass CSUMB's planning horizons from current conditions through Planning Horizon III (Year 2025).

The 1300+ acre CSUMB campus is located within the cantonment area of the former Fort Ord (see Figure 1-1). The campus, which opened in 1994, is served by an existing regional stormdrain system constructed by the U.S. Army. That portion of the existing storm drainage collection system located within the campus boundaries is owned and operated by CSUMB. This SWMP reflects the major ongoing changes in stormwater discharge policies and practices being initiated for the former Fort Ord by the Fort Ord Reuse Authority (FORA); specifically, that CSUMB and other base reusers will be responsible for localized disposal by infiltration of all or most stormwater runoff within their property.

GOALS AND OBJECTIVES

The SWMP focus is to identify stormwater improvements and to accomplish CSUMB's stormwater goals and objectives:

- Contain and percolate all stormwater on site,
- Expand upon the Stormwater Management Plan,
- Eliminate or protect pathways to prevent stormwater pollution,
- Protect soil and groundwater by capturing known acute releases and reduce chronic contamination of the environment,
- Emphasize permanent and reliable pollution controlling stormwater drainage and management facilities that are not operator dependant, and
- Provide permanent structural solutions to address the range of potential impacts resulting from the multiple use sites.

SCOPE OF WORK

Preparation of this SWMP included completion of the tasks listed below.

Task 1. Identify Study Area Characteristics
Task 2. Collect and Review Data
Task 3. Develop Drainage Criteria
Task 4. Establish Water Quality Criteria
Task 5. Analyze Stormdrain Collection and Natural Drainage Systems

Task 6. Develop Capital Improvement Projects
Task 7. Prepare Stormwater Master Plan Report
Task 8. Conduct Workshops and Coordination Meetings

WORK PRODUCTS

This SWMP is intended to provide campus planners and engineers responsible for capital improvements with sufficient information and data to serve as a basis for CIP implementation and or modifications. Work products include:

1) A system map of the overall campus stormwater facilities depicting:
   - The campus boundary,
   - Topography,
   - Sub watersheds showing drainage patterns and stormdrains,
   - Existing and proposed CSUMB facilities,
   - Potential percolation areas,
   - Future drainage patterns and release points, and
   - Stormdrain pipelines to be abandoned.

   In addition to being an electronic file in AutoCAD format, the system map is included under separate cover with this report, *Stormwater Master Plan Drawing Set*.
2) An Excel spreadsheet of prioritized projects with capital cost estimates, organized with phasing based on CSUMB Planning Horizons. Cost estimates are based on construction and material costs of facilities; cost sharing not included. Included are: a 25% construction contingency; 35% for engineering, administration, and permitting; and an initial baseline estimate of $300,000 for annual operation and maintenance of CSUMB stormwater facilities.
3) A final report in the form of an engineering planning document, incorporating comments from CSUMB staff and signed and stamped by the Project Manager and Project Engineer.

AUTHORIZATION

Schaaf & Wheeler, Consulting Civil Engineers, was retained by CSUMB to prepare this SWMP and, in so doing, to accomplish three specific objectives:

- Identify stormdrain improvements that meet the Fort Ord Reuse Plan mandate that no further stormwater discharges to Monterey Bay will occur,
- Accommodate future phases of FORA's stormwater master planning efforts, and
- Develop and recommend stormdrain improvements and an implementation strategy that corresponds to the proposed changes in the regional systems and to the implementation of CSUMB's Campus Planning Horizons.

ACKNOWLEDGEMENTS

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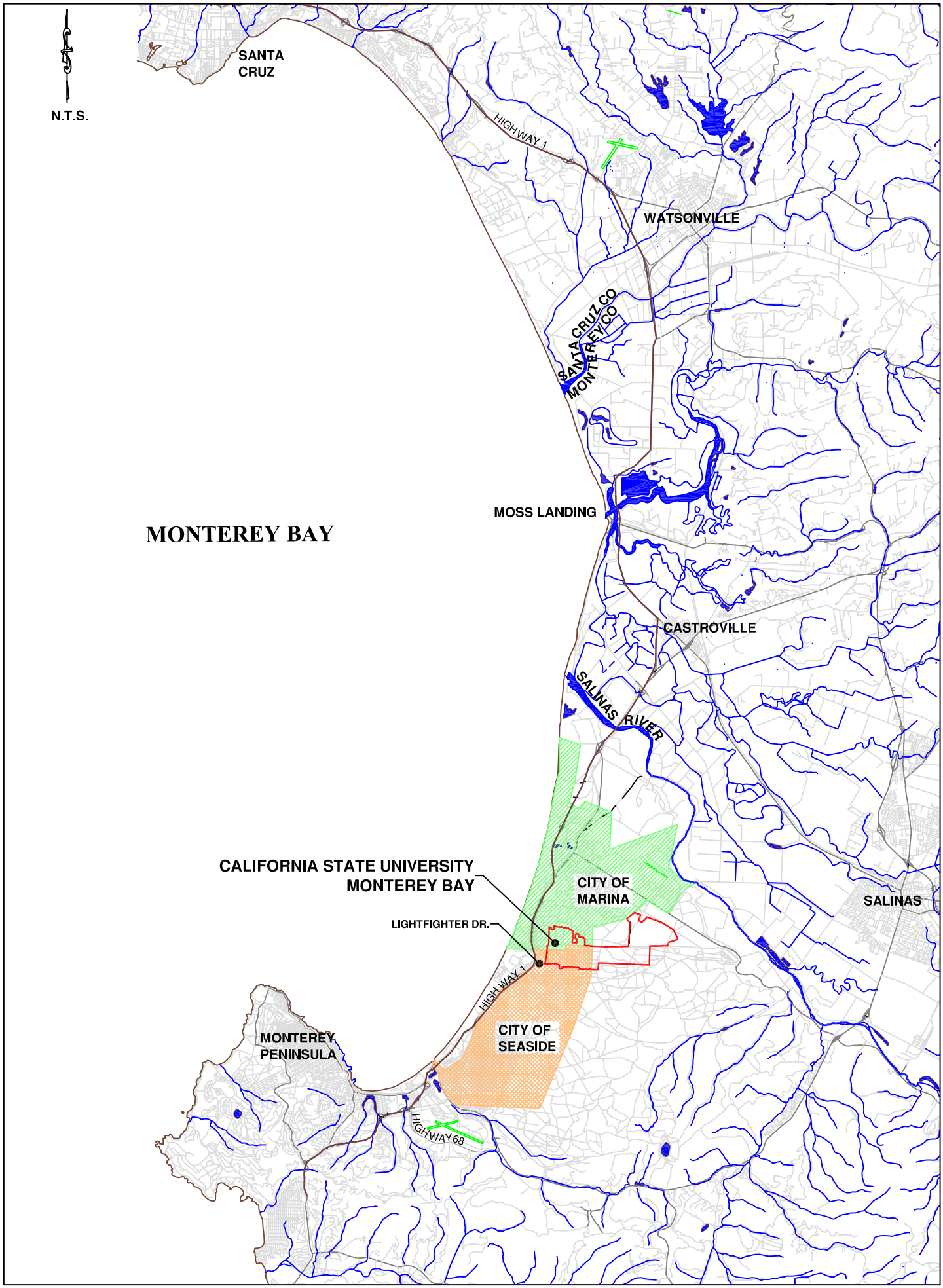
Director of Environmental Protection, Health and Safety; Robin Katsuki, Director of Design and Construction; and Kathleen Ventimiglia, University Architect. Their cooperation, courtesy, insights, and guidance were invaluable in the development of this Master Plan.

ABBREVIATIONS, ACRONYMS AND DEFINITIONS

Below are abbreviations, acronyms and definitions used in this report. Also, included as Appendix A, is Glossary of Certain Terms.

AF	acre-foot
CEQA	California Environmental Quality Act
cfs	cubic feet per second
CIP	Capital Improvement Program
CHISPA	Community Housing Improvement System and Planning Associates, Inc.
County	County of Monterey
CSUMB	California State University at Monterey Bay
ENR CCI	Engineering News Record Construction Cost Index
FORA	Fort Ord Reuse Authority
FEMA	Federal Emergency Management Agency
ft	feet
GIS	Geographic Information System
HEC-1	Hydrologic analysis model developed by the USCOE
HSG	Hydrologic Soil Group
in	inch
in/hr	inches per hour
LF	lineal feet
MCWRA	Monterey County Water Resources Agency
MPWMD	Monterey Peninsula Water Management District
MRWPCA	Monterey Regional Water Pollution Control Agency
NPDES	National Pollution Discharge Elimination System
NRCS	Natural Resources Conservation Service
ROW	right-of-way
SWMP	Stormwater Master Plan
USA	United States Army
USACOE	U.S. Army Corps of Engineers

Figure 1-1



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CHAPTER 2: STUDY AREA CHARACTERISTICS

This chapter provides an overview of the study area characteristics, including the hydrologic and environmental setting, land use, the existing storm drainage system and future rights in that system.

HYDROLOGIC AND ENVIRONMENTAL SETTING

The CSUMB campus is situated on the former Fort Ord Military Base, about 1.5 miles east of the Monterey Bay coastline. The Monterey Peninsula and Santa Lucia Mountain Range lie to the south. The City of Salinas is about eight miles to the east. Cities bordering the CSUMB campus include Marina to the north and Seaside and Del Rey Oaks to the south. The campus falls within the boundaries of the cities of Marina and Seaside, in Monterey County. Figure 1-1 places the CSUMB campus in its regional context.

Climate

The climate of the central coastal valley, around the City of Salinas, is characterized by relatively warm, dry summers and moist winters. At the immediate coast, in the vicinity of the CSUMB campus, the weather is cooler, with strong onshore winds, low clouds and fog, especially during the summer. The December 2003 *Monterey County Floodplain Management Plan* provided the following information:

- Average annual rainfall in Monterey County varies considerably but is approximately 15 inches;
- About 90% of rainfall occurs between November and April, for a given year;
- Measurable precipitation averages 51 days per year;
- The Big Sur Watershed has an estimated average annual precipitation of 43 inches;
- Records for King City (1910-2001) and the City of Salinas (1873-2001) yield 10.95 and 13.56 inches respectively.

Mean annual precipitation for the City of Monterey gage is about 18 inches per year while the former Fort Ord is approximately 14 inches.

Topography

The topography of the area of former Fort Ord, which the CSUMB campus occupies, is characterized by low, sand-dune-type formations that were extensively graded during the development of Fort Ord to provide for parking, roads and building clusters. The CSUMB Schoonover and Fredericks Park housing areas maintained the dune-like topography when built in the 1980s by the US Army. Elevations within the campus boundaries range from 110 ft to 350 ft above mean sea level.

Soils

Soils in Monterey County vary considerably between silicon/quartz deposits along the beaches and rich, alluvial deposits in the Salinas River Valley, ideal for agriculture.

The SCS Soil Survey for Monterey County identifies soils in much of the former Fort Ord, including the CSUMB Campus as being comprised of the Oceano soil type. Oceano is

described as loamy sand with Unified Soil Classification System descriptions of silty sand (SM) to poorly graded sand (SP). The Soil Survey suggests that the Oceano soils extend to depths of 80 feet. Laboratory data presented in the Soil Survey document a permeability rate ranging from 6 to 20 in/hr, thus allowing the soils to drain exceptionally well.

Because of the opportunity provided by soil conditions on the former Fort Ord, it is important to provide further background. Permeability is the quality of a soil that enables it to transmit water. (Note that permeability can also refer to the flow of air but we'll ignore that part of the definition.) Terms employed by the NRCS to describe permeability are:

- *very slow* (less than 0.06 inches per hour),
- *slow* (0.06 to 0.2 inches per hour),
- *moderately slow* (0.2 to 0.6 inches per hour),
- *moderate* (0.6 to 2 inches per hour),
- *moderately rapid* (2 to 6 inches per hour),
- *rapid* (6 to 20 inches per hour), and
- *very rapid* (more than 20 inches per hour).

The NRCS has defined and grouped soils into four runoff categories. The group designations range from Type A, the most permeable, to Type D, the least permeable. These runoff characteristics are based on soil type, permeability, slope, soil layering (particularly when underlying layers are more or less permeable than surface layers) and depth to bedrock.

A definite correlation between Hydrologic Soil Group (HSG) and permeability is not possible but for purposes of illustration the HSG letter designations and their corresponding permeability values look something like this:

D Soil Group	less than 0.06 inches per hour
C Soil Group	0.06 to 0.6 inches per hour
B Soil Group	0.6 to 6 inches per hour
A Soil Group	6 to 20 inches per hour

Note that permeability can change by a factor of ten between HSG types. For this reason it is always best to do in-situ testing when the permeability parameter becomes a vital part of the water facilities design. In the case of CSUMB, the campus footprint is dominated by the most permeable A Soil Group and a permeability value of 6 inches per hour is assumed in this SWMP development.

Recent History of Flooding in Monterey County

Summarized below is a brief history of recent flooding in the northern coastal area of Monterey County. The sources of this recent history are the *FEMA Flood Insurance Study, Unincorporated Areas* (revised September 1991), and the *Monterey County Floodplain Management Plan* (updated December 2003) prepared by Monterey County Water Resources Agency (MCWRA).

January 1969

Major floods occurred at the end of January and during the month of February. The Salinas and Carmel Rivers went on a "rampage," causing major damage and resulting in Monterey County being declared a disaster area.

January 1978

A series of storms occurred in 1978. These storms came from a more southerly direction than is normal, resulting in damage to beaches and populated beachfront areas that are usually protected from prevailing winds.

Winter of 1983

The "El Nino" winter of 1983 resulted in a number of severe storms accompanied by high tides, storm surges and waves. Storm-induced wave damage was particularly severe along the dune areas of the City of Marina.

January 1995

In 1995, storms and flooding occurred throughout Monterey and Santa Cruz Counties, causing major damage in the Carmel and Pajaro River Valleys. Over the two-day period of January 9 and 10, an intense storm deposited as much as 6 inches of rainfall, which MCWRA estimated to be a 10- to 20-year event.

March 1995

A significant storm occurred between March 10 and 13, 1995, producing major flooding throughout Monterey County. Flooding of the Salinas, Carmel and Pajaro Rivers caused mass evacuations in San Ardo, Greenfield, Soledad, Chualar, Spreckels, Castroville, Pajaro and Moss Landing. The Pajaro River levee was breeched on the Monterey County side of the River flooding the Community of Pajaro. The Salinas River overflowed its banks and crossed Nashua Road into the Reclamation Ditch/Tembladero Slough channels, flooding portions of Castroville and closing Highways 1, 156, and 183 through Castroville. Flow in the Salinas River was estimated by the Monterey County Department of Public Works to have been equivalent to a 120-year storm event.

February 1998

During the El Niño winter of 1997-98, about $1.3 million in estimated flooding and erosion damage was experienced along the Reclamation Ditch/Tembladero Slough systems. In early February 1998, as the result of a three-storm series that began February 2, major flooding occurred in urban and agricultural areas adjacent to the Reclamation Ditch/Tembladero Slough from Salinas downstream to the Potrero Road Tide Gates near Moss Landing Harbor.

Local FEMA Flood Insurance Studies

The 1984 FEMA Flood Insurance Study (FIS) for Monterey County included portions of the Cities of Marina and Seaside and unincorporated County Areas adjacent to Fort Ord. FEMA studies designate areas as being within the 100-year floodplain (Zone A), the 100- to 500-year floodplain (Zone B), areas of minimal flooding (Zone C), areas of undetermined but possible flood hazards (Zone D), areas of 110-year coastal flooding (Zone V) and areas outside of flood hazard areas (no zone designation). Zones with A and V designations are classified by FEMA as Special Flood Hazard Areas.

Two areas within the CSUMB campus are indicated on the FEMA Flood Insurance Rate Map (FIRM) as being within the 100-year floodplain. The first is the existing City of Marina percolation basin, at the intersection of Eighth Street and Fifth Avenue. The other is a percolation basin at the northwest corner of the East Campus Housing Area. Both of these percolation basins are incorporated into the existing drainage systems. The 1984 FEMA FIS does not indicate any other Special Flood Hazard Areas for the East Campus Housing land. The 1984 FIS predates the development of the Schoonover Park Housing area, which added storm-drainage systems and additional percolation basins, as discussed in Chapter 5. However, these housing areas are not considered to be at risk for significant flooding.

LAND USE

Since 1994, when the Army left Fort Ord, Fort Ord Reuse Authority (FORA) members have been in the process of redeveloping the base. The summaries of the FORA Reuse Plan and the CSUMB Master Plan provide an indication of how the land will be used.

FORA Reuse Plan

The Fort Ord Reuse Plan adopted in June 1997 provides the redevelopment framework for redevelopment of the former Fort Ord. "Its focus is on issues related to integrating the former Fort Ord property into the regional economy of the Monterey Peninsula providing the overall context and rationale appropriate to the 'General Plan' elements for all of the former Fort Ord lands."[1] The following table summarizes the proposed land use of the former Fort Ord. The corresponding figure from the Fort Ord Reuse Plan is provided in Appendix B.

November 2004 CSUMB Campus Master Plan Update

The CSUMB campus is frequently described as a collection of five zones. Central Campus houses the primary academic and student support uses on campus. West Campus contains primarily sports and recreation. North Campus is dedicated to student, faculty/staff and family housing, with some campus and student support services. East Campus Open Space and East Campus Housing are the properties east of Eighth Avenue and consist of open space and redeveloped military residential areas.

Land use categories in the November 2004 CSUMB *Master Plan Update* are shown in Appendix B and are as follows[2]:

Academic Core & Campus/Student Support:

- Library
- Student Center
- Visitor Center
- Academic Buildings

Campus Support:

- Administration Services and Maintenance
- Physical Plant Facilities

[1] Fort Ord Reuse Plan, Volume 1: Summary, Context and Framework of the Reuse Plan, September 2001.
[2] California State University Monterey Bay Master Plan Update, Volume 1 Design Plan, November 2004

Housing:
- Faculty/Staff and Family Housing
- Student Housing
- Low Density Faculty and Staff Housing
- Educational Partners

Open Space:
- Natural Landscapes
- Formal Campus Open Space
- Athletics and Informal Recreational Open Space

Athletics and Recreational Facilities:
- Sports Facilities/Buildings
- Athletic Support Services
- Fields and Outdoor Facilities

Parking:
- Surface Parking Lots
- Parking Structures

Campus Partnerships:
- Areas set aside for development of campus-business partnerships, such as research of campus-business partnerships, such as research or business/academic-related projects.

Table 2-1: Summary of the Proposed Land Use of Former Fort Ord (adapted from Table 3.3-1 of the Fort Ord Reuse Plan)[3]

LAND USE	MARINA (Acres)	SEASIDE (Acres)	MONTEREY CO. (Acres)	TOTAL (Percent total area)
CSUMB	224	313	755	**5%**
POM ANNEX		782		**3%**
HOUSING	704	818	520	**7%**
BUSINESS PARK/LIGHT INDUSTRIAL/OFFICE/R&D	549	0	797	**5%**
RETAIL	66	722	13	**1%**
VISITOR SERVING				
Hotels	25	25	30	**0%**
Golf		350	328	**2%**
Other			50	**0%**
PARKS & OPEN SPACE				
Fort Ord Dunes State Park		14	850	**4%**
Other	97	122	804	**4%**
PUBLIC FACILITIES (incl. military)	528	204	340	**4%**
HABITAT MANAGEMENT	616	962	15,601	**61%**
AREA WIDE ROWs	495	570	96	**4%**
TOTALS	**3,304**	**4,264**	**20,004**	**100%**

[3] Ibid.

MAJOR WATERSHEDS

As shown in Figure 2-1, the CSUMB campus is located south and west of the Salinas River, and straddles the southern boundary of the Salinas River Watershed. The Salinas River is 155 miles in length, originating near Santa Margarita and running north through the valley formed by the Santa Lucia and Diablo Mountain Ranges. Major tributaries include the San Antonio and Nacimiento Rivers in the south and the Arroyo Seco River near Soledad. The Salinas River has a high underflow through alluvial sediments and it supplies irrigation water for valley agriculture. Normal flows from the river do not outfall directly to the Monterey Bay; they are instead diverted to the Old Salinas River channel, flowing north and into the bay at Elkhorn Slough.

The eastern portion of the CSUMB Campus, starting at about 8th Avenue, lies within the Salinas River Watershed. The portion of the Campus west of 8th Avenue is drained by several small watersheds that slope toward Monterey Bay. See Figure 2-2. Under average rainfall conditions, the presence of coastal dunes and sandy, highly permeable soils result in direct percolation of rainwater rather than overland flow. No natural drainage courses drain the CSUMB campus to the bay.

Presently, any runoff that enters the existing regional stormdrain system from the campus west of 8th Avenue is conveyed to percolation areas/basins on the west side of Highway 1. These percolation basins are sized to store and percolate the 100-year storm and include a 25% safety factor in the form of freeboard. With implementation of this SWMP, runoff from the 100-year storm will be retained within the campus boundary except for that which collects in the existing City of Marina Percolation Basin located at 8th Street and 5th Avenue. A minimum freeboard of 25% is included in SWMP percolation basins.

Campus areas east of 8th Avenue are presently served by percolation basins designed to store and percolate runoff from a 100-year storm.

Even after the SWMP is fully implemented, runoff from storm events exceeding the 100-year event will have to cross Highway 1 and the major dune areas to reach Monterey Bay.

Given the highly permeable soil conditions that characterize the CSUMB campus and the area's reliance on infiltration of stormwater, the underlying groundwater basin boundaries are included in this discussion. The California Department of Water Resources in its Bulletin 118 on California groundwater indicates that the western portion of former Fort Ord falls within the Salinas Valley Groundwater Basin, Seaside Area Subbasin. The April 14, 2005 Monterey Peninsula Water Management District Report, *Seaside Groundwater Basin: Update on Water Resource Conditions*, indicates in its Figure 6 that the CSUMB campus is north of what is most likely the northerly boundary of the Seaside groundwater basin.

EXISTING STORMDRAIN SYSTEM

The existing regional stormdrain system serving the cantonment area of Fort Ord was constructed by the U.S. Army over a period of about 60 years, starting in 1940. The system evolved as Fort Ord was expanded and modified.

The regional stormdrain system presently collects stormwater on the east side of Highway 1 and conveys it to percolation basins between Highway 1 and the beach. Prior to construction of the percolation basins in 2004, stormwater was discharged to the ocean through outfall structures that have since been demolished. The 2004 project to divert stormwater to percolation basins marked the implementation of Phase I of the 2001 *Master Plan for Improvements to the Regional Storm Drainage System* sponsored by the City of Seaside and FORA. FORA is continuing to develop a program for stormwater management to meet the Fort Ord Reuse Plan mandate:

> …no further discharges will occur to the Monterey Bay Marine Sanctuary or to the coastal dune habitat within the future Fort Ord State Park west of Highway 1. This means that all redevelopment in the former cantonment area must provide adequate on-site infiltration of stormwater runoff and that existing impervious surfaces be modified or the runoff managed and redirected to suitable infiltration facilities.[5]

The highly permeable dune type soil conditions in the cantonment area of the former Fort Ord are the basis for the FORA 2001 Master Plan strategy to percolate stormwater locally, within each jurisdiction's boundaries, and to eliminate ocean discharges. The 100-year storm event (with 25% freeboard) is the design storm for the recently constructed FORA percolation basins. This SWMP recommends that CSUMB replace its share of the aforementioned percolation basins with suitable infiltration facilities on CSUMB property.

EXISTING SYSTEM / FUTURE RIGHTS

Most of the existing regional stormdrain system will become unnecessary and will be abandoned when this and other stormwater master plans are implemented. Until local percolation of stormwater runoff is fully implemented, however, the existing regional stormdrain system is necessary and will require major repair and/or replacement for long term use.

With the exception of the existing regional stormdrain system, utilities on the former Fort Ord such as water, sewer, gas, electrical and telephone have become the responsibility of organizations other than the U.S. Army. These utilities have a well-established potential to generate from rate payers the revenue needed to provide for their operation, maintenance, repair and improvement. To date, the existing regional stormdrain system, as a whole, has not been turned over to a single entity. The present approach used by FORA and the U.S. Army for existing stormdrains is understood to be as follows:

- When property is conveyed to a reuser such as CSUMB, the existing stormdrain system within its boundaries is also to be conveyed and becomes the responsibility of the property owner,
- That responsibility includes operation, maintenance, repair and replacement.

FORA has indicated in discussions that no written FORA policy is now or will be in place for the regional stormdrain system. Stormdrain responsibility is within the purview of the various land use jurisdictions and the conveyance agreements between the reusers and the U.S. Army

[5] FORA Stormwater Master Plan 2nd Draft, October 2003

are supposed to settle the issue. It is FORA's position that Basic California Drainage Laws govern.

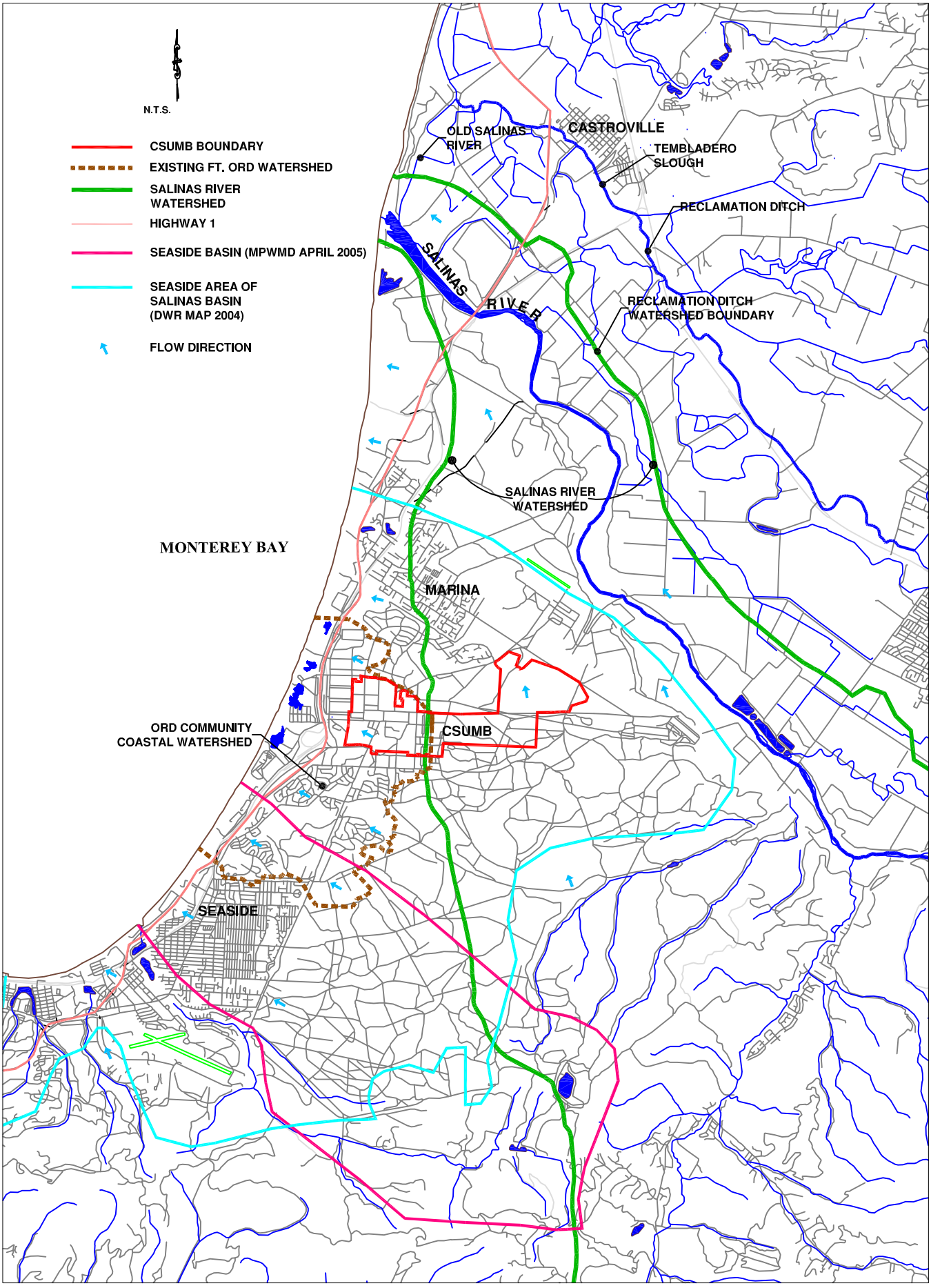
CALIFORNIA DRAINAGE LAW OVERVIEW

The Consulting Engineers and Land Surveyors of California (CELSOC) *2004 Drainage Law Seminar Course Syllabus* provides a good overview of California drainage laws. It states:

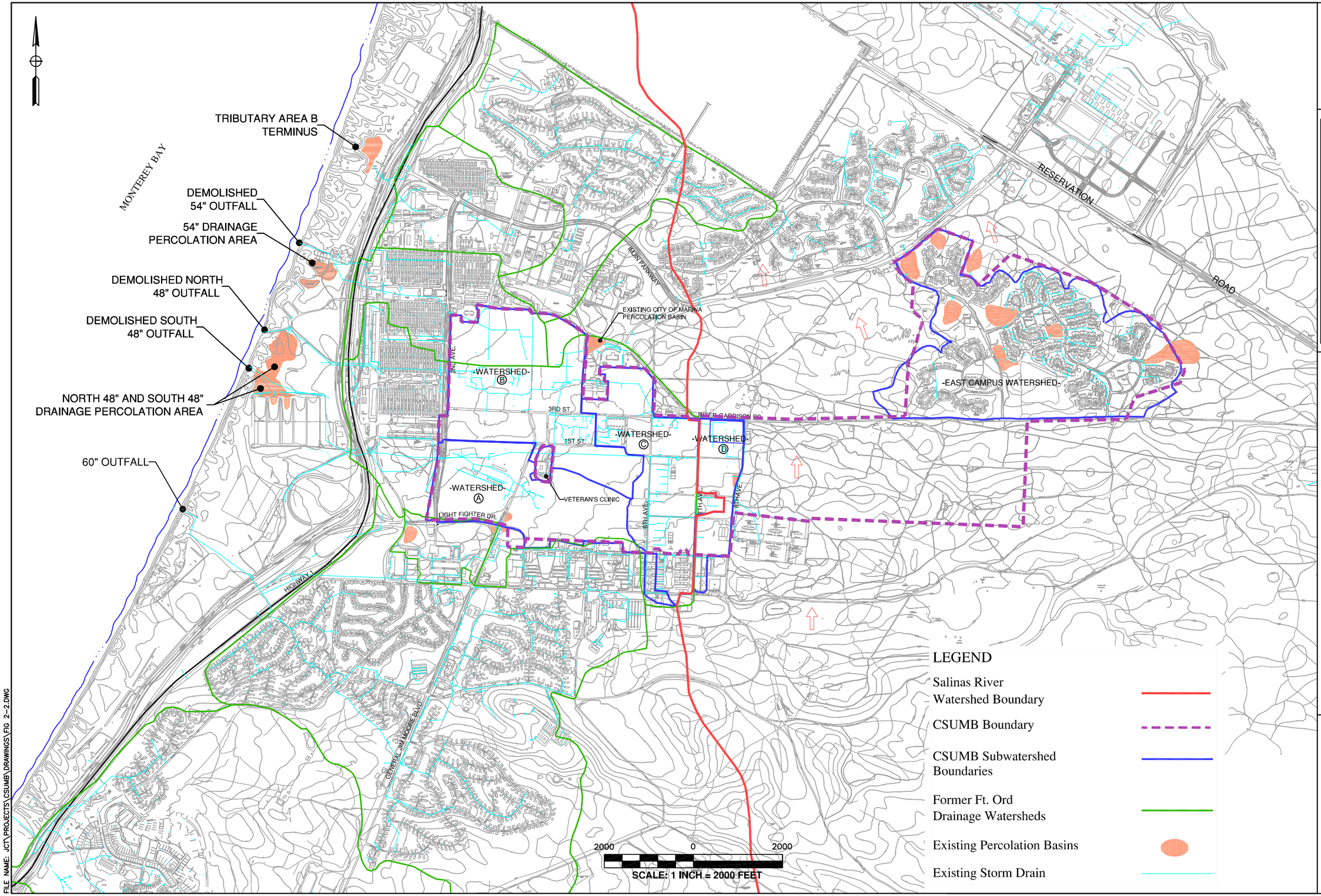
> The California Supreme Court's 1966 opinion in *Keys v. Romley* (1966) 64 Cal.2d 396 … remains the leading drainage law appellate court decision regarding surface waters. The philosophical heart of Keys is the qualification of the civil law rule's assertion of absolute property rights, the typical approach that courts have historically taken towards real property issues, with a flexible prohibition against "arbitrary and unreasonable conduct," with the court stating:
>
> > "It is therefore incumbent upon every person to take care in using his property to avoid injury to adjacent property through flow of surface waters. Failure to exercise reasonable care may result in liability by an upper to a lower landowner. It is equally the duty of any person threatened with injury to his property by the flow of surface waters to take reasonable precautions to avoid or reduce any actual potential property injury."
>
> The Supreme Court's holding on *Keys* was soon authoritatively summarized by a district appellate court in *Burrows v. State* (1968) 260 Cal.App.2d 29 into three simple rules which today are considered well-settled law:
>
> - Unreasonable drainage alteration results in liability;
> - Reasonable drainage alteration opposed to reasonable mitigation measures results in liability;
> - Reasonable drainage alteration opposed to a lack of reasonable mitigation measures avoids liability.
>
> Regarding the fourth logical permutation of reasonableness, unreasonable drainage alteration opposed to unreasonable mitigation measures, while the Supreme Court has yet to rule, pursuant to basic principals of negligence, trespass and nuisance law, and as noted at least one district court of appeal in *Sheffet v. County of Los Angeles* (1970) 3 Cal.App.3d 720, the probable answer lies in the doctrine of the duty to mitigate damages: "[t]he person who may minimize damage and fails to do so cannot recover for the excess damage occurring."

Based on the above background information, upstream properties dependent on the existing regional system components transferred to CSUMB or others, have the right to continue to convey historical flow into and through that system. However, it is assumed that the historical flows cannot increase in velocity or volume, *Locklin v. County of Lafayette* (Calif. Supreme Court 1994).

Figure 2-1



Schaaf & Wheeler



CALIFORNIA STATE UNIVERSITY Monterey Bay

REVISED FEBRUARY 10, 2004

CSUMB STORMWATER MASTER PLAN

Schaaf & Wheeler
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FILE NAME: JOT_PROJECTS\CSUMB\DRAWINGS\FIG 2-2.DWG

FIGURE 2-2

CHAPTER 3: METHODOLOGIES

The approach of this SWMP is to provide an engineering planning level document that is flexible enough for CSUMB to use with implementation of the Campus Master Plan. The guidance provided in this SWMP incorporates published and available development plans, stormwater master plans, policies, practices and standards applicable to the former Fort Ord including:

- The Fort Ord Reuse Plan mandate and planned FORA standards,
- The Cities of Marina and Seaside development plans,
- Monterey County hydrologic data and drainage standards,
- Federal and State of California water quality goals and requirements,
- USDA soil data, and
- FEMA base flood for floodplain management.

This SWMP capitalizes on the unique opportunity provided by the soil types, weather pattern, topography, environmentally sensitive coastal dunes, and ongoing reuse activities to eliminate stormwater discharges to the ocean (done) and to improve stormwater quality by infiltrating runoff at or near its source. The criteria used to design the stormdrain systems and evaluate their performance must be defensible yet simple to understand and apply. This chapter provides the background of methodologies and criteria used for developing the preferred drainage systems which were used to develop the stormwater capital improvement program.

SYSTEM ANALYSIS

Peak volume analysis is required for sizing percolation basins. The design storm has been developed using the SCS unit hydrograph methodology, calibrated to antecedent moisture conditions. Calibration is based on a statistical analysis of 31 years of streamflow data for El Toro Creek, which drains to the Salinas River east of the former Fort Ord.

The hydrologic model used to estimate peak stormwater discharge and stormwater runoff volume was the United States Army Corps of Engineers (USACOE) Hydrologic Engineering Center Flood Hydrograph Package (HEC-1). This program is widely available and supported by many private software firms.

DATA SOURCES

The Monterey County Department of Public Works Plate 25, Rainfall Intensities Chart, was used to develop rainfall intensities and rainfall depths. The United States Department of Agriculture (USDA) Soil Survey of Monterey County was referenced for soils information. USACOE Stormdrain Maps for the former Fort Ord and recent As-Built plans for CSUMB were used to locate existing stormdrain systems. The 5-ft topography used to delineate drainage basins was prepared by the aerial photogrammetry firm of Hammon Jensen Wallen using aerial photography dated April 6, 1994.

DATA DISCLAIMER

Some recommendations in this SWMP assume that existing stormdrain pipe is available and in usable condition and that pipe diameters, pipe lengths, and inverts are as indicated on the plans. However, this SWMP cannot guarantee the validity of these assumptions and recommends that site-specific field investigations and condition assessments be performed for all stormwater capital improvement projects on a project-by-project basis.

DRAINAGE CRITERIA DEVELOPMENT

FEMA has adopted as a national standard the 1 percent annual chance (100-year) flood as the base flood for floodplain management purposes. The County of Monterey and CSUMB neighboring Cities of Marina and Seaside have adopted ordinances, codes and regulations to guide and enforce the FEMA Flood Insurance Program. The aforementioned mandate of FORA and the unique conditions found on the former Fort Ord make use of the 100-year event a necessary and reasonable level of protection to be provided by CSUMB stormwater facilities.

Local agencies were contacted in order to gather and compare drainage criteria for roads and properties. This information was distilled to develop additional drainage criteria for CSUMB, to generate greater levels of protection, while respecting the neighboring ordinances of the Cities of Marina and Seaside and Monterey County and capturing the heart of FORA's proposed policies. As shown on Figure 3-1, this SWMP proposes drainage criteria with levels of protection at the 10- and 25- year for roadways and 100-year for containment on the campus. All appropriate or corresponding areas of the drainage systems within CSUMB are planned to meet these criteria upon implementation of the SWMP.

DEVELOPMENT OF ALTERNATIVES

To contain runoff resulting from the 100-year storm event within the campus boundaries, two approaches to percolation were considered:

1. Large percolation basins could be located strategically within CSUMB; however, they would tend to be unsightly facilities cordoned off by fences. Such basins would not function easily as multi-use facilities and the corresponding stormdrain systems could become large and long to meet drainage requirements.
2. Smaller, shallower percolation basins could be located throughout the campus and incorporated into the campus dunes, sports fields and parking lots. Use of smaller ponds would call for fewer and smaller stormdrains.

CSUMB representatives elected to use smaller basins and Schaaf & Wheeler engineers accompanied CSUMB staff into the campus to locate the basins. Each basin was then sized according to its particular drainage area. Maintaining flexibility at the design level, a basin's final size and drainage area will depend on campus improvements such as the grading and percent imperviousness of the final campus product and use of localized infiltration/percolation facilities upstream of the basin.

WATER QUALITY CRITERIA

Development of campus buildings and facilities may increase impervious surfaces in some locations, increasing the potential for contaminated runoff. However, infiltration of runoff at or near its source, use of properly designed and constructed basins, implementation of best management practices (BMPs) and maintenance of facilities is expected to significantly reduce contaminants. On the other hand, planned removal of asphalt, buildings and building pads will result in an overall decrease of impervious surfaces and contaminated runoff. Stormwater contaminants, including sediments that could impact soils by reducing the infiltration capacity of proposed facilities, are a concern. Regular monitoring of basin operation and effective basin maintenance is being programmed into the SWMP implementation, as well as into the Stormwater Management Plan.

The SWMP emphasizes the use of low maintenance, structural "Treatment Control" BMPs that CSUMB can implement as campus development continues.

- Each subbasin will have an infiltration facility, preferably a percolation basin.
- Vegetated swales are the preferred drainage system to capture runoff and convey it to its pond while filtering trash, oils and sediments.
- Where vegetated swales are not feasible, mechanical separators such as vortex separators should be used.

The companion document to this SWMP, in terms of stormwater quality, is CSUMB's Stormwater Management Plan. Generally speaking, the Stormwater Management Plan emphasizes the prevention of pollutant mobilization in stormwater through "source control" BMPs while the SWMP focuses on removing pollutants once mobilized in stormwater via "treatment control" BMPs. Moreover, stormwater quality BMPs in the Management Plan are inclusive of structural and non-structural (field programs, procedures, and policies) while the SWMP describes the physical conveyances and fixed facilities that can capture or reduce mobilized pollutants in stormwater. Taken together these complimentary plans are intended to keep CSUMB in compliance with state and regional water quality goals, locally adopted ordinances, and foster environmental stewardship with respect to water quality on the part of CSUMB.

HYDROLOGY AND DESIGN CRITERIA FOR ON-SITE PERCOLATION AND CONVEYANCE OF STORMWATER RUNOFF

Soils Characteristics and SCS Curve Number

As discussed under Study Area Characteristics, the study area soils are primarily Oceano Loamy Sand, classified as HSG A. Ground slopes ranging between 2 and 15 percent are common. The Soil Survey indicates soil permeability ranges from 6 to 20 inches per hour. Due to the lack of detailed permeability test data, the City of Marina and the FORA draft Stormwater Master Plan (October 2003) use 6 inches per hour as the design criteria for percolation basins and call for site-specific testing. Since permeability can change by a factor of ten between HSG types, it is recommended that site specific in-situ testing of permeability be conducted prior to commencement of design of site specific stormwater facility design.

Schaaf & Wheeler's experience in the former Fort Ord area has found runoff curve numbers between 29 and 33 for the average antecedent moisture condition (AMC) of II to be suitable for simulating runoff conditions for small, frequent storm events, a curve number of 40 suitable for simulating semi-saturated soil conditions and an AMC II-1/2 appropriate for larger, less frequent storms such as the 100-year storm.

These curve numbers assume that the characteristics of the Oceano and Baywood sands will be retained for all pervious areas. Clayey binders for grasses and other landscape amenities are not considered with a curve number of 40. Where landscape theme changes the soil characteristics, curve numbers in the range of 70 are required.

Percent Impervious

The **existing condition** impervious areas for each tributary area were estimated using digitized mapping from Hammon Jensen Wallen aerial photography, coupled with site visits with CSUMB staff.

The **future condition** impervious areas are based on the November 2004 *CSUMB Master Plan Update* data.

Design Storms

The 100-year-design storm, occurring over a 24-hour period, was used to estimate rainfall volumes and to size percolation basins. Storm events exceeding the 100-year event and the additional 25 percent basin freeboard may not be contained in the campus boundaries and could exit through release points to downstream areas.

The intensities for more frequent 10-year and 25-year storm events are recommended for designing local roadway stormdrain improvements, the standard used by Monterey County. However, subbasins will require drainage facilities adequate to collect and direct runoff from the 100-year event to the infiltration basins, away from the roadways.

Intensity

Rainfall intensities for evaluating the 10-year, 25-year, and 100-year discharges are based on the Monterey County Department of Public Works Plate 25, Rainfall Intensities Chart, and use the following formula:

$$\text{Rainfall Intensity, } I_t = \text{Conversion Factor} \times 7.75 \times (i) / (t^{1/2})$$

Where

I_t = maximum intensity of storm of t minutes duration, where I_t is the conversion of the County's two year, one hour rainfall intensity "i",

- 10-year Conversion Factor = 1.48,
- 25-year Conversion Factor = 1.73,
- 100-year Conversion Factor = 2.22,

i = 0.55 inches per hour for the project, from the County's chart,

t = Estimated 'Time of Concentration' in minutes.

The resultant rainfall intensities are:

$$I_{t\text{-}10year} = 6.31 /(t^{1/2}).$$
$$I_{t\text{-}25year} = 7.37 /(t^{1/2}).$$
$$I_{t\text{-}100year} = 9.46 /(t^{1/2}).$$

100-Year Rainfall Depth

The calculation of the rainfall depth for evaluating the 100-year volumes utilizes the aforementioned rainfall intensities and is based on the following formula:

$$\text{100-year Rainfall Depth} = I_t \times t_{hr} = 9.46 /(t^{1/2}) \times t_{hr}.$$

Where

t = 1,440 minutes for a 24-hour storm,
t_{hr} = 24 hours.

100-year Rainfall Depth = 6-inches.

Design Criteria Used for Sizing Required Percolation Facilities

The following parameters were used to size the percolation basins and should be followed for the design of all percolation facilities:

1. Facilities should be sized to hold the peak volume of the 100-year, 24-hour rainfall event;
2. Design storm precipitation depth should be developed using the Monterey County Department of Public Works Standard Details Plate 25, "Rainfall Intensities Chart," as discussed above;
3. Runoff should be calculated using SCS methodology;
4. The minimum curve number of 40 should be used for all permeable surfaces and should increase based on soil modification and treatment;
5. The facilities' percolation area should be sized to completely drain within 24-hours following the design storm;
6. Freeboard should be provided. If the percolation facilities completely drain within 24-hour of the end of the design storm, additional capacity (freeboard) equivalent to at least 25 percent of the maximum stored volume should be provided. (More freeboard would be required for longer recovery times.)

Acceptable Runoff Control and Percolation Facility Guidelines

All runoff control facilities shall be designed for zero stormwater discharge from CSUMB property for any storm up to and including the 100-year, 24-hour event as defined above. The following sections include acceptable runoff control options and recommended guidelines for the evaluation, design, and maintenance of the percolation basins and other facilities.

Runoff Control Design Options and Recommended Design Criteria

The following list should not be considered exhaustive, but the engineer should show that any alternative solution(s) could successfully achieve the recommended level of protection.

Installation of runoff control facilities on private property and in inaccessible areas is not recommended.

1. On-Site Percolation Basin, Standard Basin. The final design is required to be based upon on-site geotechnical information and shall include 25% freeboard. The basin should be designed such that sheet flows and concentrated flows are not discharged over the basin's slopes without slope protection and that outlet discharge velocities are less than 1-1/2 fps. Pipe to the bottom of the basin with energy dissipaters is recommended. Sediment and oil separators should be included upstream from the percolation basins to reduce clogging and simplify maintenance requirements.
2. Multiple/Networked Percolation Basins and Associated Drainage Swales. Follow the same procedure as for On-Site Percolation Basin or Standard Basin.
3. Below-Grade Percolation Basins. Sediment and oil separators should be included upstream of below-grade percolation basins to reduce clogging and maintenance requirements. The volume of below-grade basins should be 3-1/3 times the design volumes identified in the engineer's hydrology report to allow for the volume of the rock used for structural support.

Recommended Guidelines for the Evaluation and Design of the Percolation Basins and Other Facilities

Previous geotechnical studies on and near the CSUMB campus were reviewed by Padre Associates, Inc., to determine testing and design criteria for stormwater percolation basins. The review found that insufficient data exists to characterize subgrades throughout the campus and recommends testing methods to determine infiltration rates at proposed percolation basins (incorporated below).

Percolation Area

The surface area of the percolation basin or facilities should be sized to allow the facility to drain completely within 48 hours after the beginning of the design storm (24-hours to drain after receiving the 24-hour duration design storm) for the determined percolation rate, or permeability of the facility. Longer drainage periods shall require additional freeboard.

Freeboard

Freeboard is a buffer of additional volume intended to provide a factor of safety to account for uncertainties in estimating rainfall, runoff, and percolation rates. A volume equivalent to at least 25 percent of the maximum stored volume must be provided.

Permeability

Permeability of the soil found in the 20 feet immediately below the bottom of each proposed percolation basin shall be evaluated to estimate rates of stormwater absorption. (This recommended depth may change per the geotechnical recommendations.) Modified Dual-Ring Infiltrometer Tests with drill holes extending to depths ranging from bottom of basin

elevation to a depth of at least 20 feet below the bottom of basin elevation are recommended (see Figure 3-2.)[6]

Subsurface Variability

The subsurface variability of a percolation facility site shall be characterized to demonstrate that no low-permeability layer or groundwater table exists within 20 feet below the proposed basin bottom. Cone Penetration Test (CPT) soundings should be used to characterize subsurface conditions because of their ability to provide a near-continuous interpretation of stratigraphy. Should conventional drilling and sampling be used, sampling intervals should be continuous, i.e., frequent enough to identify even thin layers of lower permeable soil.

The identification of lower permeable soil layers should also be considered in selecting the depths of dual ring infiltrometer testing.

Release Points

Rainfall events in excess of the 100-year storm event could exit CSUMB property. Probable release points have been identified for each proposed percolation facility and are shown on the Stormwater Master Plan Drawing Set (bound separately).

Criteria and Methodology Used for Planning Stormdrain Facilities

Inlets shall be placed within their drainage system such that the travelway of all CSUMB roads shall be clear of the 10-year runoff and, furthermore, that General Jim Moore Blvd., Third Street, and Intergarrison Road shall be clear of the 25-year runoff. However, each drainage system will need to capture the 100-year runoff and direct it to the system's basin.

The rational method formula used for sizing the stormdrain facilities and placing inlets is as follows:

$$Q = C \times I_t \times A$$

Where

Q = Discharge in cubic feet per second (cfs),
C = the Rational Method Runoff Coefficient as defined below,
I_t = rainfall intensity in inches per hour (in/hr),
A = the drainage area in acres (ac).

Runoff Coefficient

The runoff coefficients used for sizing the stormdrain facilities and placing inlets for the Stormwater Master Plan are provided in Table 3-1.

[6] A Dual Ring Infiltrometer utilizes an outer pipe casing surrounding an inner pipe casing. Both casings are un-perforated but open at the bottom. During testing, the outer ring is kept full of water while the flow rate into the inner casing is measured. The intent of the method is to limit the effect of lateral flow from the inner ring by forcing flow from inner ring to be primarily vertical, thus simulating a saturated basin condition.

Any proprietary hardscaping used during design of roadways or walkways shall refer to the manufacturer's recommended coefficient. Proprietary hardscaping was not used for master planning.

25-year & 100-year Coefficient Adjustments
The runoff coefficients for the 25-year and 100-year storms shall be adjusted by a factor of 1.10 and 1.25 respectively, but shall not exceed C = 1.00.

Table 3-1: Rational Method Runoff Coefficients for CSUMB, 10-year Storm, Measured or Required by FORA[1]

Type of Drainage Area	Runoff Coefficient
Residential	
Single Family Areas	0.45
Multi-Family/Apt. Areas	0.65
Other Areas	
Parks	0.25
Playgrounds	0.35
Landscaped Areas	0.10
Undeveloped Areas	0.30
Streets, Parking Lots, Asphaltic & Concrete Surfaces	0.95
Roofs	0.95
Proprietary Hardscape	
Porous Pavements	See Manufacturer's Recommendation

1 Source: Design of Storm Drainage Facilities in Marina California, FORA Stormwater Master Plan 2nd Draft October 2003.

Intensity
The rainfall intensities for evaluating the 10-year, 25-year, and 100-year discharges were identified above. The recommended minimum time of concentration (see Glossary of Terms) for sizing stormdrains is 5 minutes.

Drainage Area
Master Plan sizing of the stormdrain facilities and placing of inlets assumes that building sites and areas adjacent to the roadways will be included in the drainage areas, based on existing topography. The design engineer for building sites and areas should consider containing runoff on site, e.g., the 10-year storm event, in the final storm system design.

Stormdrain Sizing Criteria
Stormdrain Pipe Selection
Stormdrain pipes should be sized based on the following criteria:

- Manning's 'n' = 0.013
- Minimum Pipe Size = 15"

- Minimum Velocity for Pipes Upstream of Ponds = 2 fps
- Maximum Velocity for Pipes Upstream of Ponds = 8 fps
- Maximum Outlet Velocity of Pipes at Ponds = 1-1/2 fps

Pipe slopes should be minimized to allow the final stormdrain system invert to match the basin invert. However, it will be difficult to meet the minimum pipe velocity criteria under the given constraints; therefore, the stormdrain engineer shall indicate which pipes will not meet the minimum velocities on the construction plans as a record of maintenance requirements.

New stormdrain pipes connected downstream of existing stormdrain pipes should not be smaller than the upstream pipes, in order to reduce hydraulic and maintenance problems. However, if the upstream pipes require replacement due to age, the pipes might be downsized.

Inlets
Inlets shall be placed based on the following criteria:

- Allowable spread of water on the pavement is limited to curb and gutter.
- During a 10-year storm, runoff may spread to the shoulders but not to the travelways.
- In a 25-year storm, runoff may spread to lesser travelways but may not spread across General Jim Moore Blvd., Third Street, or Intergarrison Road.
- By-pass flow shall not be allowed for 10-year storms.

100-year Inlet and Stormdrain Pipe Design
The combination of all inlets within any drainage system shall capture the 100-year runoff within that system. The stormdrain pipe shall be sized to accommodate the upstream inlets.

Roadway Stormdrain Facilities
Roadway pipe sizes were estimated to include contributing runoff areas, as applicable, from the CSUMB Master Plan Update. As previously indicated, new stormdrain pipes connected downstream of existing stormdrain pipes used the same diameters as the upstream pipes.

At the detailed design level for construction, all inlets and pipes will need to be selected, placed, and sized based on final roadway design and site improvements. All grated drainage inlets should be sized to drain when the grates are 50% clogged.

DETAILED CONSTRUCTION DESIGN RECOMMENDATIONS

Detailed construction design recommendations are developed and provided herein to direct the design engineer. These are general in the sense that they may be modified to fit the project application but detailed enough to preserve the intent of this SWMP.

Percolation Pond

Figure 3-3 shows a typical cross-section of the percolation ponds developed for the SWMP, with 1 foot (equivalent to 25%) of freeboard included. The total depth is 3 feet, with

freeboard. The minimum side slopes are 4 to 1, unless required to be less by the geotechnical consultant.

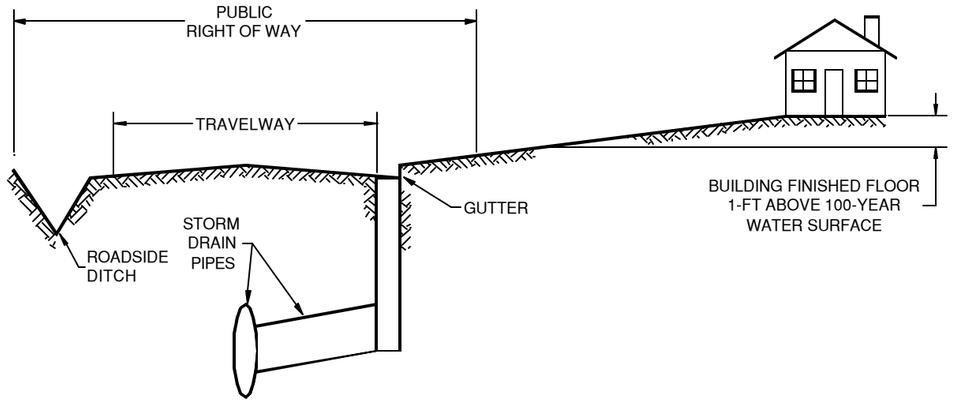
Energy Dissipation and Armor Protection for At-Grade Outfall to Ponds
Figure 3-4 provides an example of an at-grade outfall to the pond. The detail should be used for stormdrain and swale run-offs.

Energy Dissipation for Below-Grade/Bubble-Up Outfall to Ponds
Figure 3-5 is a detail of a below-grade or bubble-up outfall to a pond. The engineer should attempt to design for an at-grade outfall before reverting to this solution. The below grade outfall must be designed to prevent standing water in the unit. The unit shall include a locking grate to prevent unauthorized entry into the unit.

Roadway Interceptor Inlet
Figure 3-6 is a design approach for capturing large quantities of runoff at intersections as an alternate to multiple inlets. The need for such units would be determined at the detailed design level.

Curb Outlet to Drainage Swale
Figure 3-7 is a design approach for diverting runoff to drainage swales as an alternative to catch basins with pipe outfalls. The sizing of these outlets and any traffic control measures would be determined at the detailed design level.

FIGURE 3-1: DRAINAGE CRITERIA DEVELOPMENT



CURRENT LOCAL DRAINAGE CRITERIA

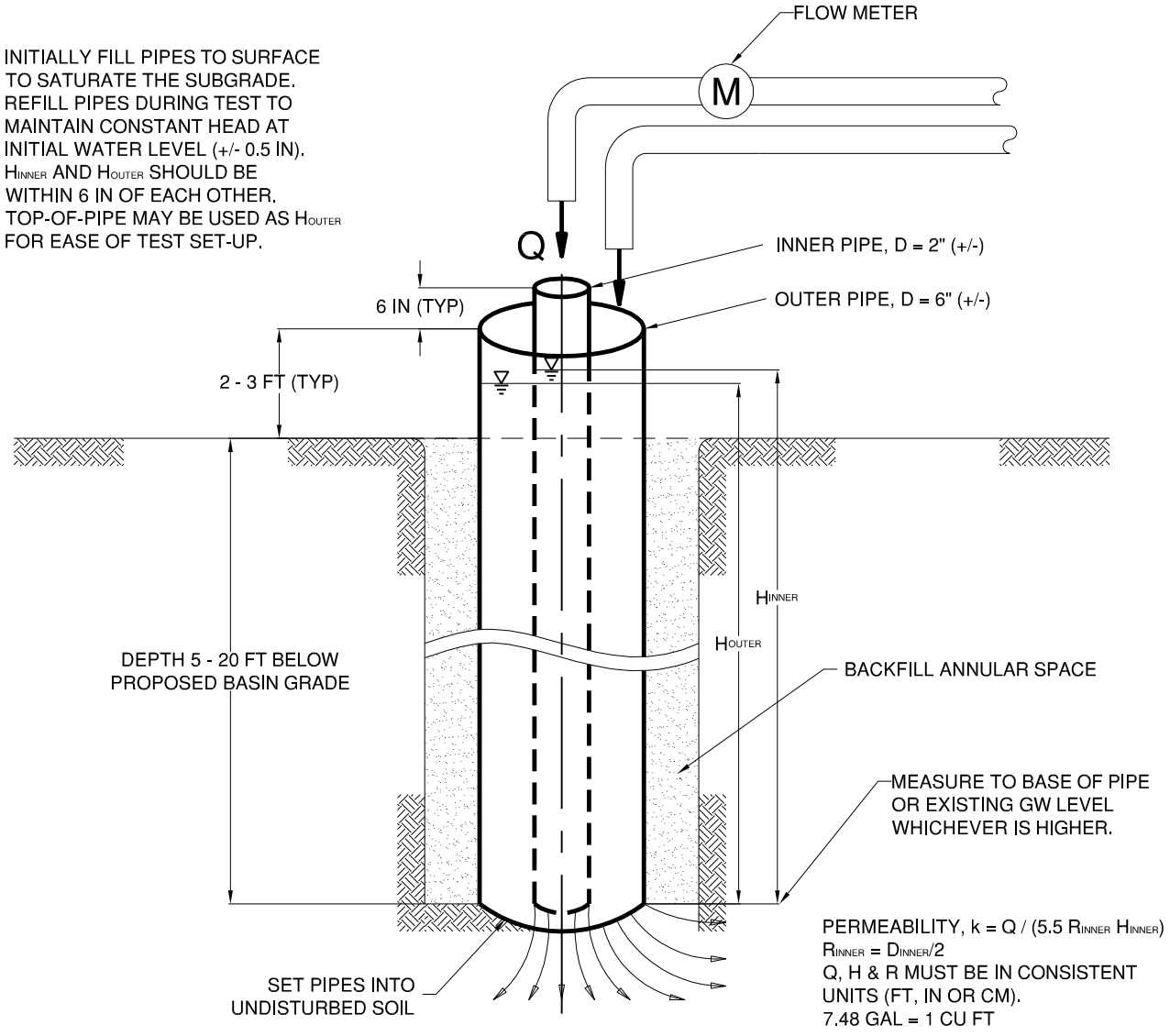
STORM EVENT	MONTEREY COUNTY[1]	CITY OF MARINA[2]	CALTRANS[3]
2-Year	Carry runoff entirely in pipes		
10-Year	No ponding allowed in travelway of roads	No ponding allowed in travelway of ***all*** roads	Design storm for freeways and travelways w/design speeds 45 mph or less
25-Year	No ponding of private property or damage to public facilities	No ponding allowed in travelway of ***major*** roads, i.e., Reservation Road, Del Monte Blvd., etc.	Design storm for frontage roads and travelways w/design speeds greater than 45 mph.
50-Year			Depressed sections that require pumping for freeways and conventional highways.
100-Year	Monterey County[4] requires all buildings have finished floor elevation greater than 1-ft above 100-year flood elevation		

Sources:

1. Monterey County design criteria for drainage of County Roads, Storm Drain Master Plan CSA-14 (Castroville).
2. City of Marina Public Works, Peter Le, P.E.
3. Caltrans Highway Design Manual, Section 831.3 Design Storm and Water Spread
4. Monterey County Ordinance No. 3272. Commercial buildings may be floodproofed to 1-ft above 100-year flood elevation.

PROPOSED CSUMB DRAINAGE CRITERIA

STORM EVENT	RECOMMENDED LEVEL OF PROTECTION
10-Year	• No ponding allowed in travelway of roads. Roadway drainage systems shall be sized to provide 10-year protection within the storm drain system. • All runoff retained at building site.
25-Year	• No ponding allowed in travelway of major campus access roads, i.e., General Jim Moore Blvd., Third Street, Intergarrison Road.
100-Year	• All runoff from the 100-year, 24-hour design storm shall be contained within campus property. • All buildings & residences shall be protected to 1-ft. above the 100-yr flood elevation. • Percolation basins and facilities sized to contain the 100-year design storm runoff shall be sized to drain the 24-hour storm within 48-hours after initiation of that storm. • Percolation basins or other retention facilities developed at the building site sized for retaining runoff from smaller storms may be used as a credit for reducing the volume of runoff to the major ponds within their local drainage subbasin, but shall not receive percolation credit. • Percolation basins shall include freeboard equal to 25% of retention volume.

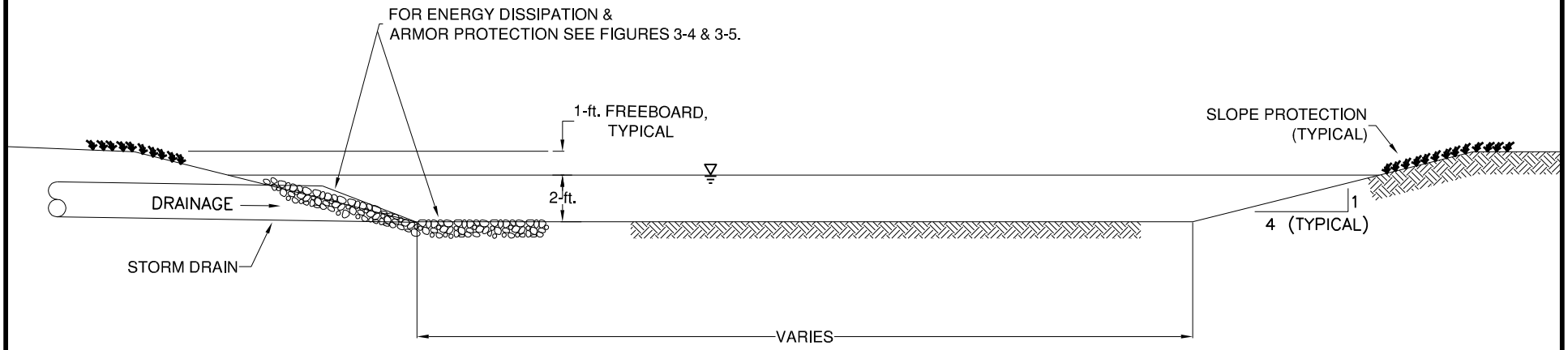


SCHEMATIC EXAMPLE: DUAL-RING INFILTROMETER TEST

~ This is not to be considered a Standard Detail ~ ~ Not to Scale ~

Schaaf & Wheeler

Figure 3-3



SCHEMATIC EXAMPLE: TYPICAL BASIN CROSS-SECTION

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~ Not to Scale ~

Schaaf & Wheeler

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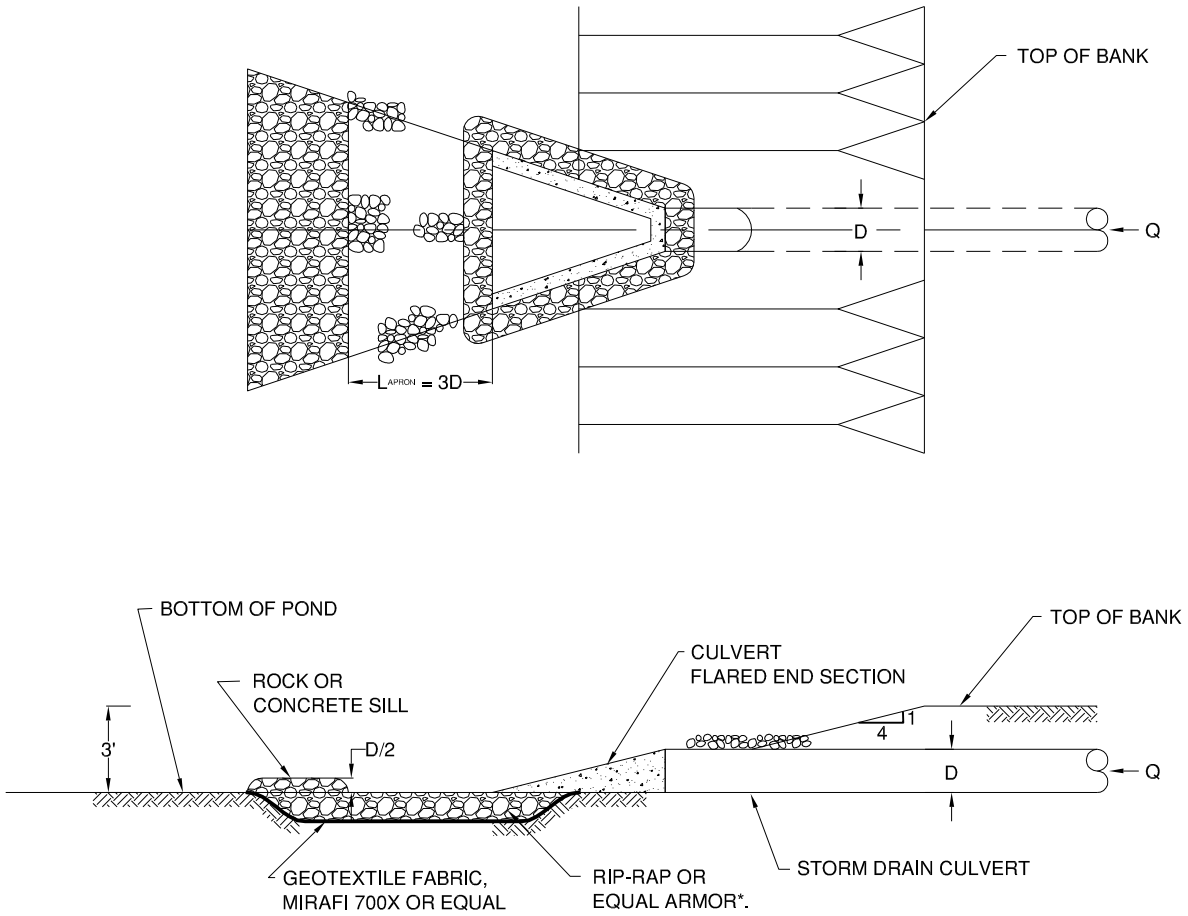

SCHEMATIC EXAMPLE: ENERGY DISSIPATION & ARMOR PROTECTION FOR AT-GRADE OUTFALL TO POND

*NOTE: APRON LINING & SILL MAY BE RIP-RAP, GROUTED RIP-RAP, OR CONCRETE.

SIZE ROCK FOR RIP-RAP EROSION DESIGN VELOCITIES
REFER TO CALTRANS STANDARD DETAILS
SECTION 72: SLOPE PROTECTION.

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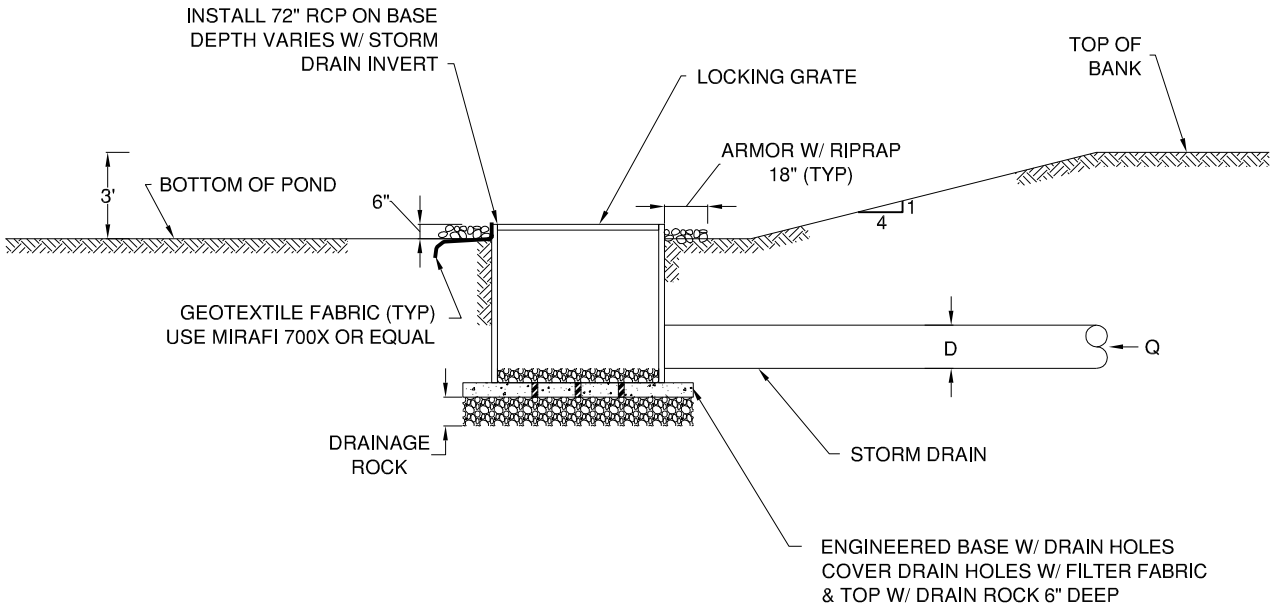
Schaaf & Wheeler



SCHEMATIC EXAMPLE: ENERGY DISSIPATION FOR
BELOW-GRADE OUTFALL & BUBBLE-UP OUTFALL

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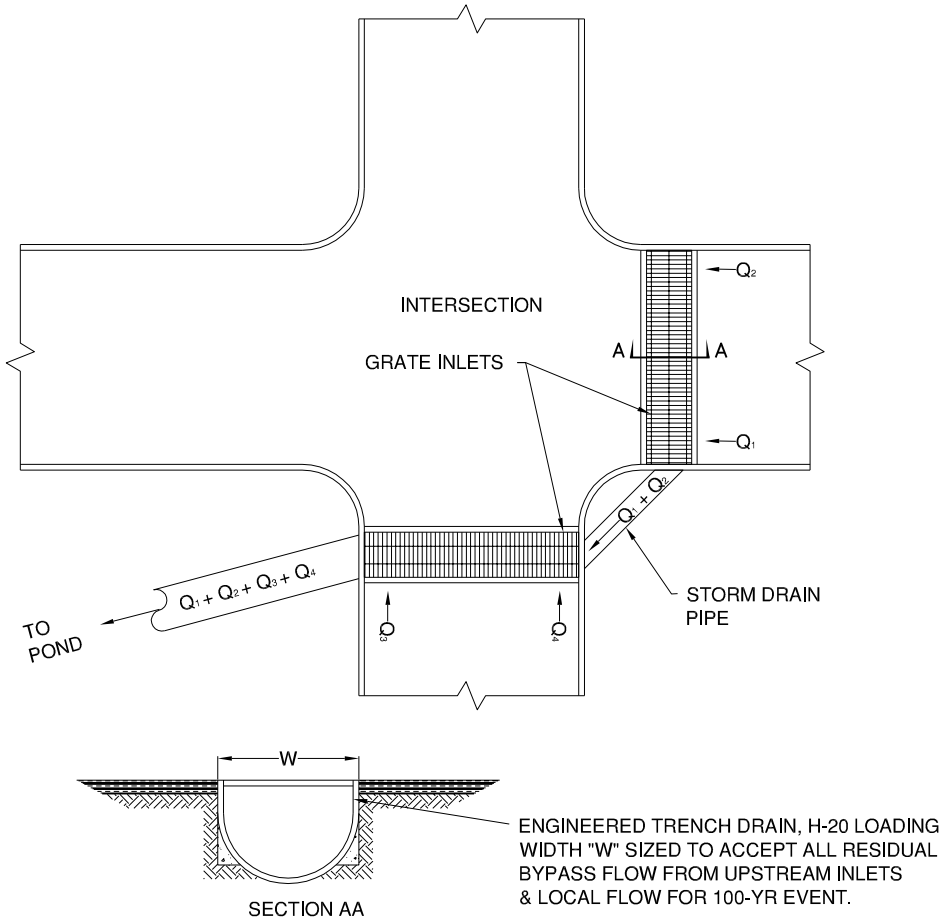
~ Not to Scale ~

Schaaf & Wheeler



SCHEMATIC EXAMPLE: ROADWAY INTERCEPTOR INLET

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Schaaf & Wheeler

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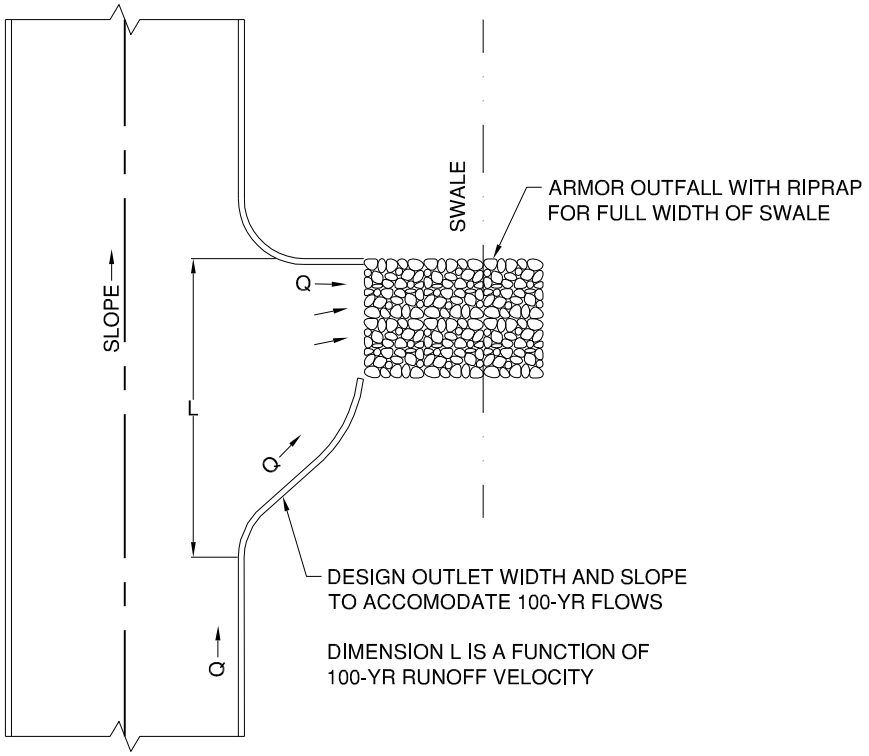

SCHEMATIC EXAMPLE: CURB OUTLET TO DRAINAGE SWALE

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~ Not to Scale ~

Schaaf & Wheeler

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CHAPTER 4: PHYSICAL CONDITION AND ORGANIZATION OF EXISTING STORMDRAIN SYSTEMS

BACKGROUND: AVAILABLE INFORMATION, FIELD OBSERVATIONS, SAND AND SEDIMENT IN EXISTING STORMDRAINS

The following observations were made during field verification of stormdrain systems depicted on old Army plans of the stormdrain system. The scope of this SWMP does not include assessing the condition of the existing CSUMB (former Fort Ord) stormdrain systems.

The stormdrain system installed by the Army was developed on a project-by-project basis beginning in the 1940s and does not appear to follow an organized stormwater master plan. As a result, underground drainage does not necessarily follow the natural grades of the land.

Due to the sandy nature of the soil, gusting winds, and ground squirrels, sand accumulates in the gutters and eventually ends up in the stormdrain system. Many field-observed inlets were found to be clogged with sand and debris. It is reasonable to anticipate that much of the CSUMB stormdrain system is impacted with sand.

Main Campus Areas

The existing CSUMB main campus area west of 8th Avenue consists of three large drainage systems and a number of other small systems and culverts. Some small systems and culverts send flow to local depressions for percolation.

In the upstream portion of the drainage areas, deficiencies were observed where debris has accumulated and damage has occurred to curb inlets. Many inlets and manholes are clogged by sand and/or vegetation. Other inlets and manholes were not found but most likely still exist and are covered either by sand or vegetation.

Discrepancies between field conditions and drainage maps were also found, most notably: in the vicinities of the student residence area between 1st and 3rd Streets and 4th and 5th Avenues; the campus administration area on 3rd Street west of 4th Avenue; and along 7th Avenue. The discrepancies involve stormdrain pipelines located other than where shown on available mapping. The Army's mapping for the former Fort Ord is schematic, in that utility locations are very approximate.

Based on the overall conditions observed during field investigations, about thirty percent of the existing manholes and inlets have major deficiencies.

Area Between 7th Avenue and 8th Avenue

Many manholes along the 7th Avenue trunkline south of A Street were not found. They may be covered by asphalt or sand and vegetation. However, the manholes that were located and the old Army plans imply that stormdrain pipes were installed below land adjacent to 7th

Avenue, at elevations 5 to 10 feet higher than the road, which is suspicious. This section of stormdrain should be verified to exist if CSUMB considers connecting to it. The Army mapping may not be correct concerning this stormdrain system in 7th Avenue.

Based on the overall conditions observed during field investigations in this area, approximately seventy-five percent of the inlets and manholes in this area have deficiencies.

East Campus

The stormdrain system in the East Campus portion of CSUMB was constructed in the mid 1980s and consists of a large number of small pipe networks and single segment lines. Some outfalls discharge to common percolation basins, others empty into small depressions or undeveloped areas. No hydraulic deficiencies were reported by campus staff or discovered in the hydraulic assessment of these campus housing areas.

Field investigation of the drainage system in East Campus found a significant portion of the small inlets in unpaved areas to be filled with sand or covered with vegetation. Some grates were missing. Inlets with missing grates were relatively shallow but could present a significant risk for injury. These deficiencies should be addressed in ongoing maintenance programs.

Concluding Remarks

Development of new stormdrain systems should take maximum advantage of developed areas and open space grading in order to localize infiltration and to avoid conveying runoff to remote areas.

All existing stormdrain facilities that will continue to be used with proposed new stormdrain systems should be assessed to determine their condition and capacity. All inlets and stormdrain manholes should be evaluated for size and condition. All stormdrain pipes should be cleaned and videoed.

Ongoing maintenance programs for keeping gutters, stormdrain inlets, manholes and pipes, clear of sand and sediment, and for maintaining the infiltration qualities of percolation facilities should be incorporated into the campus maintenance plan.

CHAPTER 5: RECOMMENDED CAPITAL IMPROVEMENTS AND SUBBASIN DESCRIPTIONS

The capital improvement projects recommended in this SWMP incorporate key assumptions and provide alternative approaches for developing drainage basins and constructing their appurtenances. The projects are labeled with associated subbasin and basin identifiers, as shown in the Stormwater Master Plan Drawing Set.

Project descriptions provide CSUMB with master plan level capital improvement cost estimates and give the design engineer guidance and information to develop project designs. The final costs of a project will depend site specific conditions including soil boring and testing results and detailed utility and topographic surveys, final project scope, competitive market conditions, and actual labor and materials costs. While many alternatives are possible, the recommended approaches take advantage of the unique soil conditions on the CSUMB campus as well as the opportunities afforded by the ongoing former Fort Ord conversion to civilian uses.

Many reuse activities involve demolition of buildings and removal of asphalt and concrete pavement. Pavement and pad removal will reduce stormwater runoff and permit infiltration and should take place as soon as possible. If the once-paved areas convey surface runoff from upstream areas, erosion protection measures should, of course, be employed.

The design engineer may alter the subbasin delineations used to size percolation basins and select drainage appurtenances in this SWMP and may adjust the final amount of impervious area. The design engineer shall be responsible for any deviations from this master plan and shall compensate for modifications, using acceptable engineering methods. All stormdrain design must include:

- Site-specific soils infiltration tests. Test results will be required, as identified in the design criteria section of this SWMP, before final basin design can begin.
- Condition assessments for the existing pipes to determine their reuse potential. Existing stormdrain pipes were used, where feasible, for developing the capital improvement program in this SWMP.
- Identification and location of existing utilities. Position of sewer, water and gas lines may affect the final design.
- Plans for abandonment in place. Existing stormdrains and inlets may be abandoned in place, as site-specific projects permit, provided all dependant upstream flows have been removed from the system. The method used to abandon stormdrain piping should be based on an engineering assessment to determine an appropriate method such as backfilling with sand or grout if the pipe is shallow and in a traveled way. This SWMP shows pipes that may be abandoned; however, the project descriptions do not identify a methodology for stormdrain abandonment.

Each subwatershed is considered a separate capital improvement project. All improvements are sized for future, build-out conditions of the CSUMB Master Plan Update unless otherwise indicated. Any CSUMB Master Plan Update project not fully implemented as shown in the

SWMP drawing set is considered a future condition. Estimated project costs are summarized in Table 5-1: Capital Improvement Costs and Implementation Guide, while detailed project costs are provided in Appendix F.

CENTRAL, NORTH AND WEST CAMPUS AND OFF-CAMPUS

Watershed A

Watershed A comprises approximately 110 acres east of General Jim Moore Blvd., 9 acres south of Light Fighter Drive, and 76 acres west of General Jim Moore Blvd. and north of Light Fighter Drive. The plan for this watershed utilizes existing percolation basins and drainage features near the intersection of General Jim Moore Blvd. and Light Fighter Drive. The West Campus Recreational Complex site was subdivided into three subwatersheds to reduce the size of the existing terminus basin near the 2nd Ave. entrance.

In general, Watershed A projects will allow CSUMB to discontinue use of the existing regional South 48" stormdrain to the North and South 48" Drainage Percolation Areas west of Highway 1, after all of the projects are implemented.

Project A1 (SWMP Drawing Set: C1 & D1)

Project A1 subwatershed consists of approximately 3 acres and includes a portion of the old parking area across from the West Campus Sports and Recreational area along 2nd Ave. This land is not designated for improvement in the CSUMB Master Plan Update. Runoff from this site spreads across the City of Seaside's share of the old parking lot and collects in a small concrete channel before it is conveyed to the 36" stormdrain.

Project Tasks

- Remove all existing pavement - approximately 1 acre.
- Revegetate with native grasses.

Release Point

The release point for A1 is into the City of Seaside Gateway area.

Interim Plan

Until this project is implemented, CSUMB should negotiate with the City of Seaside for continued use of the existing South 48" drainage system and should request a temporary drainage easement.

Project A2 (SWMP Drawing Set: C1 & D1)

Project A2 subwatershed is approximately 56 acres encompassing the football field, pool area, soccer fields, tennis courts, buildings, open space, and parking lots. Approximately 800 feet of the north portion of Light Fighter Drive and the south side of 1st Street also drains to this area. The site is estimated at 80% impervious, assuming soccer field grass is pervious and the football field artificial turf is not.

Project Tasks

- Construct a basin at the low point of area A2 at the entrance to the parking lot along 2nd Ave. using about 2.6 acres of land

  - Alternatively, construct underground percolation basins to maintain the existing acreage of parking lot.
- Reutilize existing stormdrains, wherever functional; consider using the existing 30" and 36" stormdrains to bubble up into the basins.
- Install a new stormdrain to drain the south side of 1st Street between General Jim Moore Blvd. and 2nd Ave.
- Create at least three outfalls.
- Incorporate vegetated swales to collect and filter parking lot runoff before discharging to the basins. Where swales are not feasible, use a vortex separator to remove sediment, trash, and oils.

Miscellaneous stormdrain pipes may be required based on the final development of the site but are not included in this CIP, as local drainage should be included in the CSUMB Master Plan Update.

Release Point

The release point for A2 is onto 2nd Ave. and possibly to A1 and to City of Seaside Gateway area.

Interim Plan

Until this project can be implemented, CSUMB should negotiate with the City of Seaside for continued use of the existing South 48" drainage system and should request a temporary drainage easement.

Project A3 (SWMP Drawing Set: C1 & D1)

Project A3 subwatershed is approximately 17.3 acres, the site of the proposed baseball and softball fields and multi-use field/parking lot. When developed, the site is estimated to be only 20% impervious, containing one building and miscellaneous walkways and driveways. All fields are assumed to drain through to the natural soils without any clay binders or other additives. Presently, the A3 contains a large paved area.

Project Tasks

- Remove all asphalt surfaces not in use in order to reduce impervious area.
- Construct a basin using about 0.4 acres of land, approximately as shown on Sheet A4.
  - Alternatively, reduce the basin to a depression with a berm as part of the multi-use field.
- Remove the existing concrete channel and convert to a vegetated swale, continued toward the basin as shown on Sheet D1.
- Include a rock-armored outfall from the vegetated swale.

Miscellaneous stormdrain pipes may be required, based on final development of the site. Basin size may be reduced if future conditions further reduce impervious area. If subsurface drainage is used for the baseball and softball fields, the drainage should be routed to the vegetated swales. Such miscellaneous drainage features are not included in this CIP.

Release Point

The release point for A4 is through the soccer fields and toward basin A2, on CSUMB property.

Project A4 (SWMP Drawing Set: D1)
Project A4 subwatershed is about 3 acres that belongs to CSUMB, yet drains to two non-CSUMB depressions on the south side of Light Fighter Drive at General Jim Moore Blvd. The calculated runoff is less than 1 cfs, or negligible. The site estimated at 2% impervious. This project proposes to capture runoff before it leaves CSUMB property.

Project Task

- Grade a localized depression, approximately 10 cyds to capture excess runoff.
- Modify curb with a curb cut inlet and an asphalt swale to route excess runoff.

Release Point

The release point for A4 is into City of Seaside roadside percolation basins along the south side of Light Fighter Drive.

Project A5 (SWMP Drawing Set: D1 & D2)
Project A5 subwatershed is approximately 16.0 acres of which about 13.3 acres belongs to CSUMB. The area, which includes a portion of General Jim Moore Blvd., drains to an existing basin on CSUMB property. The site estimated at 16% impervious. Army mapping indicates a culvert drains A5 to the subwatershed identified as A4 in this SWMP; however, Schaaf & Wheeler did not find the culvert during field investigations.

Project Tasks

None. The basin size required is 0.4 acres, smaller than the existing basin. No improvements are anticipated.

Release Point

The release point for A6 is across General Jim Moore Blvd. and toward subwatershed A3.

Project A6 (SWMP Drawing Set: C1, C2, D1 & D2)
Project A6 subwatershed is approximately 20.1 acres, contains about 2.8 acres of the Veteran's Clinic, and will contain a proposed parking lot. The site is estimated at 16% impervious, based on future conditions where only a small parking lot and the south half of the Veteran's Clinic are impervious.

Project Tasks

- Remove approximately 4.5 acres of pavement to reduce impervious area.
- Construct a basin using about 0.4 acres of land, approximately as shown on Sheet D1.
  - Alternatively, reduce basin size if the Veteran's Clinic percolates runoff on site.
- Incorporate vegetated swales into site improvements.
- Include a rock-armored outfall from the vegetated swale.

Removal of existing buildings, on-site drainage, and other site improvements are considered to be part of CSUMB Master Plan Update.

Release Point

The release point for A6 is through the soccer fields and toward subwatershed A3, on CSUMB property.

Project A7 (SWMP Drawing Set: C2 & D2)

Project A7 subwatershed is approximately 56.0 acres. Though it now contains nothing, in the future it will support about 4.5 acres of new parking lot and buildings on its side of the drainage divide. The site estimated at 8% impervious, based on future conditions.

Project Tasks

- Construct a basin using about 0.5 acres of land, approximately as shown on Sheet D2.
- Use a vortex separator to remove sediment, trash and oils prior to outfall.
- Anticipate needing approximately 120 LF of 15" pipe.

Miscellaneous stormdrain pipe may be required based on the final development of the site, but are not included in this CIP as local drainage should be included in the CSUMB Master Plan Update.

Release Point

The release point for A7 is toward subwatershed A6, on CSUMB property.

Project A8 (SWMP Drawing Set: D2)

Project A8 subwatershed is approximately 18 acres that includes all CSUMB sites draining north toward 6th Ave. north of Col. Durham St. and south of the University Center parking lot, including the University Center and Music Hall parking lots. Overflow and surface runoff from a 2-mg water reservoir near 6th Ave. and Col. Durham St. drains to an existing depressed area with Coast Live Oaks and walkways. Analysis of basin size shows that the basin is able to accommodate a 100-year 24-hour storm event and reservoir overflow. The drainage area is estimated at 65% impervious.

Project Tasks

- No basin construction is necessary. The basin surface area and volume need to be 0.8 acres and 2.2 acre-feet, respectively. The existing site is sufficient, as shown on Sheet D2.
- Reutilize the existing stormdrain, where functional.
- Anticipate using two outfalls.
- Install approximately 65 LF of 18" to 21" stormdrain from the existing manhole at the intersection of C St. and 6th Ave. to the 6th Ave. outfall.
- Create one inlet on the west side of 6th Ave.
- Install approximately 520 LF of 15" to 18" stormdrain under 6th Ave. and the University Center parking lot to the parking lot outfall.
- Create two inlets in 6th Ave. and one inlet in the parking lot.
  - Alternately, consider curb cuts on the south side of the parking lot.
- Use vortex separators are recommended to remove sediment, trash, and oils.
  - Alternatively, use rip rap forebays with geo-textile lining to intercept fines and trash and to reduce maintenance of the Coast Live Oak grounds.

Miscellaneous stormdrain pipe and inlets may be required at the student housing and academic buildings based on the final development of the site but are not included in this CIP, as local drainage should be included in the CSUMB Master Plan Update.

Release Point

The release point for A9 is into the A8 subwatershed, westerly, away from buildings and infrastructure along the south side of the University Center parking lot.

Watershed B

Watershed B is approximately 218 acres containing: most of the Central Campus Meadow; the 1st Street Mall; the west half of the Freshman Quad to General Jim Moore Blvd.; the North Quad housing area; the area bounded by General Jim Moore Blvd., 2nd Ave., 1st Street; and the North Campus Faculty and Staff Housing project area.

Watershed B projects will allow CSUMB to discontinue dependence on the North 48" and 54" stormdrains that discharge to the North 48" and 54" percolation basins, respectively. Watershed B projects will also reroute runoff from areas that currently discharge to the City of Marina percolation basin through existing stormdrains, according to the natural grading of CSUMB.

Project B1 (SWMP Drawing Set: B1, B2 & C1)

Project B1 subwatershed is approximately 77 acres, some 65 acres of which is covered with asphalt as of this SWMP. The current drainage area is estimated at 80% impervious. CSUMB plans to redevelop this site as the North Campus Faculty and Staff Housing project, to include a park. At that point, according to the North Campus Project Plan, a portion of the site will be regarded to drain easterly, leaving approximately 65 acres in the B1 subwatershed. Improvements to B1 are recommended prior to commencement of the North Campus Housing project. These improvements will eliminate CSUMB's reliance on the regional 54" stormdrain.

Initial Project Tasks

- Remove at least 70% of the asphalt and scarify the subbase to permit high infiltration rates, while retaining major roadways for access.
- Construct a 1-1/2 acre percolation basin at the bottom of the site to capture and percolate any remaining stormwater runoff (shown on Sheet A2).
- Grade vegetated swales to direct runoff toward the basin.
- Install one outfall from the vegetated swale armored with rip-rap.
- Abandon existing stormdrain pipes and fill inlets.
- Vegetate newly exposed and scarified soil areas to reduce erosion.

Ultimate Project Task

Build a basin at the lowest point on the site that can contain a volume of 8.84 acre-ft (14,300 cu-yd) and that occupies 3 acres. The final site design will provide refined values based on detailed site improvements using the design criteria established in this SWMP.

Release Point

The release point for B1 is onto 2nd Ave. at the most northwesterly point of the site, and through the proposed University Villages area.

Project B2 (SWMP Drawing Set: B1, B2, C1 & C2)

Project B2 subwatershed is approximately 52.4 acres and includes: the south section of the North Campus Faculty and Staff Housing project; the CSUMB Disc Golf Course; a section of General Jim Moore Blvd.; a portion of the Campus Support Center; and the North Quad student housing. The site is estimated to be 75% impervious, based on future conditions including North Campus.

Project Tasks

- Construct a percolation basin on about 2.6 acres of land in the Disc Golf Course area, as shown on the plans, above the existing stormdrain system.
- Grade the site so that the basin can receive flow from surfaces lower than 150 feet, as some such low points exist on the west side of the Campus Support Center.
    - Alternately, equip the stormdrain system for the west side Campus Support Center parking lot to drain to basin B3.
- Reutilize existing stormdrain, where functional. The existing 36" stormdrain on the south side of the basin turns northerly and becomes a 54" stormdrain.
- Consider terminating the stormdrain under the basin and construct an outlet so that discharge can bubble up into the basins.
- Incorporate vegetated swales wherever possible to collect and filter parking lot runoff before it discharges to the basins or use vortex separators prior to any piped outfalls to remove sediment, trash, and oils.

Miscellaneous stormdrain pipe will be required based on the final development of the North Campus Housing project, but these are not included in this CIP.

Release Point

The release point for B2 is toward subwatershed B3; if B3 is full the release point is toward B1 subwatershed. Alternatively, subwatersheds B2, B3, and B4 might be joined together using existing stormdrain pipes, provided the basins are all graded to the same depth.

Project B3 (SWMP Drawing Set B2)

Project B3 subwatershed is approximately 5.2 acres and consists of the inside portion of Administrative Support and the lowest area within subwatersheds B2, B3, and B4, which is proposed for parking. The proposed parking area is not large enough to accommodate a basin for the three subwatersheds so an auxiliary basin location was identified. Completion of this B3 basin would allow CSUMB to terminate use of the regional North 48" stormdrain and corresponding North 48" percolation basin. The site is estimated to be 75% impervious, based on future conditions including development of North Campus. Under existing conditions the B3 subwatershed drains to the general location of the proposed basin. All improvements for this project can be deferred until the new parking lot and building are developed, unless the parking lot on the west side of the Administrative Support is also drained to this basin.

Project Tasks

- Construct a basin with 0.5 acre-ft of storage in the location shown on the plans, using about 0.2 acres of land.
    - Alternately, consider constructing a larger basin that could connect to the stormdrain system for the west side Administrative Support parking lot in order to drain that parking lot if there are grading difficulties with the basin in B2.

- Integrate vegetated swales into plans wherever possible to collect and filter parking lot runoff before discharging to the basin.

Miscellaneous stormdrain pipe may be required based on the final development of this area, but are not included in this CIP.

Release Points
Release points for B3 are into subwatersheds B2 and B4. Alternatively, subbasins B2 and B3, or B2, B3 and B4 might be joined together using existing stormdrain pipes provided the basins are all graded to the same depth. Yet another alternative would be to fill in B3 and assign the required storage volume and surface area to B2 and/or B4.

Project B4 (SWMP Drawing Set C1, C2 & D2)
Project B4 subwatershed is approximately 95 acres and will drain: most of the Central Campus Meadow; the 1st Street Mall; the west half of the freshman dormitories and Visitor's Center to General Jim Moore Blvd.; the northern half of the Veteran's Clinic; the gymnasium; and the area bounded by 1st Street, 3rd Street, General Jim Moore Blvd., and 2nd Ave. The site is estimated to be 45% impervious.

Project Tasks

- Construct a basin in the location shown on Sheet A3, using about 2.9 acres of land.
  - Alternately, construct a smaller basin at this site and add basins upstream of basin B4. Potential sites for additional basins include the Veteran's Clinic, the Visitor Center field along General Jim Moore Blvd., and the Disc Golf Course across from the Visitor's Center.
- Use existing stormdrains within the freshman dormitories, the proposed CSUMB Master Plan Update 30" pipe in 1st Street, and other existing infrastructure, where functional.
- Install approximately 150 LF of 15" stormdrain and two inlets A Street and connect to the upstream end of the proposed 30" pipe in 5th Ave.
- Install approximately 550 LF of 30" stormdrain in 1st Street and connect to the downstream end of the proposed 30" pipe in 1st Street.
- Daylight the 1st Street line into a depression in the Visitor Center field along General Jim Moore Blvd. Use an existing culvert under General Jim Moore Blvd. to drain the depression to the Disc Golf Course. (Note: The capacity of the existing culvert was not analyzed as part of this SWMP because invert elevations were not available to determine pipe slope. Another culvert under General Jim Moore Blvd might be required.)
- Collect the Veteran's Clinic runoff in a field inlet above the southeast corner of the intersection of General Jim Moore Blvd. and 1st Street and route the runoff to the 30" stormdrain through about 100 LF of 15" stormdrain.
- Install approximately 630 LF of 24" to 30" stormdrain in 3rd Street connecting the existing 24 " line from the freshman dormitories to the inlets near at 3rd Street and 4th Ave. and into the Visitor Center field.
- Install approximately 1,500 LF of 15" to 18" stormdrain in 3rd Street between 2nd Ave. and General Jim Moore Blvd. and discharge to the proposed basin.
- Use vortex separators in the 3rd Street stormdrains to remove sediment, trash, and oils.

- Use vegetated swales to collect and filter runoff through the Disc Golf Course before discharging to the basins.

Miscellaneous stormdrain pipe may be required for site specific improvements, but these are not included in this CIP, as local drainage should be included in the CSUMB Master Plan Update.

Release Points
The release point for B4 is towards subwatershed B3.

Watershed C
Watershed C is approximately 280 acres containing: most land between 6th and 7th Avenues; the Chapman Science Center block; the eastern half of the freshman quad; all CSUMB property north and east of Third Street and the former 5th Ave., respectively; and the east half of the North Quad and North Campus Faculty and Staff Housing project areas. The CSUMB properties naturally drain toward the existing City of Marina percolation basin, which also receives runoff from an additional 80 off-campus acres.

Proposed improvements remove more than 69 acres of potential drainage area from the South 48" percolation basin. Improvements also eliminate roughly 55 acres of CSUMB impervious area draining to the City of Marina percolation basin. Finally, project B4 removes about 27 acres of CSUMB runoff currently routed to the City of Marina basin through stormdrains that naturally drain to the west.

Field evaluations of the existing drainage system within 7th Ave. indicate the inlets and stormdrains along 7th Ave. are undersized for the design runoff. All stormdrains and inlets should be replaced for projects C4 through C7.

Also, field evaluations of the existing drainage system within 7th Ave. did not verify the stormdrain system on the east side of 7th Ave. as represented in Army stormdrain mapping. Army mapping implies that there is a continuous stormdrain from south of Col. Durham Street that runs north past Intergarrison Road and discharges to open space. The stormdrain laterals running westerly within this section may actually be connected to stormdrain systems on the west side of 7th Ave. This circumstance will not impact CSUMB development, provided the SWMP Implementation Guide is closely followed. The findings were considered when sequencing subwatershed C projects.

<u>Project C1 (SWMP Drawing Set: B2 & C2)</u>
Project C1 subwatershed is approximately 26.4 acres that presently drains to the City of Marina percolation basin. A new basin is needed to serve the future North Campus Housing project and other projects directly west of the basin. Under future conditions the site is estimated to be 60% impervious.

Project Tasks
- Construct a basin using about 1.1 acres of surface area, as shown on Sheet B2.
    - Alternatively, CSUMB could negotiate for continued use of the City of Marina percolation basin. The drawback to this alternate is that the City of Marina basin may need to be expanded to serve the design storm.

- Install approximately 200 LF of 15" to 18" stormdrain with inlets in the former 5th Ave. to collect and route runoff to the basin.
- Use a vortex separator to remove sediment, trash, and oils.

Miscellaneous stormdrain pipe may be required for site specific improvements, but are not included in this CIP, as local drainage should be included in the CSUMB Master Plan Update.

Release Point

- The release point for C1 is towards the City of Marina's percolation basin.

Project C2 (SWMP Drawing Set: B2 & C2)

Project C2 subwatershed is approximately 41 acres that includes: the parking area between 5th and 6th Aves.; 3rd St.; and the 8th St. cut-off. The site is estimated to be 85% impervious. The stormdrain that underlies the parking lot also accepts discharge from Freshman Quad and Student Residential stormdrain. The connection at the southwest corner of 3rd St. and 5th Ave. is through a retaining wall and causes a nuisance discharge onto 3rd St. A new basin for the C2 parking area will also serve the eastern half of the Freshman Quad and Student Residential Area north of the 1st street Mall to 5th Ave. Re-plumbing the parking lot stormdrains will reverse the flow and eliminate the nuisance, although this is not required by this SWMP.

- Construct a basin using about 2.0 acres of land, as shown on Sheet B2.
  - Alternatively, construct an underground percolation basin to maintain the acreage of parking lot.
- Reutilize existing stormdrains might be where convenient. All existing stormdrains for Student Residential area assumed to be usable.
- Re-plumb the existing parking lot at the southwest corner of 3rd St. and 5th Ave., so that it drains to the 3rd St. entrance. (Optional.)
- Line the CSUMB north property boundary with a vegetated swale that drains to the basin.
- Install approximately 1,400 LF of 18" to 21" stormdrain along 3rd St., in front of the 3rd St. entrance, and along the proposed 5th Ave entrance road. Discharge to the project basin.
- Anticipate one outfall.
- Use a vortex separator to remove sediment, trash, and oils.

Miscellaneous stormdrain pipe may be required based on the final development of the site, but are not included in this CIP as local drainage should be included in the CSUMB Master Plan Update.

Release Point

The release point for C2 is toward the existing City of Marina percolation basin.

Project C3 (SWMP Drawing Set: C2 & D2)

Project C3 subwatershed is approximately 32 acres that includes the 6th Ave. strip from the University Center near B St. and the Chapman Science Academic Center to 5th Ave. and 3rd St. The site is estimated to be 70% impervious.

Project Tasks

- Construct a basin using about 1.1 acres of land, approximately as shown on Sheet B3.

  - Alternatively, construct a basin of reduced size to avoid encroaching upon parking lot space. Accommodate drainage by adding a basin upstream or by increasing the size of the C2 downstream basin.

- Reutilize existing stormdrains, where possible. All existing stormdrains within 6th Ave. are assumed to be usable.
- Connect approximately 600 LF of 21" to 27" stormdrain to the existing stormdrain at 6th Ave. and A St.
- Install inlets in 6th Ave. to discharge across open space and through vegetated swale to the project basin.
- Install inlets and stormdrains at the intersection of 6th Ave. and 3rd St. to drain the inlet to the basin.
- Anticipate three outfalls.
- Use a vortex separator at the intersection of 6th Ave. and 3rd St. and at the proposed parking lot to remove sediment, trash, and oils.

Other miscellaneous stormdrain pipe was not included in this CIP. That is assumed to be part of the local drainage that was included in the CSUMB Master Plan Update.

Release Point
The release point for C3 is towards Project C2, within CSUMB property.

Project C4 (SWMP Drawing Set: C2 & C3)
Project C4 watershed is approximately 11 acres that includes existing and future student residential halls west of 7th Ave. and north of A St. The site is estimated to be 75% impervious.

Project Tasks

- Construct a basin using about 0.5 acres of land, approximately as shown on Sheets B3 and C3.
- Install approximately 1,200 LF of 15" to 18" stormdrain with inlets in 7th Ave. and 3rd St. to discharge to the project basin.
- Install inlets and stormdrains within the residential areas, per site development plans.
- Anticipate two outfalls.
- Add vegetated swales or use a vortex separator to remove sediment, trash, and oils.

On-site inlets and stormdrains installed within the residential areas are not included in this CIP. That is assumed to be part of the local drainage that was included in the CSUMB Master Plan Update.

Release Point
The release point for C4 is off site, across 3rd St. toward Golden Gate University.

Project C5 (SWMP Drawing Set: C2, C3 and D3)
Project C5 subwatershed is approximately 14.4 acres that includes about half of the proposed student residential halls west of 7th Ave. and north of B St., and will receive drainage from A Street. Site is estimated to be 75% impervious.

Project Tasks

- Construct a basin using about 0.7 acres of land, approximately as shown on Sheets B3 and C3.
- Install approximately 1,200 LF of 15" to 18" stormdrain with inlets in 7th Ave. and A St.
- Install approximately 200 LF of 18" to 21" stormdrain to discharge from A St. to the project basin.
- Install inlets and stormdrain within the residential areas, per site development plans.
- Anticipate two outfalls.
- Add vegetated swales or use a vortex separator to remove sediment, trash, and oils.

Inlets and stormdrains installed within residential areas were not included in this CIP. They are assumed to be part of the local drainage that was included in the CSUMB Master Plan Update.

Release Point

The release point for C5 is through the residential area toward Project C4, within CSUMB property.

Project C6 (SWMP Drawing Set: C2, C3, D2 & D3)

Project C6 subwatershed is approximately 19 acres that includes a portion of the future student residential halls west of 7th Ave. and north of B St.; most of the parade field to the south; and the facilities building parking lot along B St., between 7th and 8th Aves. The area is estimated to be 45% impervious.

Project Tasks

- Construct a basin using about 0.7 acres of land, approximately as shown on Sheets B4 and C4. The basin will receive its drainage along B Street.
- Install approximately 100 LF of 15" to 18" stormdrain with inlets in the 7th Ave. and B St. intersection and connect to existing stormdrains.
- Install approximately 1,000 LF of 21" stormdrain, to discharge from the 7th Ave. and B St. intersection to the new C6 basin.
- Install inlets and stormdrain within the residential areas per site development plans.
- Anticipate two outfalls.
- Add vegetated swales or use a vortex separator to remove sediment, trash, and oils.

Inlets and stormdrains installed within residential areas were not included in this CIP. They are assumed to be part of the local drainage that was included in the CSUMB Master Plan Update.

Release Point

The release point for C6 is through the residential area toward Project C5, within CSUMB property.

Project C7 (SWMP Drawing Set: Ds & D3)

Project C7 subwatershed is approximately 17.4 acres that includes a portion of the student residential halls west of 7th Ave. and north of Col. Durham St. The site is estimated to be 60% impervious.

Project Tasks

- Construct a basin along the south side of the parade field using about 0.7 acres of land, approximately as shown on Sheets B4 and C4. The basin will receive its drainage along C Street.
- Install approximately 1,200 LF of 15" to 18" stormdrain with inlets to collect runoff from 7th Ave. and C St. and connect to the project basin.
- Install inlets and stormdrain within the residential areas, per site development plans.
- Anticipate one outfall.
- Use a vortex separator to remove sediment, trash, and oils.

Inlets and stormdrains installed within residential areas were not included in this CIP. They are assumed to be part of the local drainage that was included in the CSUMB Master Plan Update.

Release Point

The release point for C7 is across the parade field toward the Watershed Institute and basins A9 and C6, all within CSUMB property.

Project C8 (SWMP Drawing Set: D2, D3 & E3)

Project C8 subwatershed is approximately 5.1 acres that includes: some CSUMB property; City of Seaside roads; and a portion of CHISPA properties. The site is estimated to be 70% impervious.

Project Tasks

- Construct a basin along Col. Durham Street, using about 0.4 acres of land, approximately as shown on Sheets B4 and C4.
- Connect the existing stormdrain system beneath Col. Durham Street to discharge to the basin.
- Anticipate one outfall.
- Use a vortex separator to remove sediment, trash, and oils.

Release Point

The release point for C8 is through the planned student residential complex into area C7, which is within CSUMB property.

Project C9, City of Seaside (SWMP Drawing Set: D2, D3, E2 & E3)

Project C9 subwatershed covers approximately 13.4 acres in the City of Seaside, upstream of CSUMB and includes most of the CHISPA properties. A basin should be constructed for CHISPA by the CHISPA developer and improvements should be provided by the City of Seaside. This project is identified in this SWMP to show how C9 improvements would lessen the impact to CSUMB projects A9, C3, and C8. The site is estimated to be 80% impervious.

Project Tasks

- Construct a basin on the CHISPA site using about 0.8 acres of land, approximately as shown on Sheets B4 and B5.
- Convey City of Seaside runoff in Col. Durham Street west of Project C8 and 6th Ave. south of Col. Durham Street to the existing stormdrain system in Col. Durham Street near Parker Flats Cut-off, using approximately 1,400 feet of 18" to 27" stormdrain pipe.

- Anticipate two outfalls at the CHISPA basin.

Release Point
The release point for C9 is into CSUMB property around C8, down 6th Ave.

Watershed D
Watershed D is approximately 630 acres containing most of the land between 7th and 8th Avenues. Stormwater currently outfalls north through three stormdrains into County of Monterey open space. These systems will be replaced by on-campus percolation basins.

- The 7th Ave. stormdrain and mid block outfalls will be abandoned as projects are implemented.
- The 8th Ave. stormdrain and outfall also serves Army property along 8th Ave. and CSUMB should provide the Army with an easement and ownership of the 8th Street stormdrain, while the campus discontinues using it.
- Army maps imply that a continuous stormdrain runs from south of Col. Durham Street, north past Intergarrison Road and discharges to open space. However, field evaluations were unable to locate the stormdrain system on the east side of 7th Ave. between Col. Durham Street and A Street.

Project D1 (SWMP Drawing Set: C3)
Project D1 subwatershed is approximately 12.4 acres but wraps around area D2 and includes drainage from 8th Ave., A Street, A Street parking, 7th Ave., Intergarrison Road, and the existing parking lot. The site is estimated to be 60% impervious, under proposed conditions.

Project Tasks

- Construct a basin using about 0.7 acres of land, approximately as shown on Sheet C3.
- Remove parking lot asphalt and replace with gravel.
- Remove the concrete swale along 8th Ave. and vegetate.
- Remove the parking area along A Street near area D2 and vegetate.
- Intercept runoff from the south side of Intergarrison Road and drain to the basin.
- Intercept runoff from the east side of 7th Ave. and drain to the basin.
- Use existing parking lot inlets to drain the parking lot to the basin.
- Add vegetated swales or use a vortex separator to remove sediment, trash, and oils.
- Anticipate at least three outfalls.

Miscellaneous stormdrain pipes required for site-specific improvements based on the CSUMB Master Plan Update are assumed to be included in site-specific plans. Gravelling the parking lot is assumed to be part of the CSUMB Master Plan Update.

Release Point
Release point for D1 is across Intergarrison Road and into County of Monterey open space.

Project D2 (SWMP Drawing Set: C3)
Project D2 subwatershed is approximately 8.2 acres that currently drains to an outfall on the north side of Intergarrison Road. A small portion drains to the intersection of 8th Ave. and Intergarrison Road. The plan is to use the existing drainage system and bubble the runoff up

into a proposed basin to be constructed at the low area of the parking lot. The site is estimated to be 100% impervious.

Project Tasks

- Construct a basin using about 0.7 acres of land, approximately as shown on Sheet C3.
- Remove or abandon the stormdrain system currently serving the parking lot, along A Street.
- Replace the concrete swale along 8th Ave. with a vegetated swale that wraps around the perimeter.
- Grade the area and drain to the proposed project basin.
- Remove the parking area along A Street in area D2 and vegetate.
- Use existing parking lot inlets to drain the parking lot to the basin.
- Anticipate two outfalls.

Release Point

The release point for D2 is into area D1, which is within CSUMB property.

Project D3 (SWMP Drawing Set: C3 & D3)

Project D3 subwatershed is approximately 13.5 acres and includes a portion of the existing North Tree Fire site along 8th Ave. This project assumes the A-Street extension will be constructed and the North Tree Fire site will be demolished. The site is estimated to be 10% impervious, under proposed conditions, with about 11 acres of pavement removed as per CSUMB Master Plan Update Planning Horizon I Demolition Plan.

Project Tasks

- Construct a basin using about 0.2 acres of land at the northwest corner of the area, approximately as shown on Sheet C3.
- Add approximately 630 feet of vegetated swale along the 7th Ave. side of the site, with driveway culverts as needed.
- Add approximately 1,200 feet of vegetated swale along the 8th Ave. and the A Street sides of the site, with driveway culverts as needed.
- Remove the parking area along A Street and vegetate.
- Abandon the on-site stormdrain.
- Anticipate two swale outfalls and one stormdrain outfall.

Pavement demolition for this area is included in the CSUMB Master Plan Update and is included in this project also, as it is a critical component for this project. Removal of existing buildings was not included in this project. However, the building demolition is part of Planning Horizon I demolition plans.

Release Point

Release point for D3 is towards area D1, which is on CSUMB property.

Project D4 (SWMP Drawing Set: C3 & D3)

Project D4 subwatershed is approximately 5.4 acres and includes the proposed concrete batch plant site, a portion of the facilities along B Street next to 8th Ave., and sections of B Street and 8th Ave. The site is estimated to be 70% impervious under proposed conditions that include adding the batch plant and removing about 12.5 acres of pavement, as per the

CSUMB Master Plan Update Planning Horizon I Demolition Plan. The existing 0.94 acre-ft percolation basin with its vegetated swales is more than adequate to serve this site, which requires only a 0.4 acre basin.

Project Tasks

- Conduct percolation tests to verify that the site can percolate at least 6-inches per hour. If so, the existing basin along 8th Avenue is adequate at 0.94 acre ft, including freeboard.
- Install a culvert across B Street.
  - Alternatively, a concrete swale may be considered, though this could cause local flooding. Value engineering is recommended for this alternative.
- Remove or abandon the stormdrain lateral to the existing 8th Ave. stormdrain allowing the existing inlet to outfall directly into the basin.
- Route all batch plant runoff through a vortex separator. Closely monitor plant runoff for pollutants (fine sediments) that could line this basin and prevent percolation.
- Anticipate one swale outfall and one stormdrain outfall.

Any on-site stormdrains for the Batch Plant should be included in the development of that site and are not included in this capital improvements program.

Release Point

The release point for D4 is down hill toward subwatershed D3 on CSUMB property and along 8th Ave., which may discharge to County of Monterey Open Space.

Project D5 (SWMP Drawing Set D3)

Project D5 subwatershed is approximately 2.3 acres and includes the north side of C Street. The south side of the facilities area will also drain to the project basin, which is existing open space that does not require improvement unless the site percolates less than 6-inches per hour. The site is estimated to be 80% impervious.

Project Tasks

- Conduct percolation tests to verify that the site can percolate at least 6-inhes per hour. If so, the existing basin is adequate to meet the requirement of 0.2 acres with an available volume of 0.52 acre-ft, including freeboard.
- Install approximately 550 feet of 15” pipe and associated inlets.
- Anticipate one stormdrain outfall is anticipated.

Release Point

The release point for D5 is into area C6, which is on CSUMB.

Project D6 (SWMP Drawing Set: D3)

Project D6 subwatershed is approximately 15.4 acres and includes most of the block between 7th and 8th Aves. and Col. Durham and C Streets. The project approach is to remove the asphalt from the parking area on the west side of the block but leave the facilities warehouse site alone. The site is estimated to be 40% impervious, after pavement is removed.

Project Tasks

- Construct a basin using about 0.5 acres of land, approximately as shown on sheet C4.
- Remove the west parking lot asphalt and replace with gravel.

- Remove or abandon existing parking lot inlets. The existing system is suspected to be connected to the stormdrain on the west side of 7th Ave.
- Create two vegetated swales: one within the graveled parking area, the other along 8th Ave. and C Street.
- Install a driveway culvert and two road inlets.
- Anticipate two swale outfalls and two stormdrain outfalls.

Release Point
The release point for D6 is into subwatersheds D5 and C6, which are within CSUMB.

Project D7 (SWMP Drawing Set: D3)
Project D7 subwatershed includes the north, CSUMB side of Col. Durham Street and a portion of the south side open space area of subwatershed D6. Runoff from D6 will be negligible. The basin is to be a depression just east of the northeast corner of 7th Ave. and Col. Durham Street. that will capture 10-year storm runoff and reduce water spread on 7th Ave. Site grading, asphalt removal and vegetation is included in project D6.

Project Tasks
- Install a curb cut inlet to the depression with an asphalt swale.

Release Point
The release point for D7 is into area D6, which is on CSUMB.

Project D8 (SWMP Drawing Set: D3 & E3)
Project D8 subwatershed is approximately 4 acres of Army property outside CSUMB south of Col. Durham Street; however, it may impact CSUMB projects C4 through C7 and D6. If the project is not going to be implemented by the Army or CSUMB, then downstream basins and systems should be upsized to include this drainage area. The site is estimated to be 100 % impervious.

Project Tasks
- Construct a 0.4 acre basin, as shown on Sheet C4.

Release Point
The release point for D8 is into CSUMB property along 7th Ave.

Project D9 (SWMP Drawing Set: E3)
Project D9 subwatershed is approximately 2.5 acres of Army property outside CSUMB south of project D8; however it may impact CSUMB projects C4 through C7 and D6. If the project is not implemented by the Army or CSUMB, then downstream basins and systems should be upsized to include this drainage area. The site is estimated at 100 % impervious.

Project Tasks
- Construct a 0.2 acre basin would be construction, as shown on Sheet C5.

Release Point
The release point for D9 is into CSUMB property along 7th Ave.

East Campus

The East Campus Housing area is approximately 430 acres of residential development directly north of Inter-Garrison Road and roughly 1.5 miles east of the campus core. The area includes part of the Fredrick's Park and all of Schoonover Park, built by the Army in the 1980s. Therefore, the existing stormdrain systems are relatively new. East Campus Housing currently drains into eight existing basins, six of which are within CSUMB property, one partially within CSUMB property, and one completely outside of CSUMB property.

Project EC1 (SWMP Drawing Set: A4, A5 & B5)

Project EC1 subwatershed is approximately 37.4 acres and drains the neighborhood blocks of Yorktown Ct., Saratoga Dr., Princeton Ct., and Concord Ct. Yorktown Ct. runoff is currently diverted to a drainage basin north of Bunker Hill Drive. This project drains Yorktown Ct. street and lot runoff as well as runoff from recreational areas to existing basin EC1. The site is estimated at 42% impervious, based on existing conditions.

Project Tasks

- Eliminate outfall to offsite percolation basin north of Bunker Hill Drive when off-site property is being developed or when convenient for CSUMB.
- Install approximately 1,300 of 18" to 21" stormdrain pipe and inlets along Bunker Hill Drive to drain all onsite water to basin EC1.

Release Point

The release point for EC1 is primarily to the offsite basin southwest and across Abrams Dr. and secondarily toward the northwest.

Project EC2 (SWMP Drawing Set A4 & A5)

The EC2 subwatershed drains roughly 12.8 acres off Trenton Ct. into an existing percolation basin to the north of the development. Basin EC2 receives street and lot runoff and provides adequate storage under existing conditions. The site is estimated at 20% impervious.

Release Point

The release point for EC2 is northwest across Imjin Parkway.

Project EC3 (SWMP Drawing Set: A5, B4 & B5)

Subwatershed EC3 is approximately 21.4 acres east of Abrams Dr. It drains into an existing percolation basin that receives street and lot runoff as well as runoff from recreational use areas and provides adequate storage under existing conditions. The site is estimated at 8% impervious.

Release Point

The release point for EC3 is to the northwest, along Abrams Dr.

Project EC4 (SWMP Drawing Set: A5 & B5)

Subwatershed EC4 is approximately 27.4 acres and drains to a basin just north of Schoonover Rd. Garbee Ct., Edde Ct., and White Ct. all contribute to this percolation basin which also receives runoff from recreational use areas. This basin provides adequate storage under existing conditions. The site is estimated at 40% impervious.

Release Point
The release point for EC4 is northwest through Yorktown Ct.

Project EC5 (SWMP Drawing Set: B5, B6, C5 & C6)
Subwatershed EC5 is approximately 31.2 acres and drains to a basin east of Abrams Dr. Fredericksburg Ct., Wilderness Ct., Antietam Ct., Mannassas Dr. and Abrams Dr. all contribute to this percolation basin which also receives runoff from recreational use areas. This basin provides adequate storage under existing conditions. The site is estimated to be 19% impervious.

Release Point
Release point for EC5 is north to basin EC4.

Project EC6 (SWMP Drawing Set: B5 & B6)
Subwatershed EC6 is approximately 28.9 acres and drains to a basin off of Schoonover Dr. The properties on Holovits Ct., Jackson Ct., and Sherman Ct. as well as road drainage from Abrams Dr. contribute to this percolation basin, which also runoff from recreational use areas. This basin provides adequate storage under existing conditions. Site is estimated at 45% impervious.

Release Point
The release point for EC6 is northwest along Schoonover Rd.

Project EC7 (SWMP Drawing Set: B6 & C6)
Subwatershed EC7 is approximately 40.3 acres and drains to a basin that is partially located in Monterey County open space. The lots on Wainwright Ct., Wedemeyer Ct., Patch Ct., Simpson Ct. and Clark Ct. as well as road drainage from Schoonover Rd. drain to this percolation basin, which also receives runoff from recreational use areas. The site is estimated at 37% impervious.

Project Tasks
- Re-grade the existing basin, as indicated on Sheet F2, to retain CSUMB runoff within the campus boundary.

Release Point
The release point for EC7 is northwest along Schoonover Rd.

Project EC8 (SWMP Drawing Set: B6)
Subwatershed EC8 is approximately 20.5 acres and drains to an area north of Eichelberger Ct. Eichelberger Ct. and Hodges Ct. contribute to the runoff.

Project Tasks
- Relocate the culvert outfall of the existing discharge to allow for a basin to be graded.
- Construct a new basin of approximately 2 acres to capture runoff.

Release Point
- The release point for EC8 will be northerly across Old County Road.

Project EC9 (SWMP Drawing Set: A5, A6, B5 & B6)
Subwatershed EC9 is approximately 16.5 acres and drains portions of Thomas Ct., Henson Ct., and a basketball court. This area currently drains offsite to swales along the Campus boundary.

Project Tasks
- Construct a new basin to capture runoff using approximately 0.5 acres.

Release Point
The release point for EC9 will be northerly toward Old County Road.

Project EC10 (SWMP Drawing Set: A5, B5 &B6)
Subwatershed EC10 is approximately 24.3 acres and drains the neighborhood blocks of Combs Ct., Warrelman Ct., Thomas Ct., and Henson Ct. This area currently drains offsite to swales along the Campus boundary.

Project Tasks
- Construct a new basin to capture runoff, using approximately 0.7 acres.

Release Point
The release point for EC10 will be north toward Old County Road.

Project EC11 (SWMP Drawing Set: B4, B5, C4 & C5)
Subwatershed EC11 is approximately 59 acres and drains the neighborhood blocks of Gettysburg Ct., Petersburg Ct. and Spotsylvania Ct. This area currently drains offsite to a swale north of Gettysburg Ct.

Project Tasks
- Construct a new basin to capture runoff using approximately 0.8 acres.

Release Point
The release point for EC11 will be offsite into County of Monterey open space.

STORMWATER MASTER PLAN PHASING AND CONSTRUCTION COST ESTIMATE

Capital Improvement Project Phasing
Figure 5-1 provides an overview of subbasin projects, including upstream predecessor projects.

Phase I: 20 projects without predecessors.

Phase II: 4 projects that rely on implementation of one or more Phase I projects.

Phase III: 5 projects that require implementation of one or more Phase II projects.

Phase IV: 2 projects dependent on implementation of one or more Phase III.

The consequence of not implementing a project's upstream predecessor is that the project may not be able to provide 100-year protection.

Each project is color coded to indicate any associated CSUMB Master Plan Update Planning Horizons. However, many projects cannot be driven by planning horizon as they are determined primarily by upstream predecessors.

Capital Improvement Project Cost Estimates

Figure 5-1 also provides a summary of the estimated project costs; details are in Appendix F. Projects C9, D8, and D9 are non-CSUMB projects that reduce upstream runoff from the Army and City of Seaside sites and are included for CSUMB's use.

Each project includes a 25% construction contingency; 10% Contractor's overhead and profit; and 35% engineering design, soil testing, existing storm drain assessments, construction management, environmental and administrative soft costs.

The contingency, overhead and profit, and other soft costs are typical industry averages appropriate for civil improvements planning. However, they do not follow the California State University Capital Outlay Estimate approach found in form CPDC 2-7 which follows their estimating approach for State and Non-state funded building projects. At the request of CSUMB staff, this SWMP includes Appendix G, which are the cost estimates using form CPDC 2-7. The project construction cost estimate with the 25% construction contingency was inserted into line G1020, "Site Prep & Site Improvements, while the Required Additional Services section of the forms were manipulated to force the grand total to equal as closely as reasonable the SWMP grand totals.

All project costs are stand-alone estimates. Potential cost saving construction approaches such as recycling of asphalt pavement, concrete or metals, were not included in these planning-level cost estimates. Such approaches are recommended as they can be applied. Also, some costs may be reduced if the projects are implemented in tandem with CSUMB Master Plan Planning Horizon projects. Cost estimates for abandoning pipes and inlets are not included; they are considered incidental if the inlets are only filled-in and the pipes are left in place.

Recommended Stormwater Master Plan Update Schedule

As previously indicated, the vast majority of SWMP projects are not associated with CSUMB Planning Horizons. However, a convenient schedule for updating this SWMP would be when the California State University Monterey Bay updates their campus master plan.

54" PERCOLATION POND

NORTH / SOUTH 48" PERCOLATION POND

MONTEREY BAY

POTENTIAL DRAINAGE EASEMENT

EXISTING 54" SD

HIGHWAY 1

POTENTIAL DRAINAGE EASEMENT

EXISTING NORTH 48" SD

UNIVERSITY VILLAGES

CITY OF MARINA

CITY OF SEASIDE

EXISTING SOUTH 48" SD

POTENTIAL DRAINAGE EASEMENT

CITY OF SEASIDE GATEWAY

MAIN PARKWAY

CITY OF MARINA

MONTEREY COUNTY

0-ft 500 1,000 1,500

2ND AVE

-B1-
(NONE)

-C1-
(NONE)

-B2-
(C2, C3, C4)

-C2-
(C3, C4)

-B3- (NONE)

3RD ST

-B4-
(A9, C3, C5-C9)

-C3-
(A9, C5-C9)

-C4-
(NONE)

-D1-
(D3, D5, D6, D7)

INTER-GARRISON RD.

MONTEREY COUNTY

CSUMB

-D2-
(D3)

7TH AVE

8TH AVE

1ST ST

-C5-
(NONE)

-D3-
(NONE)

POTENTIAL DRAINAGE EASEMENT FOR ARMY

-D4-
(NONE)

-A2-
(A3, A4, A7, B4, C3)
(C5-C9)

GENERAL JIM MOORE BLVD

-A6-
(NONE)

-A3-
(NONE)

-A7-
(NONE)

-C6-
(D5- D9)

-A8-

-D5-

-C7-
(NONE)

-D6-
(NONE)

-A1-

LIGHTFIGHTER DR.

-A5-

-A4-

-D7-

COL. DURHAM AVE.

-A8-
(SEASIDE, C8, C9)

-C8-

-D8-

-C9-

-D9-

-C8-
(SEASIDE, C9)

-D5-
(NONE)

CITY OF SEASIDE

MONTEREY COUNTY

LEGEND

FUNDED HORIZON I PROJECT (2005-2015)*	HORIZON III PROJECT (2025 +)*
REMAINING HORIZON I PROJECT (2005-2015)*	FLOATABLE PROJECT*
HORIZON II PROJECT (2015-2025)*	NON-CSUMB PROJECT/EXISTING SUBBASIN*
CSUMB BOUNDARY	PROPOSED CSUMB PERCOLATION POND
-B3- PROJECT / SUBWATERSHED	EXIST REGIONAL / EXIST PERCOLATION POND
(C2, C3, C4) UPSTREAM PREDECESSOR PROJECT / SUBWATERSHED	

* ALL PROJECTS ARE PROPOSED. THEY ARE NOT APPROVED TO DATE.

CALIFORNIA STATE UNIVERSITY Monterey Bay

REV SED FEBRUARY 12, 2004

STORMWATER MASTER PLAN
FIGURE 5-1: IMPLEMENTATION PLAN

Schaaf & Wheeler
CONSULTING CIVIL ENGINEERS
100 12TH STREET, BLDG. 2900
MARINA, CA 93933
(831) 883-4848

This map is intended to be used with Table ES-1 of the CSUMB Stormwater Master Plan. There are 31 projects grouped into four phases for the four small watersheds of the main campus and the single East Campus watershed (not shown). The phasing of a project denotes its order of importance is as follows.

- Phase I, 20 Projects: most critical, stand alone (no predecessor) projects,
- Phase II, 4 Projects: rely on implementation of one or more Phase I projects (at least one predecessor),
- Phase III, 5 Projects: require implementation of one or more Phase II projects (at least two predecessors), and
- Phase IV, 2 Projects: dependent on implementation of one or more Phase III projects (at least three predecessors).

ALL PROJECTS* AGAINST CSUMB PLANNING HORIZONS
*EXCLUSIVE OF EAST CAMPUS

11/21/05
SCALE: AS NOTED
DESIGN: MJW
DRAWN: MJW
CHECKED: DAF

FIGURE 5-1

TABLE 5-1: CAPITAL IMPROVEMENT COSTS AND IMPLEMENTATION GUIDE

CALIFORNIA STATE UNIVERSITY MONTEREY BAY
STORMWATER MASTER PLAN
20-CITY ENR CONSTRUCTION COST INDEX FOR AUGUST 2005 = 7478.51

					CSUMB MASTER PLAN UPDATE SCHEDULE				
STORMWATER MASTER PLAN PROJECT PHASE	**SUBBASIN SWMP PROJECT**	**ESTIMATED PROJECT COSTS* ($)**	**OFFSITE SYSTEM DISCHARGE REDUCED BY PROJECT**	**SUBBASIN SWMP PROJECT PREDECESSOR**	**CURRENTLY FUNDED PLANNING HORIZON I PROJECTS (2005-2015) w/ FUNDED OR PROPOSED CONSTRUCTION DATE**	**REMAINING PLANNING HORIZON I PROJECTS (2005 - 2015)**	**PLANNING HORIZON II PROJECTS (2015 - 2025)**	**PLANNING HORIZON III PROJECTS (Beyond 2025)**	**FEASIBLE ALTERNATIVES / INTERIM SOLUTIONS**
PHASE I	A7	$108,000	South 48" Percolation Basin	None			Extended Parking west of Meadows, Meadow Road		
	A6	$326,000	South 48" Percolation Basin	None		Meadow Road Parking at General Jim Moore Blvd.			Provide basin/discharge area provided for Veterans Hospital to reduce size of basin A6.
	A5	No Improvements Planned	South 48" Percolation Basin	None					
	A4	$7,000	South 48" Percolation Basin	None					
	A3	$945,000	South 48" Percolation Basin	None	West Campus Recreation Complex (2006 funded)	West Campus Recreation Complex			
	A1	$76,000	South 48" Percolation Basin	None		Pavement Removal			Negotiate temporary drainage easement with City of Seaside to continue use of south 48" percolation basin system.
	B3	$27,000	North 48" Percolation Basin	None		2nd Ave. & 3rd St. Parking	Office & Academic Bldg at 3rd Ave.		
	B1	Project Cost Provided by CSUMB North Campus Housing Project	54" Percolation Basin	None	North Campus Housing (2006-2008)				Negotiate temporary drainage easement with City of Marina / Marina Community Partners to continue use of 54" percolation basin system. Remove excess asphalt to reduce impervious area & provide temporary on-site percolation basins with swales (~$4.7 M).
	C9, City of Seaside	$842,000	South 48" Percolation Basin	None					
	C7	$438,000	South 48" Percolation Basin	None	6th Ave. Mall (2005-2006)	6th & 7th Ave. Student Residential & Academic Bldgs	Student Housing 6th Ave. & Butler St., Parking		Size A8 system to accept C7 runoff.
	C5	$577,000	South 48" Percolation Basin	None	6th Ave. Mall (2005-2006)	6th & 7th Ave. Student Residential & Academic Bldgs, Parking lots		Residence Halls, Demolition of Buildings	Size C3 & C2 systems to accept C5 runoff.
	C4	$491,000	Marina Percolation Basin at 8th St.	None	6th Ave. Mall (2005-2006)	6th & 7th Ave. Student Residential & Academic Bldgs, Parking lots		Residence Halls	Size C3 & C2 systems to accept C4 runoff.
	C1	$204,000	Marina Percolation Basin at 8th St.	None		North Campus Housing, North Quad Expansion, 5th St. Entrance.			Negotiate continued use of City of Marina percolation basin indefinitely.
PHASE I -CONT-	Army D9	$37,000	County of Monterey Open Space North of Intergarrision Road	None					Size C7 system to accept D9 runoff.
	Army D8	$82,000	County of Monterey Open Space North of Intergarrision Road	None					Size C7 system to accept D8 runoff.
	D7	$7,000	County of Monterey Open Space North of Intergarrision Road	None		Pavement & Building Removal			
	D6	$785,000	County of Monterey Open Space North of Intergarrision Road	None		Pavement & Building Removal			
	D5	$128,000	County of Monterey Open Space North of Intergarrision Road	None		Pavement & Building Removal			

TABLE 5-1: CAPITAL IMPROVEMENT COSTS AND IMPLEMENTATION GUIDE

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					CSUMB MASTER PLAN UPDATE SCHEDULE				
STORMWATER MASTER PLAN PROJECT PHASE	**SUBBASIN SWMP PROJECT**	**ESTIMATED PROJECT COSTS* ($)**	**OFFSITE SYSTEM DISCHARGE REDUCED BY PROJECT**	**SUBBASIN SWMP PROJECT PREDECESSOR**	**CURRENTLY FUNDED PLANNING HORIZON I PROJECTS (2005-2015) w/ FUNDED OR PROPOSED CONSTRUCTION DATE**	**REMAINING PLANNING HORIZON I PROJECTS (2005 - 2015)**	**PLANNING HORIZON II PROJECTS (2015 - 2025)**	**PLANNING HORIZON III PROJECTS (Beyond 2025)**	**FEASIBLE ALTERNATIVES / INTERIM SOLUTIONS**
	D4	$308,000	Existing Percolation Basin.	None		Batch Plant			
	D3	$1,067,000	County of Monterey Open Space North of Intergarrision Road	None		A Street Extension, Pavement & Building Removal			
	EC1	$520,000		None					
	EC2	No Improvements Planned		None					
	EC3	No Improvements Planned		None					
	EC4	No Improvements Planned		None					
	EC5	No Improvements Planned		None					
	EC6	No Improvements Planned		None					
	EC7	$323,000		None					
	EC8	$323,000		None					
	EC9	$323,000		None					
	EC10	$323,000		None					
	EC11	$323,000		None					
PHASE II	C8	$119,000	South 48" Percolation Basin	Offsite C9, a non-CSUMB project	6th Ave. Mall (2005-2006),	6th & 7th Ave. Student Residential & Academic Bldgs, Parking lots			Size A8 system to accept C9 & C8 existing runoff.
	C6	$574,000	South 48" Percolation Basin	D5, D6, D7, D8, D9	7th Ave. Mall (2005-2006)	7th & 7th Ave. Student Residential & Academic Bldgs		Demolition of Buildings	Size C3 & C2 systems to accept C6 runoff.
	D2	$148,000	County of Monterey Open Space North of Intergarrision Road	D3					
	D1	$1,287,000	County of Monterey Open Space North of Intergarrision Road	D3, D5, D6, D7					Basin D1 maybe built as an underground retention facility to maximize parking space.
PHASE III	A8	$233,000	South 48" Percolation Basin	City of Seaside diversion of 6th Ave. discharge, C8, C9	6th Ave. Mall (2005-2006)	Tech Center	Student Housing 6th Ave. & Butler St.		Design system to accept existing City of Seaside runoff.
	B4	$1,117,000	North 48" Percolation Basin, City of Marina Percolation	A8, C3, C5, C6, C7, C8, C9	Co-gen Plant (2006 funded)	1st Street Mall, Academic Bldgs, Student Services & Union		Research Institute	Upstream basins along General Jim Moore Blvd. would allow basin B4 to be reduced. Provide basin/discharge area provided for Veterans Hospital to reduce size of basin B4 and upstream basins.
	B2	$320,000	North 48" Percolation Basin	C2, C3, C4	North Campus Housing (2006-2008)	North Campus Housing			Negotiate temporary drainage easement with City of Marina / Marina Community Partners to continue use of north 48" percolation basin system. A temporary storm drain by-pass could be installed to eliminate the impact to North Campus Housing to allow the Planning Horizon I housing project to be fully implemented.

TABLE 5-1: CAPITAL IMPROVEMENT COSTS AND IMPLEMENTATION GUIDE

CALIFORNIA STATE UNIVERSITY MONTEREY BAY
STORMWATER MASTER PLAN
20-CITY ENR CONSTRUCTION COST INDEX FOR AUGUST 2005 = 7478.51

					CSUMB MASTER PLAN UPDATE SCHEDULE				
STORMWATER MASTER PLAN PROJECT PHASE	**SUBBASIN SWMP PROJECT**	**ESTIMATED PROJECT COSTS* ($)**	**OFFSITE SYSTEM DISCHARGE REDUCED BY PROJECT**	**SUBBASIN SWMP PROJECT PREDECESSOR**	**CURRENTLY FUNDED PLANNING HORIZON I PROJECTS (2005-2015) w/ FUNDED OR PROPOSED CONSTRUCTION DATE**	**REMAINING PLANNING HORIZON I PROJECTS (2005 - 2015)**	**PLANNING HORIZON II PROJECTS (2015 - 2025)**	**PLANNING HORIZON III PROJECTS (Beyond 2025)**	**FEASIBLE ALTERNATIVES / INTERIM SOLUTIONS**
	C3	$655,000	Marina Percolation Pond at 8th St.	A8, C5, C6, C7, C8, C9	8th Ave. Mall (2005-2006)	8th & 7th Ave. Student Residential & Academic Bldgs, Parking lots	6th Ave. Academic Building		Size C2 system to accept C3 runoff.
	8th Ave.	$64,000	County of Monterey Open Space North of Intergarrision Road	D1, D2, D4					
PHASE IV	A2	$1,005,000	South 48" Percolation Basin	A3, A6, B4, C3, C5, C6, C7, C8, C9	West Campus Recreation Complex (2006 funded)	West Campus Recreation Complex	West Campus Recreation Complex	West Campus Recreation Complex	Negotiate temporary drainage easement with City of Seaside to continue use of south 48" percolation basin system. Basin A2 maybe built as an underground retention facility to maximize parking space.
	C2	$1,010,000	Marina Percolation Basin at 8th St.	C3, C4		Renovation of Bldg. 12, 5th St. Entrance		Parking Structures	Basin C2 maybe built as an underground retention facility to maximize useable space.

* This master plan level estimate of construction cost is a professional opinion, based upon the engineer's experience with the design and construction of similar projects. It is prepared only as a guide, and is based upon incomplete information. The estimate is subject to change. Schaaf & Wheeler makes no warrranty, whether expressed or implied, that the actual costs will not vary from these estimated costs, and assumes no liability for such variances. This estimate specifically excludes any costs associated with designing for, handling and dispoal of hazardous wastes, contaminated materials, and/or unexploded ordnance. Costs associated with land, right-of-way, or easement purchase were purposely excluded as all projects are within the CSUMB property boundary.

CHAPTER 6: LANDSCAPE AND MAINTENANCE RECOMMENDATIONS

RECOMMENDED GUIDELINES FOR MAINTENANCE OF PERCOLATION BASINS AND OTHER FACILITIES

The performance and maintenance requirements for percolation facilities are directly related to the sediment load of the influent water. If water is excessively turbid, rapid plugging of the sediments can occur and permeability can be reduced by orders of magnitude. Sediment suspended in runoff can be significantly reduced by use of flow-based settling facilities such as mechanical oil/sand separators or vegetative swales. Such facilities are recommended in the master plan. Sediment cannot be completely eliminated and will accumulate in the percolation basins, requiring periodic maintenance in the form of scraping the sediment from the bottom and sides of the percolation facility. The influent water quality should be assessed by collection of samples from the existing drainage system. Samples should be collected from influent conveyances at the beginning and end of the rainfall season. Samples should be collected at the most downstream sampling locations. Collected samples should be analyzed for suspended solids, oil, and grease, at a minimum.

Basin and Swale Landscaping and Maintenance

Percolation rates have the potential to decrease below minimally acceptable values unless proper maintenance and landscaping criteria are followed. It is imperative that no topsoil be placed in the percolation basins or in areas with a propensity to erode into the basins. Vegetation typical of the dunes environment can be allowed within the basins as long as excessive organic material is removed before it has an opportunity to decay into fine material that could clog the percolation surface.

Percolation rates can be expected to decrease over time, unless facility maintenance is performed. Annual maintenance should include debris and trash removal. The surface of the facility should be monitored for signs of accumulated silt that can form a shell over sands and could dramatically affect percolation rates. Materials that could potentially clog the surface must be removed to allow runoff to be in direct contact with clean sand. It is recommended that percolation testing be performed at least once every five years on the undisturbed bottom of each basin to determine if the design percolation rates are being maintained.

Stormdrain Maintenance

Road Maintenance

The sandy soils around CSUMB drift into the roads and parking lots due to wind and ground squirrels and eventually make their way to the stormdrains. Trash, grease and sediment from work areas and rooftops can contribute to stormdrain and percolation deficiencies. Some inlets to the former Fort Ord stormdrain system are filled with sands and silts rendering them inoperable. CSUMB should incorporate the following practices into the campus maintenance program:

- Street and parking lot cleaning at regular intervals to reduce sediment build-up and deposition to the stormdrain systems,

- Annual inspection and cleaning of drainage inlets before the rain season begins,
- Implementation of source control best management practices (BMPs) for maintaining work, fueling, trash, and vehicle wash areas to reduce grease and sediment loading,
- Roof runoff controls to settle sediments before they can enter the stormdrain inlets,
- Vegetating open ground, and
- Plating appropriate native vegetation in and on the perimeters of the percolation basins.

Continued road maintenance will reduce the cost and potential flooding hazards associated with plugged stormdrain collection systems.

Collection System Maintenance

The stormdrain system cannot function if one of its components is plugged. Even when hydraulic analysis say criteria are met, blocked inlets or pipes will cause flooding – potentially with serious consequences. Even the most rigorous maintenance programs cannot prevent all problems during every event; still, it is important that debris does not accumulate.

All storm pipes being reused should be cleaned before they are connected to the proposed systems herein. Initial and continued maintenance techniques may include grate cleaning, inlet flushing, pipe flushing (hydrojetting), balls and mandrels for cleaning, vactoring, and physically entering storm pipes to remove accumulated debris by hand.

ANNUAL OPERATION MAINTENANCE COSTS

To establish an annual operation and maintenance budget for stormwater facilities it is recommended that 3% of the non-pavement removal portion of the projected SWMP capital improvement costs be used – about $10 million dollars. This would provide about $300,000 annually to operate and maintain the SWMP percolation basins and associated stormdrain piping, water treatment devices and landscaping. There will be a 5- to 10-year transition period while pavement is removed and the present CSUMB stormwater facilities, dominated by pipelines, are replaced with onsite percolation basins. Considerable fluctuation in annual operation and maintenance costs makes necessary the establishment of a reserve fund to cover major repair costs such as cleanup and repair after a storm. The 3% of capital improvement costs should be indexed to a standard such as the Engineering News Record Construction Cost Index to allow an annual review and adjustment.

RECOMMENDED LANDSCAPE GUIDELINES FOR INCREASING SOIL POROSITY AND DECREASING OVERLAND FLOW

Landscape guidelines are provided in Appendix H. Application of the specifications are for campus landscaping where lawns and native grasses, plants, and shrubs are used to implement the Planting Palette for the Master Plan Update while maintaining acceptable porosities. However, they are not intended for use on percolation basins and other primary drainage facilities. Pervious paving products are gaining acceptance for low-impact development, by decreasing runoff for storms. However, they are the first surface to collect the “first flush” of a storm and therefore are prone to clogging. CSUMB should prepare a maintenance and replacement program wherever they are used.