SAN DIEGO COUNTY REGIONAL AIRPORT AUTHORITY **STAFF REPORT**	**ITEM NO.** **7**
SUBJECT: **CONSISTENCY DETERMINATION – OCEANSIDE MUNICIPAL AIRPORT - AIRPORT LAND USE COMPATIBILITY PLAN - CONSTRUCTION OF A REGIONAL SHOPPING CENTER, "PAVILION AT OCEANSIDE," AT MISSION AVENUE AND FOUSSAT ROAD, CITY OF OCEANSIDE**	**MEETING DATE:** **APRIL 5, 2007**

RECOMMENDATION:

Staff recommends that the Board, acting in its capacity as the Airport Land Use Commission (ALUC) for the County of San Diego, adopt Resolution No. 2007-0031 ALUC, making a determination that the proposed project: Construction of a Regional Shopping Center, "Pavilion at Oceanside," at Mission Avenue and Foussat Road, City of Oceanside, is **conditionally consistent** with the Oceanside Municipal Airport Land Use Compatibility Plan (ALUCP).

COMMITTEE DISCUSSION:

Requests for ALUC consistency determinations are presented directly to the ALUC.

BACKGROUND:

The ALUC is responsible for preserving the operational capacity of airports and minimizing the public's exposure to excessive noise and safety hazards within the areas around public and military airports, per California Public Utilities Code §21675. This function is accomplished by reviewing land use projects and actions located within an Airport Influence Area (AIA) for compliance with the land use compatibility criteria and policies set forth in the ALUCP for that airport and making determinations about the project's consistency with that ALUCP.

JUSTIFICATION:

To assist the Board in making a determination of consistency, this report: (1) describes the proposed project and (2) analyzes its consistency with the Oceanside Municipal ALUCP.

1. Proposed Project: Construction of a Regional Shopping Center, "Pavilion at Oceanside," at Mission Avenue and Foussat Road, City of Oceanside

The Oceanside Municipal ALUCP was adopted originally in 1981 and amended in October 2004. The Oceanside ALUCP provides a land use plan for the environs surrounding the Oceanside Municipal Airport based upon noise contour maps and flight activity zones (FAZ). In addition, the ALUCP describes the actions necessary to help ensure compatible land use planning surrounding Oceanside Municipal Airport.

On November 13, 2006, the Airport Authority received an application from the City of Oceanside requesting a determination of consistency for a proposed project at Mission Avenue and Foussat Road in the City of Oceanside. The project is located within the AIA and partially within the FAZ for Oceanside Airport. The application was deemed complete on November 28, 2006. On January 4, 2007 the applicant requested that the determination by the ALUC be deferred while the project was redesigned. The revised plans were received January 25, 2007. A map showing the location of the proposed project within the 60-70 decibel (dB) Community Noise Equivalent Level (CNEL) noise contours and partially within the FAZ is provided as Attachment 1.

Description of Project. Based on the plans submitted to the ALUC, the proposed project, the "Pavilion at Oceanside," involves the demolition of an outdoor theater facility, and the construction of a regional shopping center on that property and adjoining vacant property. The developer proposes approximately ten groupings of commercial buildings, to include retail sales stores and restaurants, and a movie theater. The total square footage of commercial space will be approximately 917,000 square feet. The parcel size is approximately 88.25 acres. Buildings will range in height from 23 to 46 feet.

Noise Contours. The Oceanside ALUCP provides projected noise contours that are important for determining the compatibility of land uses around the airport. The proposed project is located within the 60-70 dB CNEL noise contours and borders the 65-70 dB CNEL noise contours of Oceanside Municipal Airport. The Oceanside ALUCP identifies commercial retail, including shopping centers and movie theaters, located within the 60-70 dB CNEL noise contours as compatible with airport uses.

Height and Safety. The Oceanside ALUCP establishes land use restrictions in FAZs to preclude incompatible development from intruding into areas of significant risk resulting from aircraft takeoff, landing and pattern operations. For purposes of the Oceanside ALUCP the FAZ corresponds to the airport's "runway protection zone" as promulgated by Federal Aviation Regulations Part 77 (Obstruction Hazards) and Part 152 (Runway Protection Zones). Because the proposed project is located partially within the Oceanside Airport FAZ, there are potential safety issues with respect to the proposed project. Based on the plans submitted to the ALUC, the developer proposes to locate all buildings outside the FAZ and to restrict the height of proposed buildings outside the FAZ to less than 50 feet in height.

The proposed project has been identified by the State Department of Transportation (Caltrans), Division of Aeronautics, as appearing to be located partially within the approach and departure, inner turning, and traffic pattern zones. The California Airport Land Use Planning Handbook, published by Caltrans, recommends that uses in the approach and departure, inner turning, and traffic pattern zones be limited to low density uses. The project proposes that the areas within these flight activity zones will be restricted to vehicle parking.

Ownership. The property is owned by John M. and Robert C. Siegel of Oceanside; the applicant for the project is Thomas Enterprises, represented by Mel Kuhnel of San Diego; the architect is Wakefield Beasley & Associates of Norcross GA; and the planner is Lightfoot Planning Group of Carlsbad.

2. Recommendation of a Conditionally Consistent Determination

Based upon review of the materials submitted in connection with the proposed project and of the policies provided in the Oceanside Municipal ALUCP, staff recommends that the Board makes a determination that the project is **conditionally consistent** with the Oceanside Municipal ALUCP based on the following facts and findings:

(1) The proposed project involves the construction of a regional shopping center, "Pavilion at Oceanside," at Mission Avenue and Foussat Road, City of Oceanside. The proposed project is located within the 60-70 dB CNEL noise contours and partially within the FAZ for Oceanside Municipal Airport.

(2) The Oceanside ALUCP identifies commercial retail uses located within the 60-70 dB CNEL noise contours as compatible with airport uses.

(3) The Oceanside ALUCP identifies land use restrictions for property located within the FAZs. Therefore, as a condition of project approval, no structures may be constructed within the FAZ; and any changes to the proposed location, intensity or height of structures within the project must be submitted to the ALUC for a re-evaluation of the project's consistency with the Oceanside ALUCP.

(4) If the proposed project contains the above-required conditions, the proposed project would be consistent with the adopted Oceanside ALUCP.

FISCAL IMPACT: There is no fiscal impact.
ENVIRONMENTAL REVIEW: A. This Board action is not a project that would have a significant effect on the environment as defined by the California Environmental Quality Act (CEQA), as amended. 14 Cal. Code Regs. Section 15378. This Board action is not a "project" subject to CEQA. Pub. Res. Code Section 21065. B. California Coastal Act Review: This Board action is not a "development' as defined by the California Coastal Act Pub. Res. Code Section 30106.
EQUAL OPPORTUNITY PROGRAM: Not applicable.
PREPARED BY: ANGELA SHAFER-PAYNE VICE PRESIDENT, STRATEGIC PLANNING

Attachment 1
Consistency Determination
Mission Avenue and Foussat Road, San Diego

Responsibility

The Airport Land Use Commission's (ALUC) responsibility is to respond to a request for a consistency determination on the proposed project.

Issue

Is the proposed project consistent with the adopted Oceanside Airport Land Use Compatibility Plan (ALUCP)?

Proposed Project

The proposed project involves the construction of a regional shopping center on a 88.25 acre parcel located within the 60-70 dB CNEL noise contours for the Oceanside ALUCP, and partially within the Flight Activity Zone (FAZ) .

Recommendation

The ALUC should determine that the proposed project is **conditionally consistent** with the adopted Oceanside ALUCP because it identifies commercial retail uses within the 60-70 dB CNEL noise contours as compatible; with the condition that no structures could be constructed in the FAZ.

Project Location

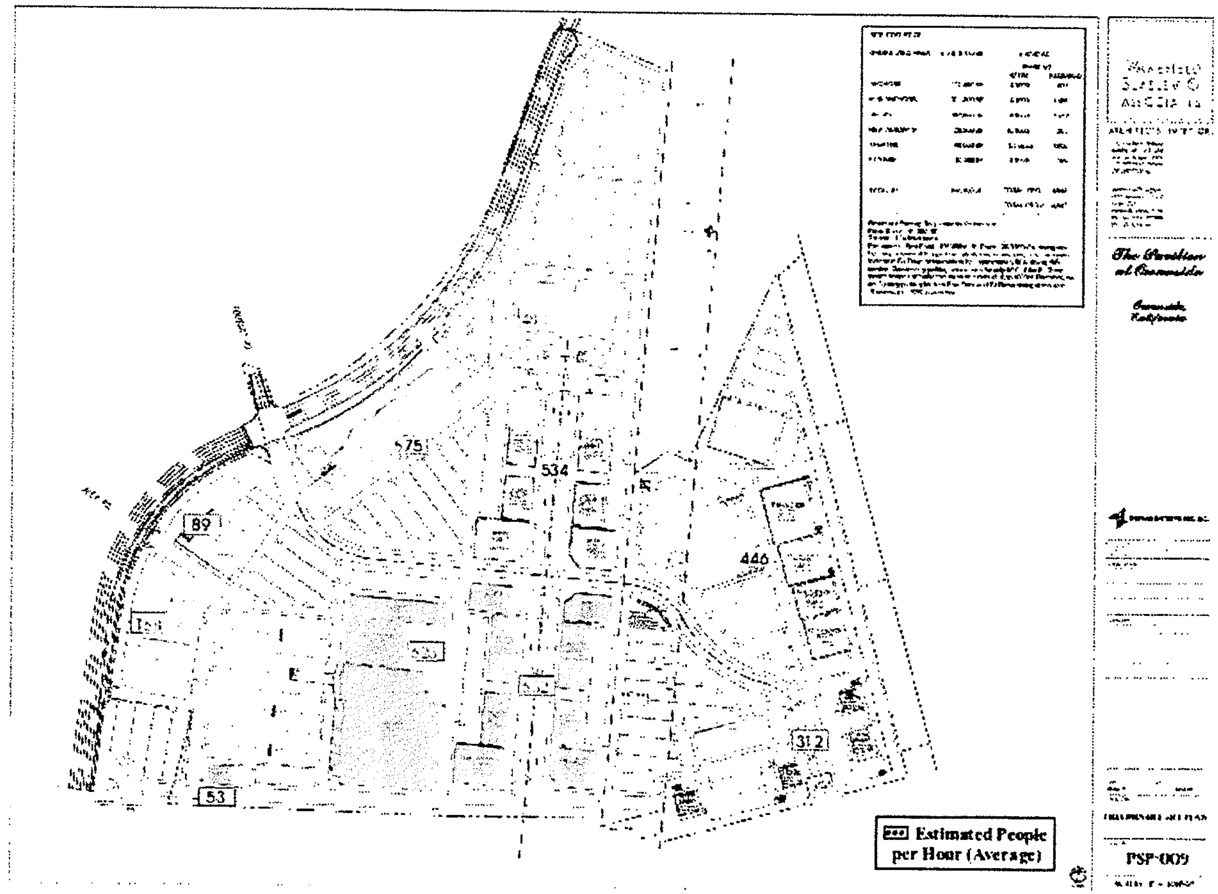
Mission Avenue and Foussat Road, San Diego

The Pavillion at Oceanside

0 750 1,500 Feet

Site Plan

Mission Avenue and Foussat Road, San Diego



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RESOLUTION NO. 2007-0031 ALUC

A RESOLUTION OF THE BOARD OF THE SAN DIEGO COUNTY REGIONAL AIRPORT AUTHORITY MAKING A DETERMINATION THAT THE PROPOSED PROJECT: CONSTRUCTION OF A REGIONAL SHOPPING CENTER, "PAVILION AT OCEANSIDE," AT MISSION AVENUE AND FOUSSAT ROAD, CITY OF OCEANSIDE, IS CONDITIONALLY CONSISTENT WITH THE OCEANSIDE MUNICIPAL AIRPORT LAND USE COMPATIBILITY PLAN.

WHEREAS, the Board of the San Diego County Airport Authority, acting in its capacity as the Airport Land Use Commission (ALUC) for San Diego County, was requested by the City of Oceanside to determine the consistency of a proposed development project: Construction of a Regional Shopping Center, "Pavilion at Oceanside," at Mission Avenue and Foussat Road, City of Oceanside, which is located within the Airport Influence Area (AIA) for the Oceanside Municipal Airport Land Use Compatibility Plan (ALUCP), originally adopted in 1981 and amended in October 2004; and

WHEREAS, the site plans for the proposed development indicate that the proposed project would involve the construction of a regional shopping center with retail stores, restaurants, and movie theater, which would be located within the 60-70 decibel (dB) Community Noise Equivalent Level (CNEL) noise contours for Oceanside Municipal Airport and partially within the Flight Activity Zone (FAZ); and

WHEREAS, the Oceanside Municipal ALUCP identifies commercial uses located within the 60-70 dB CNEL as compatible with airport uses; and

WHEREAS, the Board has considered the information provided by staff, including information in the staff report and other relevant material regarding the project; and

WHEREAS, the Board has provided an opportunity for the City of Oceanside, and interested members of the public to present information regarding this matter;

NOW THEREFORE BE IT RESOLVED, that the Board, acting as the ALUC for San Diego County, pursuant to Section 21670.3 of the Public Utilities Code, determines that the proposed project: Construction of a Regional Shopping Center, "Pavilion at Oceanside," at Mission Avenue and Foussat Road, City of Oceanside, is conditionally consistent with the Oceanside Municipal

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ALUCP, which was adopted in 1981 and amended in 2004, based upon the following facts and findings:

(1) The proposed project involves the construction of a regional shopping center, "Pavilion at Oceanside," at Mission Avenue and Foussat Road, City of Oceanside. The proposed project is located within the 60-65 dB CNEL noise contours and partially within the FAZ for Oceanside Municipal Airport.

(2) The Oceanside ALUCP identifies commercial retail uses located within the 60-70 dB CNEL noise contours as compatible with airport uses.

(3) The Oceanside ALUCP identifies land use restrictions for property located within the FAZs. Therefore, as a condition of project approval, no structures may be constructed within the FAZ; and any changes to the proposed location, intensity or height of structures within the project must be submitted to the ALUC for a re-evaluation of the project's consistency with the Oceanside ALUCP.

(4) If the proposed project contains the above-required conditions, the proposed project would be consistent with the adopted Oceanside ALUCP.

(5) This Board action is not a "project" as defined by the California Environmental Quality Act (CEQA), Pub. Res. Code Section 21065; and is not a "development" as defined by the California Coastal Act, Pub. Res. Code Section 30106.

PASSED, ADOPTED AND APPROVED by the Board of the San Diego County Regional Airport Authority at a regular meeting this 5th day of April, 2007, by the following vote:

AYES:	Board Members:	Bersin, Boland, Desmond, Finnila, Nieto, Watkins, Young, Zettel
NOES:	Board Members:	None
ABSENT:	Board Members:	Panknin

ATTEST:

TONY R. RUSSELL
DIRECTOR, CORPORATE SERVICES/
AUTHORITY CLERK

APPROVED AS TO FORM:

BRETON K. LOBNER
GENERAL COUNSEL

AVIATION SYSTEMS INC.
Aviation Consultants

November 19, 2007

Mr. Patrick O'Day
President
O'Day Consultants Inc.
2710 Loker Avenue West, Suite 100
Carlsbad, CA 92008-6603

Re: Pavilion Shopping Center, 06-O-0390.001 (Revised)

Dear Mr. O'Day:

This is in response to your request for a supplemental airspace impact analysis of the property identified as the Pavilion Shopping Center located in Oceanside, California.

We have reviewed the above referenced property site against Federal Aviation Regulation (FAR) Part 77 (14 CFR 77); FAA Order 8260.3B, the United States Standard for Terminal Instrument Procedures (TERPs), and FAA Order 7400.2E, Procedure For Handling Airspace Matters, and offer the following.

A shopping center site plan dated 10-1-07 was provided to indicate planned building locations and heights. Several points, considered indicative of potential points where FAA Obstruction criteria may be exceeded, were selected based on proximity to the Oceanside Airport Runway 28, and overall structure height. These points appear on the enclosed map.

Based on elevation provided in the Elevation Exhibit dated October 1, 2007, we have calculated the following maximum approvable heights for sixteen (16) reference points selected randomly for review.

As in the previous study, the runway 28 Departure Slope presented the primary Operational limitation. The Obstruction Standards Levels are included for those points that are below the respective proposed building heights.

Point O #1 44 feet AGL – OBS Standard-24 feet AGL
Point O #2 38 feet AGL – OBS Standard-20 feet AGL
Point O #3 37 feet AGL – OBS Standard-22 feet AGL

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Point O #4	30 feet AGL
Point O #5	39 feet AGL – OBS Standard-23 feet AGL
Point O #6	57 feet AGL – OBS Standard-33 feet AGL
Point O #7	62 feet AGL
Point O #8	52 feet AGL
Point O #9	139 feet AGL (Horizontal Surface)
Point O #10	84 feet AGL
Point O #11	79 feet AGL
Point O #12	109 feet AGL
Point O #13	135 feet AGL (Horizontal Surface)
Point O #14	138 feet AGL (Horizontal Surface)
Point O #15	28 feet AGL – OBS Standard – 12 feet AGL
Point O #16	28 feet AGL – OBS Standard – 12 feet AGL

FAA Obstruction Standard criteria which, if exceeded, would be considered by the FAA to be a Presumed Hazard requiring an extended study to determine the impact of any structure on aviation safety. To the extent that a structure in these areas does not exceed the operational limits, they may be approved.

Building points on the attached Elevation Exhibit O #4 (+10 feet) and O #5 (+1 foot) are compromised by the Departure Slope surface. The south end of the associated building (highlighted) would also exceed the Departure Slope (+2 feet).

Over all, it appears that there is a significant portion of the site plan, except for the points noted above, that will afford suitable structure locations at the heights shown on the site plan. It is also necessary that all proposed structures are kept clear of the Runway Protection Zone. This is the opinion of Aviation Systems, Inc.

Sincerely,

Jerry Chavkin

Jerold Chavkin
Vice President, Airspace Operations

Attachments

05-1115

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AVIATION SYSTEMS INC.
Aviation Consultants

Mr. Patrick O'Day
President
O'Day Consultants Inc.
2710 Loker Avenue West, Suite 100
Carlsbad, CA 92008-6600

Date: **May 10, 2005**
ASI #: **05-O-0340.001**
Site ID: **Pavilion Shopping Center**
Location: **Oceanside, CA**

Dear Mr. O'Day:

This is in response to your recent request for an airspace impact analysis of a property identified as the Pavilion Shopping Center, Oceanside. California.

We have reviewed the above referenced property site against Federal Aviation Regulation (FAR) Part 77 (14 CFR 77); FAA Order 8260.3B, the United States Standard for Terminal Instrument Procedures (TERPs), and FAA Order 7400.2E, Procedure For Handling Airspace Matters, and offer the following.

Attached are two Exhibits, A and B. Exhibit A depicts Areas A, B, and C which are derived from applying operational criteria which, if exceeded, would be considered by the FAA to constitute a Hazard to Air Navigation. Area A is a Departure Slope of 22:1 which rises from the Runway 24 elevation of 28 feet AMSL. At the nearest point of the property, any structure would be limited to 21 feet AGL. At the furthest point of the property, any structure would be limited to 138 feet AGL (may not exceed 178 feet AMSL). Area B is a 7:1 Slope which rises from the side of the Departure area and would limit any structure to less than 148 feet AGL. Area C is a Flat Surface which is within the Airport Horizontal Surface. Structures up to 178 feet AMSL could be approved.

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O'Day Consultants Inc.
May 10, 2005 – Page Two

Exhibit B depicts Areas D and E which are derived from applying FAA Obstruction Standard criteria which, if exceeded, would be considered by the FAA to be a Presumed Hazard requiring an extended study to determine the impact of any structure on aviation safety. To the extent that a structure in these areas does not exceed the operational limits, they may be approved. Area D is an Approach Slope of 34:1 which rises from the Primary Surface elevation of 28 feet AMSL. At the nearest point of the property, any structure could be limited to 16 feet AGL. At the furthest point of the property, any structure could be limited to 88 feet AGL. Area E is a 7:1 Slope which rises from the side of the Approach area and could limit any structure to less than 148 feet AGL.

To summarize, those portions of the property nearest the runway will be impacted by FAA airspace protection standards. In addition, the Airport Land Use Compatibility Plan may impose more restrictions. The shaded area depicted on Exhibit B is the airport Runway Protection Zone (RPZ). Its function is "to enhance the protection of people and property on the ground" as defined in airport design documents.

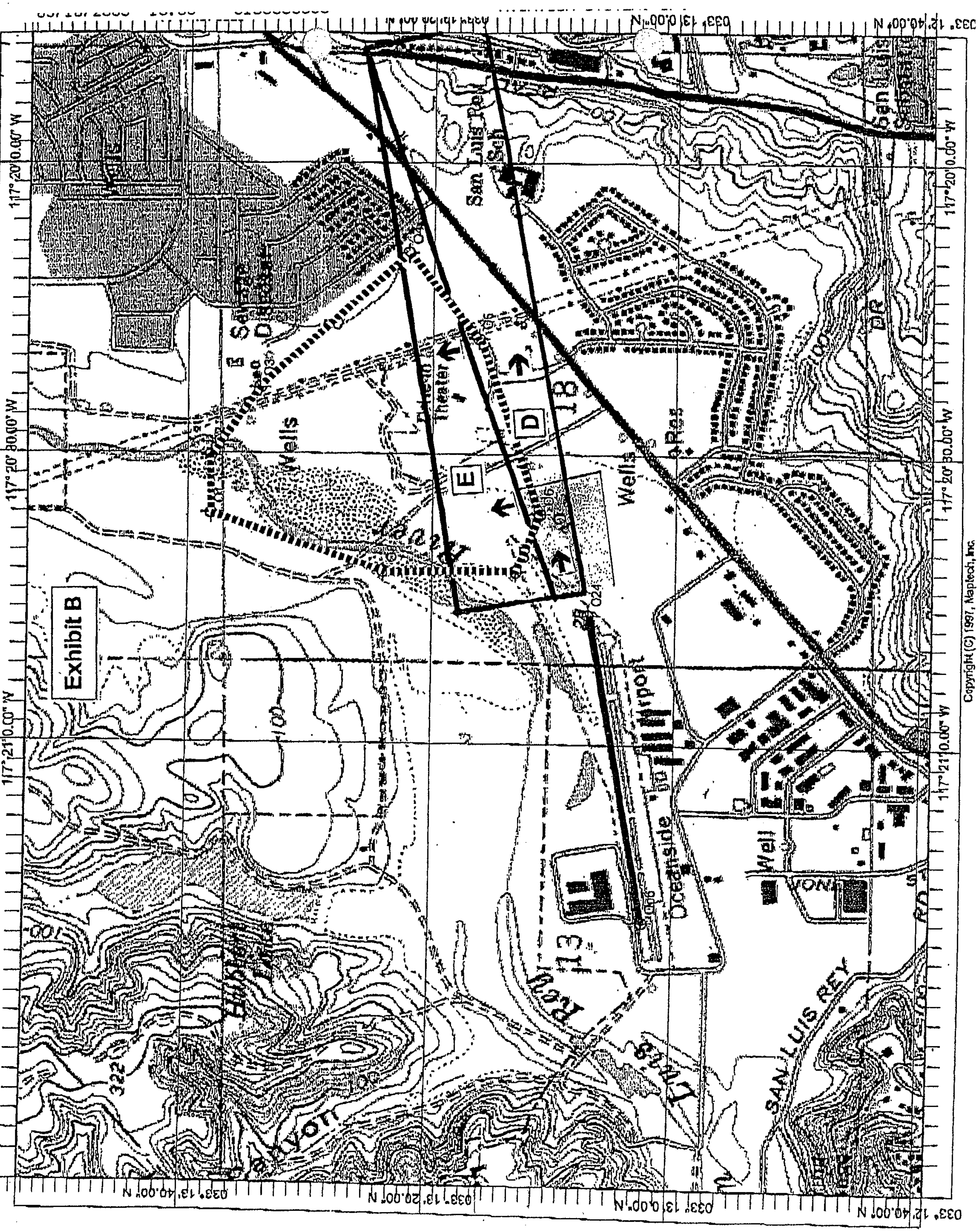
Over all, it appears that there is a significant portion of the property that might afford suitable structure locations. This is the opinion of Aviation Systems, Inc.

Sincerely,

Jerold Chavkin
Vice President
Airspace Operations

Attachments

05-1115 / 9



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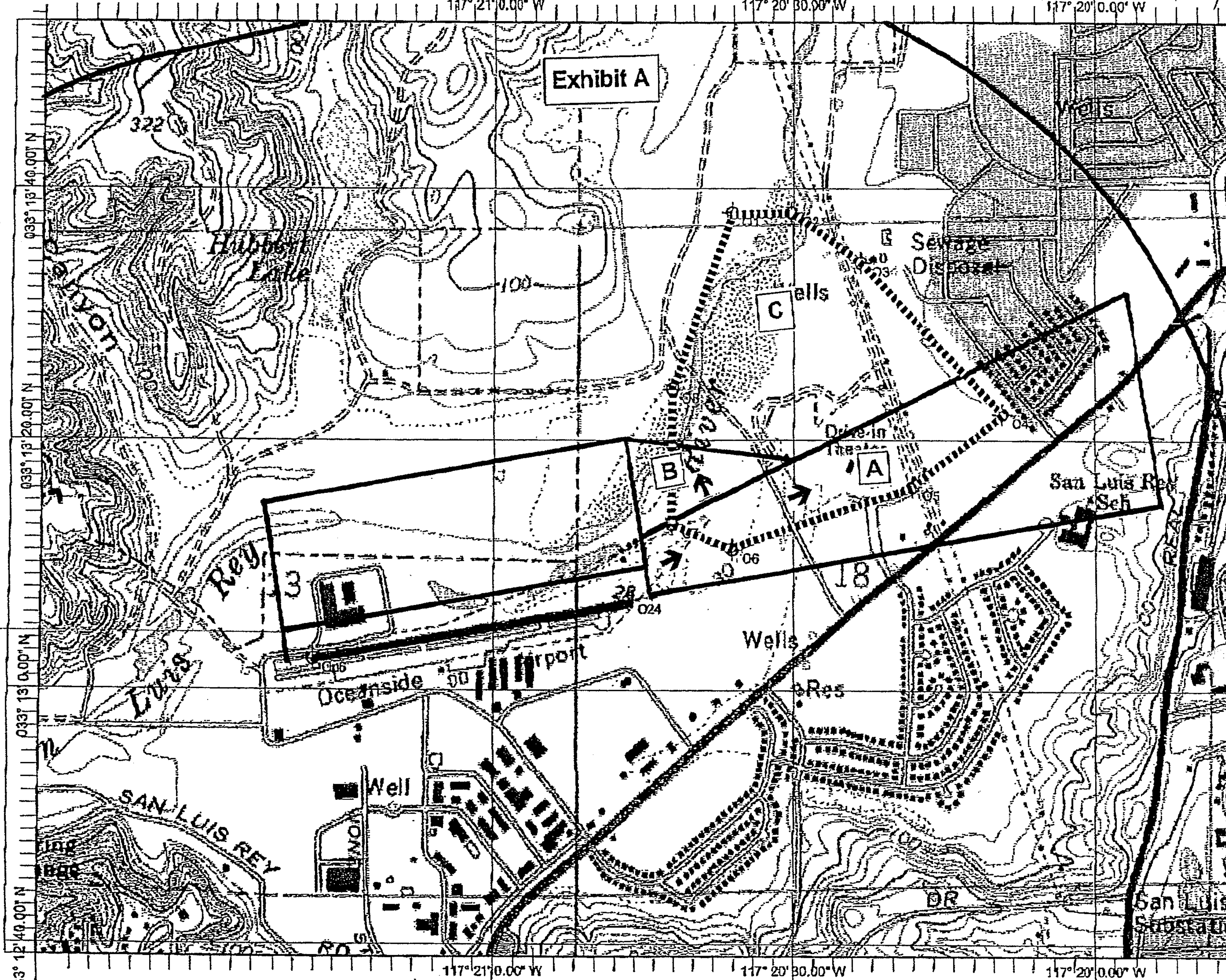
Exhibit A
117° 21' 0.00" W
117° 20' 30.00" W
117° 20' 0.00" W
033° 12' 40.00" N
033° 13' 0.00" N
033° 13' 20.00" N
033° 13' 40.00" N
A
B
C
Hubbert Lake
322
100
Sewage Disposal
Wells
Drive-in Theater
San Luis Rey Sch
Luis Rey
Oceanside Airport
Well
SAN LUIS REY
Res
DR
REAL
San Luis Substation

G. Hydrology Report and Stormwater Management Plan

HYDROLOGY REPORT

for

The Pavilion at Oceanside

City of Oceanside, California

Prepared for:

O'Day Consultants, Inc.

June 6, 2006
Revised July 18, 2006
Revised May 8, 2007
Revised August 27, 2007
Revised December 14, 2007

REGISTERED PROFESSIONAL ENGINEER
TORY R WALKER
No. 45005
Exp. 3-31-2008
CIVIL
STATE OF CALIFORNIA

Tory R. Walker, R.C.E. 45005
President

TORY R. WALKER ENGINEERING, INC.
WATER RESOURCES PLANNING & ENGINEERING

Filed w/Application
12/20/07

Table of Contents

List of Attachments

Introduction

This drainage study was prepared for the 92-acre Pavilion project, located at the existing drive-in theatres bounded by Foussat Road, Mission Avenue, San Luis Rey River, and Fireside Street in the City of Oceanside, California (See Exhibit A, Existing Conditions Hydrology Map). The future development proposes a movie theatre, commercial buildings, restaurants, and parking areas. Portions of the project will drain into Park Pond to the north, San Luis Rey River to the west, and Middle Pond to the southwest. The storm drain analysis was performed using Rational Method calculations since the total onsite drainage area is less than the 640 acre division between the Rational Method and hydrograph methods, as discussed in the San Diego County Hydrology Manual. The Advanced Engineering Software (AES) Rational Method Hydrology Computer Program Package was used for the Rational Method calculations. AES was used to route the design storm runoff from the subareas to the discharge locations. The objectives of this study were to analyze the pre-development runoff patterns, determine the runoff for the post development condition, and analyze the conveyance capacity of the proposed drainage facilities.

Additionally, preliminary hydrograph calculations were performed using U.S. Army Corps of Engineers' (USACE) HEC-HMS software. The hydrographs were used to estimate runoff volume from the site, which was used to determine the storage volume needed onsite for areas draining directly to the San Luis Rey River. This analysis is in accordance with design criteria for drainage to the San Luis Rey River, as described in the Input Parameters section.

The pre-development drainage patterns are shown on Exhibit A (Existing Condition Hydrology Map). In the pre-development condition, 20.2 acres drains to the 24-inch RCP at the low point of Foussat Road and 28.8 acres drains to the upstream end of the 60-inch RCP along Highway 76, resulting in an onsite total of 49.0 acres that drain to the Middle Pond. The tributary area to the 48-inch reinforced concrete pipe (RCP) under the San Luis Rey River Levee is 64.1 acres. The site is protected from flood flows in the San Luis Rey River by flap gates on the outlets from the Middle and Park Ponds and the 48-inch RCP. In the pre-development condition, when the San Luis Rey River is flowing at flood stage, the flap gates will be closed and onsite runoff will either be conveyed to the Middle Pond or will collect at the low points of the site until it can gravity drain to the river. In the post-developed condition, runoff will be conveyed to the Middle or Park Ponds, or detained onsite in underground systems, during high flows in the San Luis Rey River.

The tributary area analyzed for the project included approximately 24.5 acres of offsite areas adjacent to the project site (See Exhibit C). These areas will drain to the ponds and river through storm drain systems that will convey onsite runoff in the post-development condition. Offsite areas include portions of Highway 76 and Foussat Road (11.2 acres), the SDG&E property (8.3 acres), and the San Luis Rey River levee embankment (2.0 acres) and proposed Pala Road extension (2.9 acres). There are no significant offsite flows from south of Highway 76 that will flow onto the site, since offsite flows are currently directed to either the Park Pond Channel and Park Pond northeast of the site or the Middle Pond southwest of the site.

Input Parameters

Design Storms – Three design storm events were analyzed for this study, as listed below. The first two design storms are in accordance with the City of Oceanside's Drainage System Design Criteria for projects draining to the San Luis Rey River. The third design storm is standard for design of storm drain systems.

1. Onsite 10-year event coincident with the 100-year storm in the San Luis Rey River. The volume of the 10-year onsite runoff will be detained onsite or in the existing Park and Middle Ponds until the peak of the 100-year storm in the river has passed and the onsite runoff can drain through the flap gates into the river channel.
2. Onsite 100-year event to determine discharge capacity to San Luis Rey River.
3. Onsite 50-year event used for the design of the project storm drains. Storm drain sizes have been assumed in this report using open channel flow calculations.

Land Uses – General commercial development with paved roadways and parking lots.

Soil Type – Hydrologic Soil Group D assumed since project will be constructed on fill.

Runoff Coefficients – "C" values were determined based on land use and soil type, in accordance with the San Diego County Hydrology Manual.

Precipitation – San Diego County Hydrology Manual Rainfall Isopluvial Maps for the 10, 50-, and 100-year events.

Time of Concentration – Times of concentration for the initial subareas were determined using an initial time of concentration nomograph (See attached). This nomograph, which was used in the City's last Master Drainage Plan, has been accepted by the City as an alternative to the method shown in the San Diego County Hydrology Manual (2003). Travel time calculations were used to determine the times of concentration at the project discharge locations. Times of concentration at the discharge location are included with attached calculations, and basin/node locations can be seen on the attached Hydrology Map.

AES Methodology

The Advanced Engineering Software (AES) Rational Method program operates as a link-node model. In performing a link-node study, the total watershed area is divided into subareas that discharge at designated nodes, and different flow processes are used to route the flow between nodes.

The procedure for the Subarea Summation Model is as follows:

(1) Subdivide the watershed into subareas with the initial subarea being less than 10 acres in size, and subsequent subareas gradually increasing in size. Assign upstream and downstream nodal numbers to each subarea to correlate calculations to the watershed map.

(2) Estimate a T_c by using a nomograph or overland flow velocity estimation.

(3) Using T_c, determine the corresponding values of I. Then Q = C I A.

(4) Using Q, estimate the travel time between the current node and the first downstream node by using Manning's equation (open channel flow) for the channel or conduit linking the nodes.

The nodes are joined together by links, which may be street gutter flows, drainage swales, drainage ditches, pipe flow, or various channel flows. The 16 options in AES for link routing are listed below. The model allows more definition below the top code number, which is documented as a 2 digit code. For example, a Code 22 is an initial subarea analysis where the user enters the time of concentration, and a Code 52 is a open channel flow analysis using a Natural Valley nomograph.

1. Confluence analysis at node.
2. Initial subarea analysis (including time of concentration calculation).
3. Pipeflow travel time (computer estimated).
4. Pipeflow travel time (user specified).
5. Open channel travel time.
6. Street flow analysis through subarea.
7. User-specified information at node.
8. Addition of subarea runoff to main line.
9. V-gutter flow through area.
10. Copy main stream data to memory bank
11. Confluence a memory bank with the main stream memory

12. Clear a memory bank
13. Clear the main stem
14. Copy memory bank into main stem memory
15. Hydrologic data bank storage functions
16. User specified source flow at a node

The engineer enters in the pertinent nodes and then the hydrologic process. At the confluence point of two or more basins, the following procedure is used to adjust the total summation of peak flow rates to allow for differences in basin times of concentration. This adjustment is based on the assumption that each basin's hydrographs are triangular in shape.

(1). If the collection streams have the same times of concentration, then the Q values are directly summed,

$$Q_p = Q_a + Q_b;\ T_p = T_a = T_b$$

(2). If the collection streams have different times of concentration, the smaller of the tributary Q values may be adjusted as follows:

(i). The most frequent case is where the collection stream with the longer time of concentration has the larger Q. The smaller Q value is adjusted by the ratio of rainfall intensities.

$$Q_p = Q_a + Q_b\ (I_a/I_b);\ T_p = T_a$$

(ii). In some cases, the collection stream with the shorter time of concentration has the larger Q. Then the smaller Q is adjusted by a ratio of the T values.

$$Q_p = Q_b + Q_a\ (T_b/T_a);\ T_p = T_b$$

Underground storm drains are analyzed in a similar way. Flow data obtained from the surface model for inlets and collection points are input into the nodes representing those structures. Design grades and lengths are used to compute the capacity of the storm drains and to model the downstream travel times.

Hydrologic Analysis Results

The pre-development condition peak 100-year flow rate and the post-development condition peak 10-, 50-, and 100-year flow results are summarized in Tables 1 and 2. AES calculations for the 10-, 50-, and 100-year storms and the Proposed Condition Hydrology Map (Exhibit D) are attached. Pipe sizes in the AES calculations for "Code 3" routing operations were estimated by the program using open channel flow methodology, and are an approximation of the actual sizes that will be needed at the site. Detailed storm drain design will be performed in the grading plan approval phase of the project.

Table 1. Summary of Existing Condition Discharges

Subarea	Node	Description	A (ac)	Q_{100} (cfs)
10	19	Flow to Middle Pond	49.0	50.0
20	29	Flow to 48" RCP under levee	64.1	68.2

Table 2. Summary of Discharges without Detention

Subarea	Node	Description	A (ac)	Q_{10} (cfs)	Q_{50} (cfs)	Q_{100} (cfs)
100	109	Flow leaving site upstream of Caltrans 60" RCP	29.0[a]	63.6	87.3	96.9
150	115	Flow to 60" RCP upstream of Foussat Road	17.7[a]	39.9	55.0	61.0
100	119	Flow to Middle Pond	58.4	108	150	166
200	213	Flow leaving site to existing 48" RCP	28.3[b]	55.3	76.4	84.6
200	217	Flow to 48" RCP under levee	33.1	61.7	85.2	94.4
300	307	Flow to Park Pond Channel	5.9	12.8	17.8	19.7
310	319	Flow to Park Pond Channel	4.5	10.8	15.0	16.6
320	323	Flow to Park Pond Channel	0.77	1.9	2.6	2.9
500	501	Flow to Park Pond Box Culvert[c]	1.3	2.9	3.9	4.3
505	506	Flow to Park Pond Box Culver[c]	2.3	5.5	7.5	8.2
510	511	Flow to Park Pond Box Culvert[c]	2.6	5.3	7.2	8.0

Subarea	Node	Description	A (ac)	Q_{10} (cfs)	Q_{50} (cfs)	Q_{100} (cfs)
515	516	Flow to Park Pond Box Culvert[c]	1.2	2.6	3.6	3.9
520	521	Flow to Park Pond Box Culvert[c]	3.3	6.9	9.4	10.3

Notes: (a) These areas are included in the area at Node 119
(b) This area is included in the area at Node 217
(c) The culvert is a triple 8 foot x 4 foot reinforced concrete box (RCB)

Pipe-full hydraulic calculations were performed using Manning's equation to estimate the capacities of two of the existing storm drains at the project site. The storm drains that were analyzed were the 60" RCP along Highway 76 and the 48" RCP under the San Luis Rey River levee.

Table 3. Summary of Pipe-Full Hydraulics

Subarea	U/S Node	D/S Node	Diameter (in)	Slope (ft/ft)	Pipe-Full Q (cfs)	Calculated Q_{100} (cfs)	Calculated Q/ Pipe-Full Q (%)
100	115	117	60	0.0053	190	155	82%
100	117	119	60	0.0023	125	166	133%
200	214	215	48	0.0050	102	85	83%
200	215	217	48	0.0113	153	94	61%

Discussion of Results

The results in Tables 1 and 2 indicate that the proposed project will increase the peak flow rates leaving the site. The GDM analysis anticipated commercial use at this site, and the detention analysis included below will demonstrate that the downstream facilities are sufficiently sized to handle these flow increases. The results in Tables 2 and 3 indicate that the existing storm drain for Subarea 200 (the 48-inch RCP under the levee) has capacity to convey the 100-year flow to the San Luis Rey River. The existing storm drains in Subarea 100 have sufficient capacity up to the intersection of Foussat Road and Highway 76 (Node 117), and will be flowing under a pressure flow condition between this intersection and the Middle Pond (Nodes 117 and 119). The capacity of the 60-inch storm drain along Highway 76 was analyzed using the STORM software to determine the hydraulic grade line along the project site. The output from STORM and hydraulic grade line profile plot, which shows that the system has capacity to convey the 100-year flow, are attached.

The 100-year peak flow from Subareas 300 through 320 to the Park Pond Channel upstream of the double 96-inch RCPs is 39.2 cfs, and the 100-year flow from Subareas 500 through 520 is 34.7 cfs to the Park Pond Box Culvert (See Exhibits A and D). Offsite flows for these subareas were not determined for this study since the project area was anticipated as being tributary to the Park Pond (per USACE General Design Memorandum (GDM), 1983).

Preliminary Onsite Detention Analysis

A preliminary hydrograph analysis was performed using the USACE HEC-HMS software to determine the 10-year storm runoff volume from the portion of the Pavilion site draining to the San Luis Rey River through the existing 48-inch RCP under the levee. The 10-year storm was selected since it is the City's policy to evaluate this onsite condition coincident with the peak of the 100-year storm in the San Luis Rey River. This is the condition where the flood stage water surface elevation in the river will prevent the site from draining. Hydrograph calculations were not prepared for the 100-year onsite storm since it is assumed this runoff will be discharged to the river and not detained. Additionally, hydrograph calculations were not prepared for the areas draining to the Park and Middle Ponds, since these areas were anticipated as being tributary to the detention basins in the GDM. These offsite basins are discussed later in this report.

Subarea 200 is directly tributary to the San Luis Rey River through an existing 48-inch RCP. This subarea consists of 33.1 acres, which includes 20.0 acres of onsite commercial area, 4.8 acres of offsite area from the Pala Road extension, and 8.3 acres of offsite undeveloped SDG&E property. The estimated 10-year runoff volume from this subarea is 7.3 acre-feet (See attached HEC-HMS output). During a 10-year storm, assuming a coincident 100-year water surface elevation in the San Luis Rey River, runoff will collect in the storm drain system, since it will be blocked from draining by the flap-gate on the river side of the levee.

After the detention volume of the Subarea 200 storm drains is exceeded, runoff will begin to back up through the system and flow to the north through a bypass connection to the Subarea 300 storm drain (See Exhibit E). The connection will be made inside the inlet structure adjacent to the SDG&E property, north of Node 205. In this structure, the invert elevation of 33.78 feet for the pipe flowing to the Subarea 200 storm drain is 0.65 feet lower than the invert elevation of the bypass pipe flowing north. The preliminary analysis indicates that this configuration will result in ponding depths of less than 2 feet on the SDG&E property near the inlet, where the ground elevation is approximately 34.0 feet, or 0.43 feet below the bypass elevation of 34.43 feet. A ponding depth of 2 feet would inundate 3.9 acres of the SDG&E property. However, for most of the 3.9 acres the depth would be less than 1 foot. The project team has discussed the ponding issue with SDG&E staff and is awaiting approval. Providing the bypass connection will not put the SDG&E property at risk for back-flows from Park Pond. The GDM lists the design water surface elevation in Park Pond for the 100-year storm as 33.8 feet, which is below the lowest elevation on the property. Additionally, no ponding is anticipated in the onsite parking areas since the SDG&E property is at a lower elevation than the parking lots along the Subarea 200 storm drain, which allow the runoff to pond in the offsite area before ponding on the proposed parking lots.

<u>USACE GDM Area Comparison</u>

The Subarea Map in the 1987 Supplement to the 1983 USACE GDM (See Exhibit B for GDM Map) shows the basin boundary between the Park and Middle Ponds running through the Pavilion site. By transposing the boundary line to the current project topography, the onsite area anticipated as being tributary to the Park and Middle Ponds in the GDM could be determined. These onsite areas were approximately 42.3 acres to the Park Pond and 49.4 acres to the Middle Pond (See Exhibit C). The Pavilion site has been designed so that the drainage area tributary to each pond is comparable with the GDM Map. Runoff volumes from the project site will be comparable to the values anticipated in the GDM, since the proposed improvements are consistent with the site zoning.

<u>Flow Tributary to Park Pond</u>

In the proposed condition, 21.9 acres of onsite area will drain directly to Park Pond. This area includes Subareas 300, 310, 320, 500, 505, 510, 515, and 520 (See Exhibit D). The onsite area of 21.9 acres is less than the 42.3 acres of onsite area accounted for in the GDM as being tributary to the Park Pond. The area is being reduced, since Subarea 200, which has a tributary area of 33.1 acres (including 20.0 acres of onsite commercial area, 4.8 acres of offsite area from the Pala Road extension, and 8.3 acres of offsite undeveloped SDG&E property), was accounted for in the GDM as being tributary to the Park Pond, but will be conveyed directly to the San Luis Rey River through the existing 48-inch RCP under the levee. In the 10-year storm condition, assuming a coincident 100-year water surface elevation in the San Luis Rey River, a portion of the runoff from Subarea 200 will also drain to the Park Pond by backing up through the storm drain to the bypass structure north of Node 205 as discussed above. With the addition of Subarea 200, the total tributary area to the Park Pond in the post-development condition will be a maximum of 55.0 acres, consisting of 41.9 acres of onsite area and 13.1 acres of offsite area (Pala Road Extension and SDG&E Property). The total area of 55.0 acres is a 2.4 acre increase over the pre-development condition of 42.3 acres of onsite area and 10.3 acres of offsite area (total of 52.6 acres) accounted for in the GDM (See Exhibit C). The actual tributary area will be less than 55.0 acres, since some runoff will be detained in the Subarea 200 storm drains; but the maximum area has been used for these preliminary calculations.

The increase in tributary area of 2.4 acres to Park Pond over the GDM Map will be mitigated by onsite underground detention in Subarea 200. The 2.4 acre increase in area represents 7.3% of the total Subarea 200 tributary area of 33.1 acres. The required underground detention can therefore be approximated as 7.3% of the 10-year runoff volume of 7.3 acre-feet, or 0.53 acre-feet. The preliminary calculation shown in Table 3 indicates that there is 0.46 acre-feet of storage volume available in the storm drain system, based on the pipe sized determined by the AES software open-channel flow calculations for the 50-year storm.

Table 4. Subarea 200 Storm Drain Volume

Diameter (in)	Area (ft^2)	Length (ft)	Volume (ft^3)	Volume (ac-ft)
24	3.14	1225	3848	0.09
30	4.91	1675	8222	0.19
36	7.07	345	2439	0.06
42	9.62	365	3512	0.08
48	12.57	165	2073	0.05
			Total =	0.46

<u>Flow Tributary to Middle Pond</u>
In the pre-development condition, the area tributary to the Middle Pond through the Caltrans 60-inch RCP is 49.0 acres. This includes 37.8 acres of onsite area and 11.2 acres of offsite area. Exhibit A, which illustrates the existing drainage areas, indicates that 20.2 acres west of Old Foussat Road and 28.8 acres east of Old Foussat Road (the sum of these areas being 49.0 acres) currently drains to the Middle Pond. The portions of the 20.2 acres and the 28.8 acres that include the offsite area (11.2 acres) are hatched. The onsite area of 37.8 acres is less than the 49.4 acres of onsite area indicated on the GDM Map (see Exhibit C). When compared to the GDM Map, (Exhibit B) the proposed onsite area tributary to the Middle Pond through the 60-inch RCP will decrease from 49.0 acres to 46.7 acres and the offsite area will increase from 11.2 to 11.7 acres. The changes in routing result in a net decrease of 1.8 acres of tributary area when compared to the GDM Map subareas. Since the GDM anticipated ultimate build-out of the watershed, including the project site, the proposed runoff volume will therefore slightly decrease from the values anticipated in the GDM. The decrease at Middle Pond is not equal to the increase at Park Pond, since 0.6 acres of offsite area along Foussat Road will be routed to Middle Pond when the half-street improvements are constructed. This 0.6 acre area is currently tributary to the Middle Pond through the storm drain at the Alex Road intersection.

Park Pond and Middle Pond Capacities

At the City's request, current topography was prepared for both the Park Pond and Middle Pond to compare the current volumes with the volumes anticipated in the GDM. Table B-4 of the GDM summarizes anticipated storage volumes at several elevations. With this information and the current topography, stage-storage data and curves were prepared for both ponds (see attached Stage-storage data).

The current volume in Park Pond is significantly larger than anticipated in the GDM and is even larger than what is needed to accommodate the future extension of Pala Road. Our analysis of Middle Pond indicates that some silt has accumulated in the pond, but that with less than one foot of removal of silt, the current capacity will match that anticipated with the GDM.

Conclusion

The 10-, 50-, and 100-year peak discharges from the proposed development have been determined by Rational Method calculations. The results of the Rational Method 50-year storm analysis will be used when designing the storm drains for the site, and the 100-year storm analysis will be used to check building finished floor elevations against backwater on the site. Hydrograph calculations were also performed to estimate the runoff volume from Subarea 200. In the post-development condition, 33.1 acres is tributary to the existing 48-inch RCP under the levee. Runoff from this area will be detained onsite and also conveyed north to the Park Pond during times when a high water surface elevation in the San Luis Rey River does not allow the site to drain. Preliminary storm drain calculations indicate that the storm drain pipe volume will partially mitigate the runoff volume increase from the 2.4 acre increase in tributary area to the Park Pond. The preliminary analysis of the Park Pond indicates that the capacity of the Park Pond exceeds the anticipated volume in the GDM. Additionally, the area tributary to the Middle Pond will decrease by 1.8 acres from the area anticipated in the GDM.

References

1. County of San Diego Department of Public Works, Flood Control Section. San Diego County Hydrology Manual. (2003)

2. U.S. Army Engineer District, San Francisco. San Luis Rey River, Design Memorandum No. 1, Hydrology (Revised Edition). (1977)

3. U.S. Army Corps of Engineers, Los Angeles District. San Luis Rey River Basin, Phase II General Design Memorandum. (1983)

4. U.S. Army Corps of Engineers, Los Angeles District. San Luis Rey River Basin, Supplement to the Phase II General Design Memorandum. (1987)

HYDROLOGY MAPS

- Exhibit A: Existing Condition Hydrology Map
- Exhibit B: 1987 USACE GDM Subarea Map
- Exhibit C: Hydrology Map from 1987 GDM Subareas
- Exhibit D: Proposed Condition Hydrology Map
- Exhibit E: Schematic of Storm Drain Bypass
- Exhibit F: Estimated SDG&E Corridor Ponding Limits

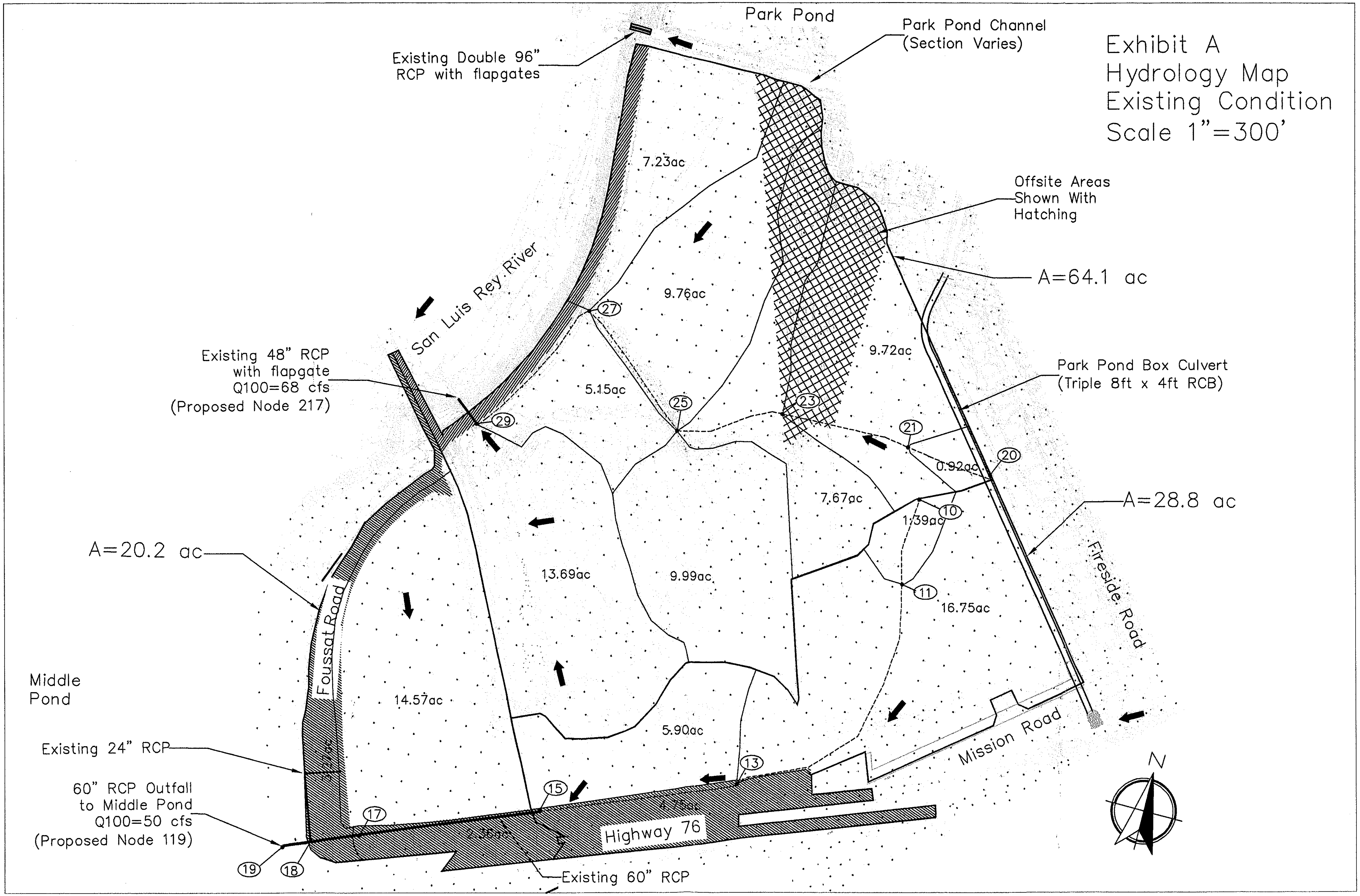
Exhibit A
Hydrology Map
Existing Condition
Scale 1"=300'
Park Pond
Park Pond Channel
(Section Varies)
Existing Double 96"
RCP with flapgates
Offsite Areas
Shown With
Hatching
A=64.1 ac
San Luis Rey River
Existing 48" RCP
with flapgate
Q100=68 cfs
(Proposed Node 217)
Park Pond Box Culvert
(Triple 8ft x 4ft RCB)
A=28.8 ac
A=20.2 ac
Fireside Road
Foussat Road
Middle
Pond
Existing 24" RCP
60" RCP Outfall
to Middle Pond
Q100=50 cfs
(Proposed Node 119)
Mission Road
Highway 76
Existing 60" RCP
7.23ac
9.76ac
9.72ac
5.15ac
0.92ac
7.67ac
1.39ac
13.69ac
9.99ac
16.75ac
14.57ac
5.90ac
27
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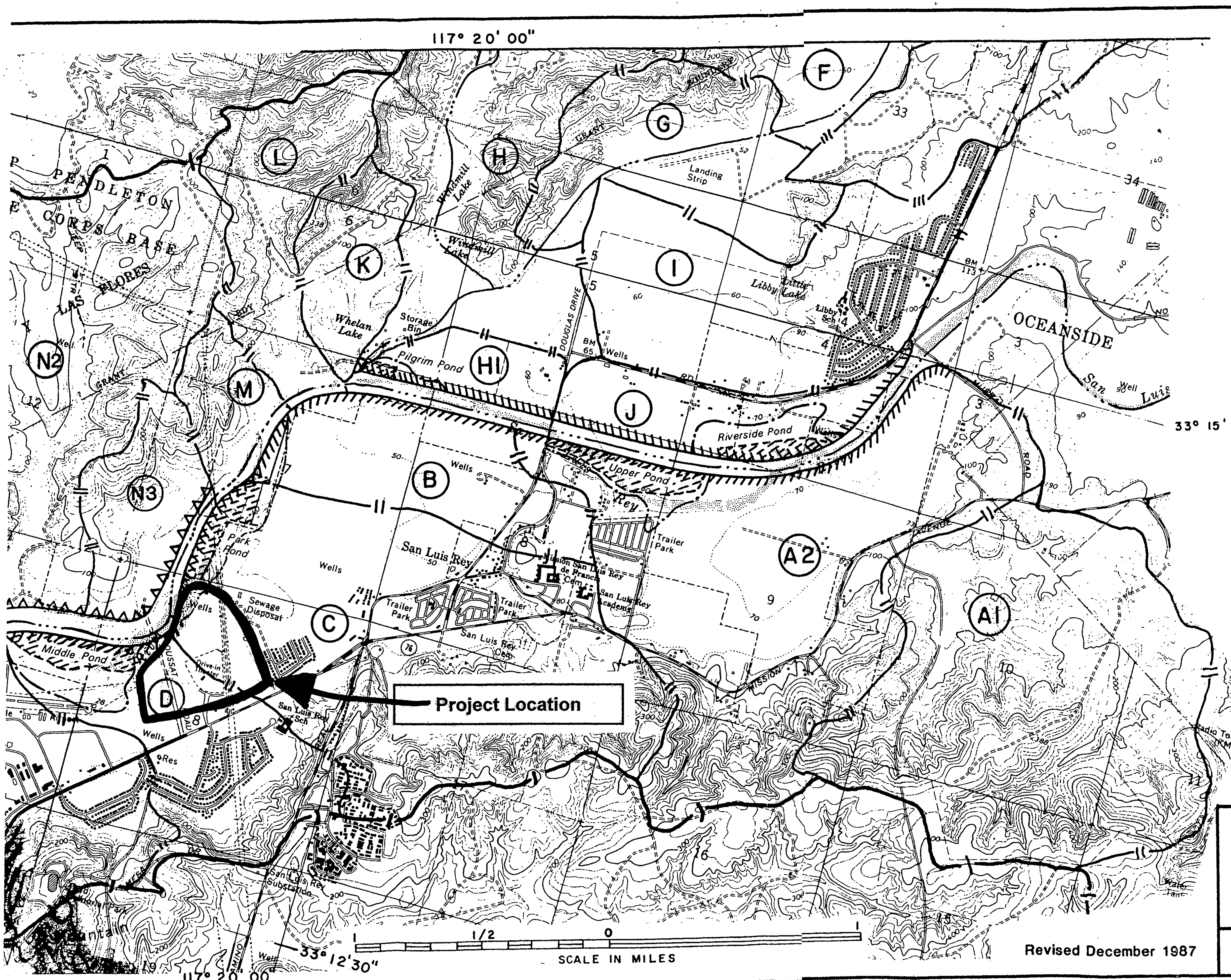
N

Exhibit B: 1987 USACE GDM Subarea Map



LEGEND

- DRAINAGE BOUNDARY
- SUBAREA DR. BOUNDARY
- NON-CONTRIBUTING AREA
- PROPOSED LEVEE
- (A) SUBAREA DESIGNATION
- PONDING AREA
- INDUCED FLOODING AREA
- PROPOSED LEVEE OR REVETMENT

NOTE: FLOOD DATA IS SHOWN ONLY AT POSSIBLE LOCATIONS OF INDUCED FLOODING OF FLOOD CONDITION III THAT COULD BE CAUSED BY PROJECT FEATURES.

SAN LUIS REY RIVER BASIN
SAN DIEGO COUNTY, CALIF.

SUBAREA MAP AND
INTERIOR DRAINAGE
RESIDUAL FLOODING
OVERFLOW MAP

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

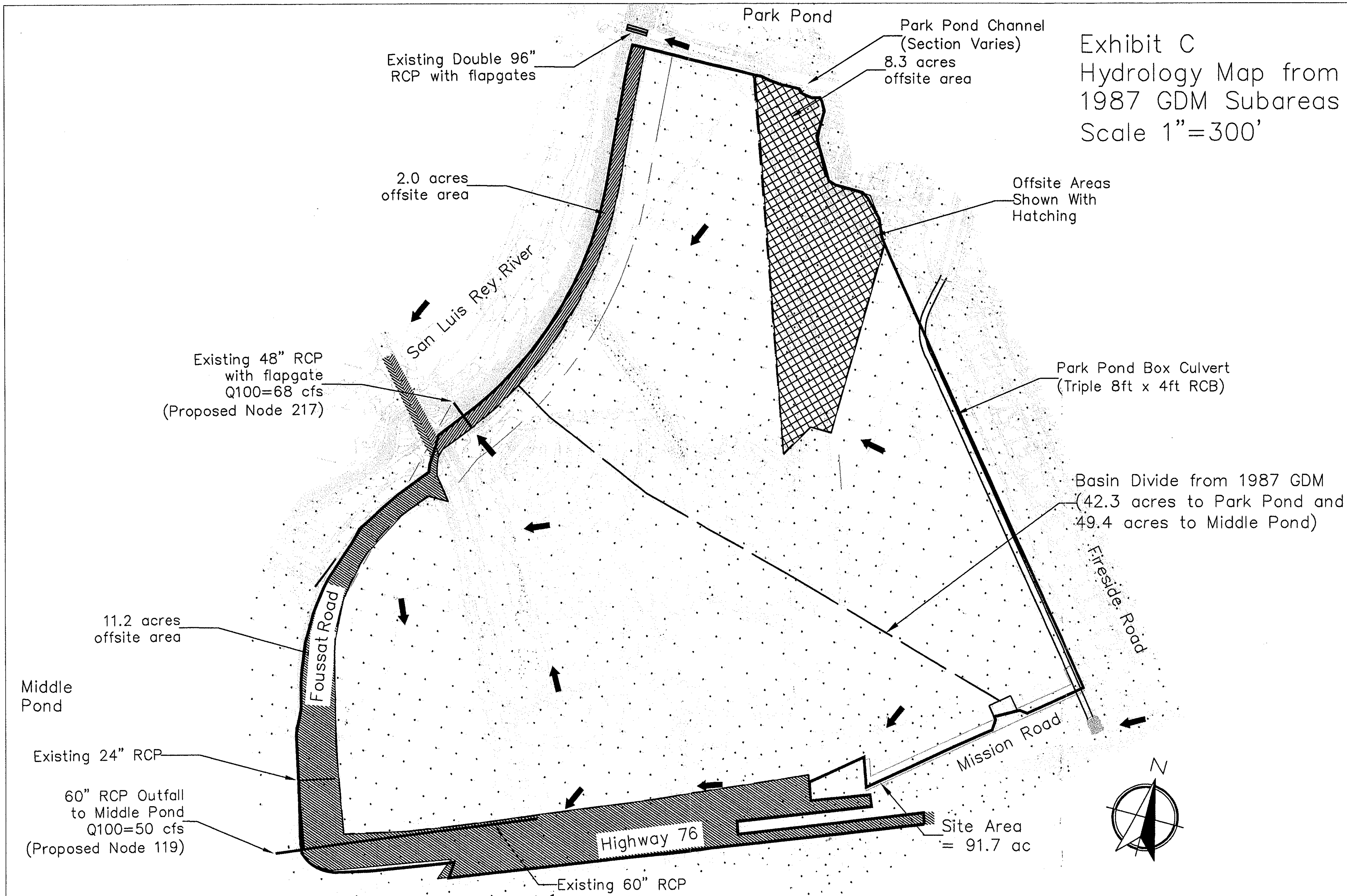


Exhibit C
Hydrology Map from
1987 GDM Subareas
Scale 1"=300'
Park Pond
Park Pond Channel
(Section Varies)
8.3 acres
offsite area
Existing Double 96"
RCP with flapgates
2.0 acres
offsite area
Offsite Areas
Shown With
Hatching
San Luis Rey River
Existing 48" RCP
with flapgate
Q100=68 cfs
(Proposed Node 217)
Park Pond Box Culvert
(Triple 8ft x 4ft RCB)
Basin Divide from 1987 GDM
(42.3 acres to Park Pond and
49.4 acres to Middle Pond)
Fireside Road
11.2 acres
offsite area
Foussat Road
Middle
Pond
Mission Road
Existing 24" RCP
60" RCP Outfall
to Middle Pond
Q100=50 cfs
(Proposed Node 119)
Highway 76
Site Area
= 91.7 ac
Existing 60" RCP
N

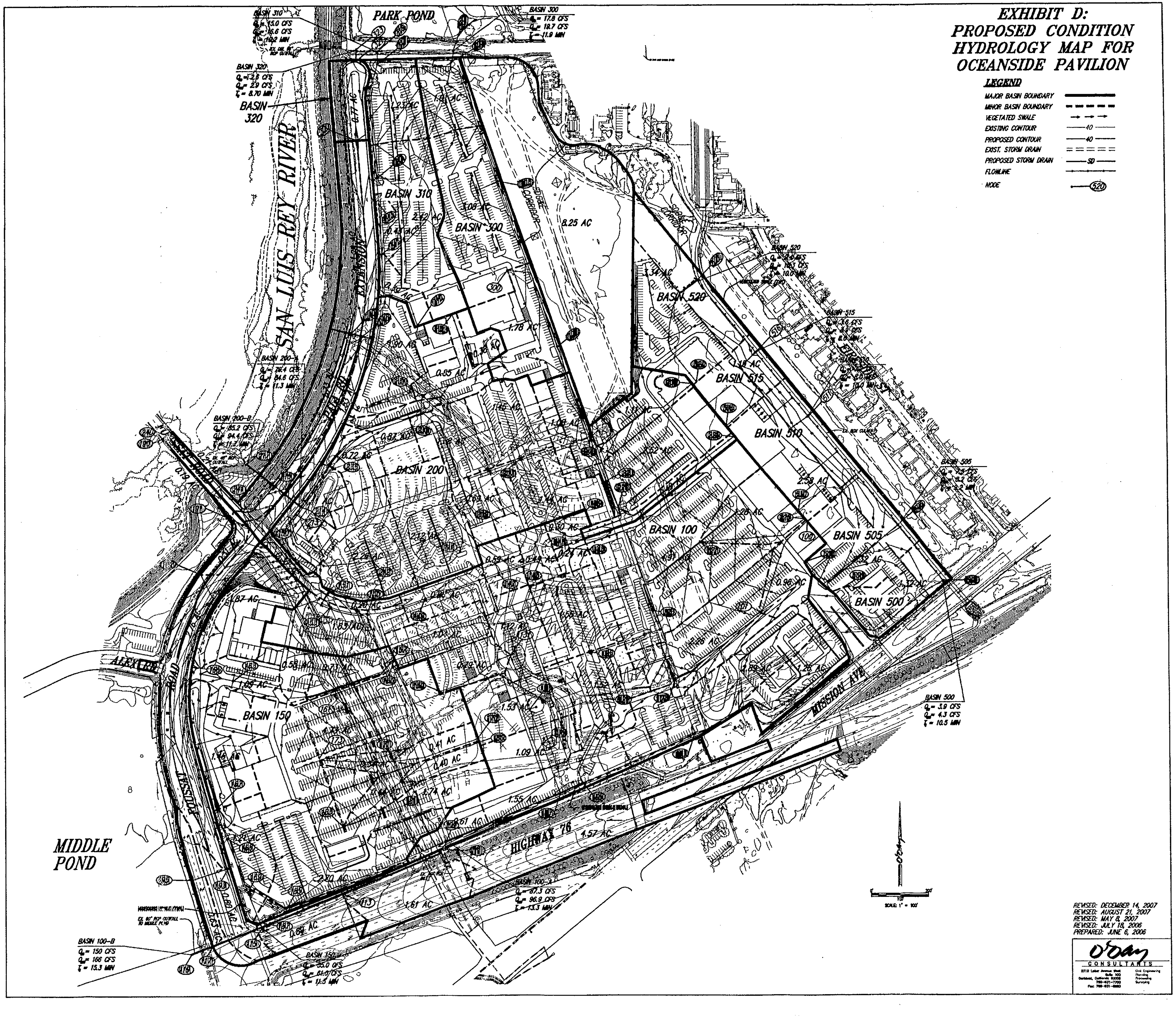
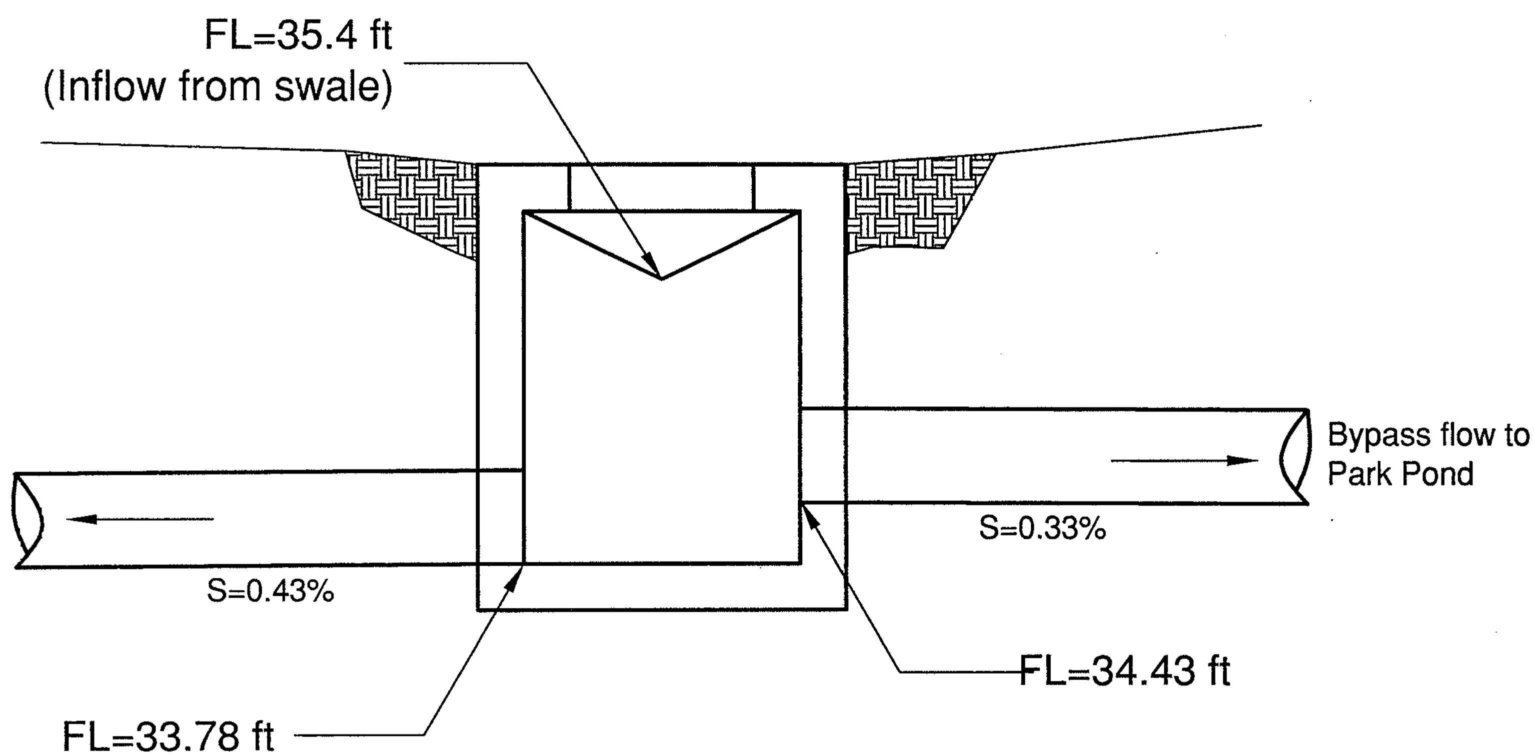


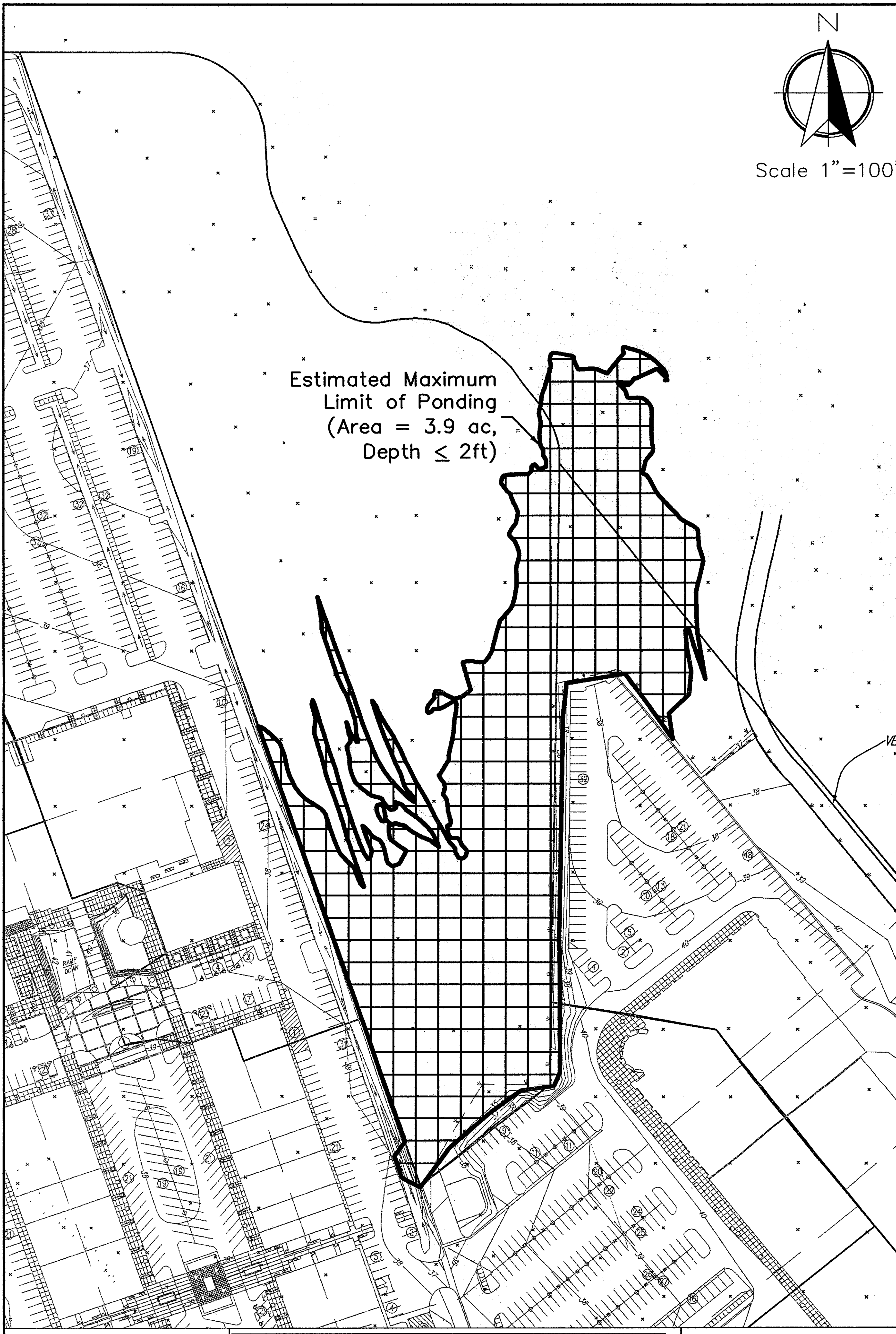
EXHIBIT D:
PROPOSED CONDITION
HYDROLOGY MAP FOR
OCEANSIDE PAVILION
LEGEND
MAJOR BASIN BOUNDARY
MINOR BASIN BOUNDARY
VEGETATED SWALE
EXISTING CONTOUR
PROPOSED CONTOUR
EXIST. STORM DRAIN
PROPOSED STORM DRAIN
FLOWLINE
NODE
PARK POND
SAN LUIS REY RIVER
MIDDLE POND
HIGHWAY 76
MISSION AVE
BASIN 310
BASIN 300
BASIN 320
BASIN 200
BASIN 150
BASIN 100
BASIN 520
BASIN 515
BASIN 510
BASIN 505
BASIN 500
8.25 AC
4.57 AC
BASIN 500
Q = 3.9 CFS
Q = 4.3 CFS
T = 10.5 MIN
BASIN 100-B
Q = 150 CFS
Q = 166 CFS
T = 15.3 MIN
BASIN 100-A
Q = 87.3 CFS
Q = 96.9 CFS
Q = 13.3 MIN
BASIN 300
Q = 17.8 CFS
Q = 19.7 CFS
T = 11.9 MIN
BASIN 320
Q = 2.8 CFS
Q = 2.9 CFS
T = 8.70 MIN
SCALE: 1" = 100'
REVISED: DECEMBER 14, 2007
REVISED: AUGUST 21, 2007
REVISED: MAY 8, 2007
REVISED: JULY 18, 2006
PREPARED: JUNE 6, 2006
O'Day
CONSULTANTS

EXHIBIT E
SCHEMATIC FOR STORM DRAIN BYPASS STRUCTURE



TORY R. WALKER ENGINEERING, INC.
WATER RESOURCES PLANNING & ENGINEERING

SCALE	NTS
CLIENT NO.	67-02



Tory R. Walker Engineering, Inc.
Water Resources Planning & Engineering

Exhibit F
Estimated Ponding Limits
for SDG&E Corridor

HYDROLOGIC MODEL OUTPUT

100-Year Storm – Existing Condition

NOTE: WORKSHEETS ARE ON FILE IN A
SEPARATE TECHNICAL APPENDIX AT
THE CITY OF OCEANSIDE'S PLANNING DEPARTMENT
AND MAY BE REVIEWED AT THAT LOCATION
DURING NORMAL BUSINESS HOURS

STORM WATER MITIGATION PLAN SUBMITTAL REQUIREMENTS CHECKLIST - RESPONSES

PROJECT: Oceanside Pavilion (P-7-06, D-6-06)

DATE OF REPORT: August 21, 2007

REVIEWED BY: DC – 4th Check

DATE REVIEWED: September 26, 2007

DATE RESPONSE: December 17, 2007; ***RESPONSE BY BRL – O'DAY CONS.***

Comment 3g Response: Please see attachment 9 & 10. Please note that the BMP exhibit is colored and that incorporating pervious and landscaped area on top of the grass swale and buffer strip area will cause conflicts and even more confusion. Typical BMP details are on the BMP exhibit.

Comment 8c Response: I have revised Section 3.3 "Dock Areas"

Comment 8i Response: I have revised Section 3.3 "Public Roadways"

Comment 9a Response: Please see revised attachment 8 of the SWMP report for information on the proprietary devices proposed.

Comment 9a Response: Please see revised Section 3.4.

Comment 9a Response: Please see revised Attachment 6.

STORM WATER MANAGEMENT PLAN

For

OCEANSIDE PAVILION

DP 06-06
P 04-06

Prepared May 18, 2006
Revised July 14, 2006
Revised May 4, 2007
Revised August 21, 2007
Revised December 14, 2007

JN 05-1115/5

Prepared By:
O'DAY CONSULTANTS
2710 Loker Avenue West, Suite 100
Oceanside, CA 92008

REGISTERED PROFESSIONAL ENGINEER
JOHN P. STROHMINGER
No. C55187
Exp. 6/30/08
CIVIL
STATE OF CALIFORNIA

12-19-07

John P. Strohminger R.C.E. 55187 Date

Filed w/Application
12/20/07

TABLE OF CONTENTS

Attachments:

STORM WATER MANAGEMENT PLAN

Federal, state and local agencies have established goals and objectives for storm water quality in the region. The proposed project, prior to the start of construction activities, will comply with all federal, state and local permits including the Stormwater Management Plan (SWMP) required under the County of San Diego Watershed Protection, Stormwater Management, and Discharge Control Ordinance (WPO) (section 67.871), the City of Oceanside's Standard Urban Storm Water Mitigation Plan, and the National Pollution Discharge Elimination System (NPDES) from the Regional Water Quality Control Board (RWQCB).

The purpose of this SWMP is to address the water quality impacts from the proposed improvements as shown on the Site Development Plan. This project will provide guidelines in developing and implementing Best Management Practices (BMPs) for storm water quality during construction and post construction.

A SWPPP will be prepared and approved prior to issuance of a grading permit. The approved SWPPP shall be implemented during the construction phase. The SWPPP will consist of the selected BMPs, guidelines and activities to carry out actions, which will prevent the pollution of storm water runoff. The SWPPP will also include the monitoring and maintenance of the construction BMPs during the construction phase.

1.0 PROJECT DESCRIPTION

This report analyzes the water quality flow for the 92-acre Oceanside Pavilion project located at the old drive-in theatres bounded by Foussat Road, Mission Ave, San Luis Rey River, and Fireside Street. The existing APNs for the site are the following: 160-270-31, 82, 79 and 160-280-14, 48-51, 53-55 and 160-290-58, 60, 63 and the "City Parcel" is 160-270-77.

The future development proposes a movie theatre, strip mall, parking, restaurants, and other commercial buildings. All on site streets and drive aisles will be private. The Pala Road extension to the west will be public. The project will drain into Park Pond to the north, San Luis Rey River to the west and Middle Pond to the southwest. See Attachment 1 for a Vicinity Map.

The pre-development condition has 30% (25.7 acres) impervious area see Attachment 9. The post-development proposes 85% (78.5 acres) impervious area see Attachment 10. The impervious area includes the public Pala Road extension.

Excerpts from the *Hydrology Report for The Pavilion at Oceanside* prepared by Tory R. Walker Engineering, Inc are included in this report in Attachment 11. A copy of this report is on file at the City of Oceanside Engineering Department.

1.1 Hydrologic Unit Contribution

The project is located in the Mission Subarea (903.11) of the Lower San Luis Watershed in the San Luis Rey Hydrologic Unit in the San Diego Region.

1.2 Beneficial Uses

The beneficial uses for the hydrologic unit are included in attachment 4, and the definitions are listed below. This information comes from the Water Quality Control Plan for the San Diego Basin.

MUN – Municipal and Domestic Supply: Includes uses for community, military, or individual water supply systems including, but not limited to, drinking water supply.
AGR – Agricultural Supply: Includes uses of water for farming, horticulture, or ranching including, but not limited to, irrigation, stock watering, or support of vegetation for range grazing.
IND – Industrial Service Supply: Includes uses of water for industrial activities that do not depend primarily on water quality including, but not limited to, mining, cooling water supply, hydraulic conveyance, gravel washing, fire protection, or oil-well repressurization.
REC 1 –Contract Recreation: Includes uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water-skiing, skin and SCUBA diving, surfing, white water activities, fishing, or use of natural hot springs.
REC 2 –Non-Contact Recreation: Includes the uses of water for recreational activities involving proximity to water, but not normally involving body contact with water, where ingestion of water is reasonably possible. These include, but are not limited to, picnicking, sunbathing, hiking, camping, boating, tide pool and marine life study, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities.
COMM – Commercial and Sport Fishing: Includes the uses of water for commercial or recreational collection of fish, shellfish, or other organisms including, but not limited to, uses involving organisms intended for human consumption or bait purposes.
WARM – Warm Freshwater Habitat: Includes uses of water that support warm water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.
EST – Estuarine Habitat: Includes the uses of water that support estuarine ecosystems including, but not limited to, preservation or enhancement of estuarine habitats, vegetation, fish, or wildlife (e.g., estuarine mammals, waterfowl, shorebirds).
MAR –Marine Habitat: Includes uses of water that support marine ecosystems including, but not limited to, preservation or enhancement or marine habitats, vegetation such as kelp, fish, shellfish, or wildlife (e.g., marine mammals, shorebirds).
WILD –Wildlife Habitat: Includes uses of water that support terrestrial ecosystems including but not limited to, preservation and enhancement of terrestrial habitats, vegetation, wildlife, (e.g., mammals, birds, reptiles, amphibians, invertebrates), or wildlife water food and sources.
RARE – Rare, Threatened, or Endangered Species: Includes uses of water that support habitats necessary, at least in part, for the survival and successful maintenance of plant or animal species established under state or federal law as rare, threatened or endangered.
AQUA – Aquaculture: Includes the use of water for aquaculture or mariculture operations including, but not limited to, propagation, cultivation, maintenance, or harvesting of aquatic plants and animals for human consumption or bait purposes.
MIGR –Migration of Aquatic Organisms: Includes uses of water that support habitats necessary for migration, acclimatization between fresh and salt water, or other temporary activities by aquatic organisms, such as anadromous fish.

SHELL – Shellfish Harvesting: Includes uses of water that support habitats suitable or the collection of filter-feeding shellfish (e.g., clams, oysters, and mussels) for human consumption, commercial, or sport purposes.
SPWN – Spawning, Reproduction, and/or Early Development: Includes uses of water that support high quality aquatic habitats suitable for reproduction and early development of fish. This use is applicable only for the protection of anadromous fish.

2.0 CHARACTERIZATION OF PROJECT RUNOFF

According to the California 2002 303d list published by the RWQCB (Attachment 3), Pacific Ocean Shoreline, San Luis Rey Hydrologic Unit is a 0.49 mile impaired water segment associated with the stormwater discharge from this project. Also listed as receiving waters is the San Luis Rey River, which has a low priority for chloride. The Pacific Ocean Shoreline, San Luis Rey Hydrologic Unit has low priority impairment for bacteria indicators. Sites tributary to clean water act section 303(D) water bodies require additional BMP implementation.

Runoff will be directed to grass swales and storm drains to the Park Pond to the north, the San Luis Rey River to the west and the Middle Pond to the southwest. A more detailed analysis of storm runoff is in the *Hydrology Report for The Pavilion at Oceanside* by Tory R. Walker Engineering, Inc. A flow summary excerpt from this report is provided in Attachment 11. A copy of the report is on file at the City of Oceanside Engineering Department.

2.1 Soil Characteristics

A soils report for the site has been prepared by Eberhart/United Consultants titled *Preliminary Geotechinical Engineering Study, Siegal Property, Expressway 76 and Mission Avenue, Oceanside, California* dated March 1, 2005. The majority of the project area consists of soil group C. There are no unstable slopes.

2.2 Potential Discharges

The project will contain some pollutants commonly found on similar developments that could affect water quality. The following list is taken from Table 1 of the City of Oceanside's *Standard Urban Storm Water Mitigation Plan, SUSMP* (Attachment 4). It includes anticipated pollutants for Commercial Development greater than 100,000 ft^2, Restaurants, Parking Lots, and Streets.

1. Sediments
2. Nutrients from fertilizers
3. Heavy metals
4. Organic compounds
5. Trash and debris
6. Oxygen demanding substances
7. Oil and grease from paved areas
8. Bacteria and viruses
9. Pesticides from landscaping and home use

The **primary pollutants** of concern are a low priority for bacteria and a low priority for chloride. All other pollutants are **secondary pollutants**. Incorporating multiple BMP systems, in some cases in series, will treat bacteria and chloride. Secondary pollutants will be treated as well. Long runs of grass swales, vegetated buffer strips, and inlet filters will treat bacteria before leaving the site and discharging into Park Pond, Middle Pond, and the San Luis Rey River.

In general, BMP implementation requirements for commercial activities are primarily non-structural BMPs. The most stringent Source Control BMPs will be utilized for restaurant locations to insure water quality compliance (Attachment 12).

3.0 MITIGATION MEASURES TO PROTECT WATER QUALITY

To address water quality for the project, BMPs will be implemented during construction and post construction. Required BMPs are selected from Table 2: Storm Water BMP requirements Matrix, of the City of Oceanside's *SUSMP* (Attachment 5).

3.1 Site Design BMPs

This City of Oceanside has developed the *Commercial Urban Runoff Requirements Manual* as part of the City's Jurisdictional Urban Runoff management Program (JURMP) and the City's Clean Water Program. Chapter 1 page 2 of the urban runoff manual states: "According to Item E of the NPDES Order (pg 13, Table 3), BMPs for all commercial activities should achieve the Maximum Extent Practicable (MEP) performance standard. In general, implementation requirements for commercial activities are primarily non-structural BMPs such as, controlling sources of pollutants and altering operational activities to reduce the potential for pollution. Structural BMPs such as treatment systems and devices are typically required when non-structural BMPs alone cannot achieve adequate reduction of pollution potential."

All Site Design BMPs will be designed to CASQA standards. Control of post-development peak storm water runoff discharge rates and velocities is desirable in order to maintain or reduce pre-development downstream erosion by applying the following concepts:

Vegetated Buffer Strips:
Vegetated buffer strips will be installed where applicable between streets, drive aisles, parking, and buildings. These strips will promote infiltration and initial canopy abstraction, see Attachment 6.

Biofilters:
A biofilter, or vegetated swale as it is referred to here, will be constructed at the locations shown on the SWMP exhibit (Attachment 6). The perimeter of the site will have long runs of grass swale. There will also be grass swales running through parking lots in key locations to treat parking lot runoff see Attachment 6. These swales make up the majority of water quality treatment on the site. Parking and street runoff will be diverted to these swales where the water will be treated before leaving the site.

Private Street Design:
Paved widths of streets have been designed to the minimum acceptable widths with vegetated swales running through parkways see Attachment 6. Pervious pavement should not be designed for sites with a seasonal high water table within 4 feet below the surface and a subgrade that will

deform excessively due to traffic loading. Decorative concrete is specified on the landscape plans as enhanced concrete pavement.

Public Street Design:
The paved width of Pala Road has been designed to the minimum acceptable widths with landscaped parkways, see Attachment 6.

Maintain Natural Drainage Pattern:
The general drainage pattern of the site will remain intact. Any runoff routing will take advantage of the existing drainage patterns.

Minimize Directly Connected Impervious Areas:
To the maximum extent practicable, parking lots, sidewalks, patios, roof top drains, rain gutters, and other impervious surfaces shall drain into adjacent landscaping or vegetated swales prior to discharging to the storm water conveyance system. Runoff from impervious areas will be diverted into vegetated swales shown on the SWMP exhibit (Attachment 6).

Protect Slopes and Channels:
All runoff will be safely conveyed away from the tops of slopes. Energy dissipaters shall be installed at the outlets of new storm drains, culverts, or channels that enter unlined channels in accordance with applicable standards and specifications to minimize erosion. Energy dissipaters will be installed in such a way as to minimize impacts on receiving waters. Slopes shall be planted with native or drought tolerant vegetation.

Sediment discharge will be greatly reduced after development due to the addition of impervious areas but will still be treated through vegetated swales.

3.2 Source Control BMPs

This City of Oceanside has developed the *Commercial Urban Runoff Requirements Manual* as part of the City's Jurisdictional Urban Runoff management Program (JURMP) and the City's Clean Water Program. Chapter 1 page 2 of the urban runoff manual states: "According to Item E of the NPDES Order (pg 13, Table 3), BMPs for all commercial activities should achieve the Maximum Extent Practicable (MEP) performance standard. In general, implementation requirements for commercial activities are primarily non-structural BMPs such as, controlling sources of pollutants and altering operational activities to reduce the potential for pollution. Structural BMPs such as treatment systems and devices are typically required when non-structural BMPs alone cannot achieve adequate reduction of pollution potential."

The most stringent Source Control BMPs will be utilized for restaurant locations and for the primary pollutants.

Source Control BMPs help minimize the introduction of pollutants and sedimentation into storm water in order to maintain or reduce pre-development levels of pollutants by applying the following concepts:

Provide Storm Water Conveyance System Stenciling and Signage:
All storm water conveyance inlets and catch basins shall provide concrete stamping, porcelain tile, inset permanent marking or equivalent as approved by the City of Oceanside within the project area with prohibitive language satisfactory to the City Engineer.

Trash Storage Areas to Reduce Hazardous Waste Introduction:
This project does not propose outdoor areas for storage of hazardous materials.

Trash Storage Areas to Reduce Pollution Introduction:
All trash containers shall contain attached lids that exclude rain or contain a roof or awning to minimize direct precipitation. Storage areas shall be paved, screened or walled to prevent off-site transport of trash, and designed not to allow run-on from adjoining areas.

Use Efficient Irrigation Systems & Landscape Design:
Irrigation systems shall employ rain shutoff devices to prevent irrigation during precipitation and be designed to each landscape area's specific water requirements consistent with the *Oceanside Landscape* Manual. Irrigation of landscaped areas will use flow reducers or shutoff valves triggered by a pressure drop top control water loss in the event of a broken sprinkler heads or lines. Bubblers and or drip irrigation will be installed in the parking lot planters. Maintenance of common areas will be performed by contract with a professional maintenance company.

Employee Training & Good Housekeeping for Restaurants:
Commercial Businesses shall provide training to all employees to stress the importance of a clean and orderly work environment for the prevention of Urban Runoff contamination. Training sessions shall do the following from Chapter 2 of the City of Oceanside's "Commercial Urban Runoff Requirements Manual":

- Fully discuss the various components of BMP implementation such as routine inspections, clean ground surfaces, waste disposal, equipment, etc.
- Stress the importance of quickly and completely cleaning up spilled materials. All employees of a business should be educated to understand that when spilled materials are left to enter the soil or to coat impervious surfaces, spill areas can pollute subsequent storm runoff and harm Receiving Water quality.
- Make clear the location and usage of spill response and grounds maintenance equipment. Example equipment includes brooms, vacuums, sorbents, foams, neutralizing agents, etc.
- Discuss updated procedures and report on the progress of practicing good housekeeping at every meeting.
- If applicable, provide instruction on manual operation of valves, drums, and containers and frequency of checking these devices for leaks and spills.
- Outline a regular schedule for housekeeping activities to allow the determination of progress being made.
- Read and discuss in depth the "Grease and Urban Runoff Requirements for Oceanside Eating and Drinking Establishments" handout, see Attachment 12.

Examples of good housekeeping BMPs from the "Commercial Urban Runoff Requirements Manual" that apply to eating and drinking establishments are as follows:

- Dumpsters and grease bin areas shall be kept securely closed when not in use, and shall be inspected and cleaned regularly. Leaking dumpsters shall be repaired or replaced as soon as possible.
- Parking areas and other outside surfaces shall be routinely cleaned using dry methods (e.g., sweeping) to prevent the accumulation of significant materials. Accumulated materials shall be properly disposed.
- Parking areas and other surfaces shall not be cleaned using wet methods (e.g., hosing, steam-cleaning, pressure washing) unless adequate precautions have been taken to prevent the entry of wash water and other contaminants into the Storm Water Conveyance System or Receiving Waters.
- Outdoor grease interceptors shall be properly maintained, and routinely inspected to ensure their proper functioning. Any problems noted shall be corrected as soon as possible.
- Equipment (mats, grease filters, etc.) may not be washed in areas where wash water or rinse water will drain to the Storm Water Conveyance System or Receiving Waters. Dischargers are responsible for obtaining all necessary approvals from the City prior to discharging to the sewer.
- As necessary to prevent the entry of pollutants in the Storm Water Conveyance System or Receiving Waters, designated work areas shall utilize structural controls to (1) prevent the discharge of spills from the work area, (2) prevent run-on from contacting work surfaces and pollutants, and (3) prevent rainfall from contacting work surfaces and pollutants. The City may order the use of these and/or other structural controls if it determines that the Maximum Extent Possible has not been met.

Grease Handling and Disposal:
The following BMPs are recommended by the *Commercial Urban Runoff Requirements Manual*:

- Never pour oil, grease, or oily liquids such as sauces or salad dressings down a sink, sanitary sewer, storm drain, or into a dumpster.
- Recycle waste oil and grease whenever possible. Most landfills will not accept grease or other liquid wastes for disposal.
- To ensure proper operation of the traps and prevent sewer blockages, minimize the amount of grease your facility sends to the grease trap or interceptor.
- Inspect and clean grease traps and interceptors regularly. Grease traps should be cleaned weekly to ensure adequate grease removal.
- Keep solids out of sink drains by scraping pots and dishes prior to washing and installing screens over drains to trap solids.
- Never use solvents or emulsifiers as grease trap additives. When the additives are diluted by the wastewater of other users, the grease comes out of the solution and settles in the lateral and sewer lines causing blockages.

Employee Training & Good Housekeeping for Landscaping:
Commercial Businesses shall provide training to all employees to stress the importance of a clean and orderly work environment for the prevention of Urban Runoff contamination. The City's *Commercial Urban Runoff Requirements Manual* outlines the following landscaping and grounds keeping BMPs:

- Precautions shall be taken to prevent spills, leaks, and over application of chemical products during landscaping and ground keeping activities.
- Precautions shall be taken to prevent over irrigation of landscaped areas.
- Pesticides, herbicides, fertilizers, and other chemical products shall be used in accordance with label directions. These products shall not be disposed to streets or gutters, but shall be collected and properly disposed.
- Ground and landscaped areas shall be periodically inspected. Litter, debris, organic matter (leaves, cut grass, etc.), and other materials with the potential to contaminate Urban Runoff shall be collected and properly disposed.
- Materials and equipment necessary for spill response shall be maintained and kept readily accessible, and employees trained in their proper use

3.3 Individual Priority Project Categories

Dock Areas
Loading/unloading dock areas shall be designed to preclude urban run-on and runoff or mitigate for such. Emergency shut-off valves shall be installed in case of spills per the City's request. Storm drain inlets at depressed loading docks will include biofilter inserts with hydrocarbon booms to treat runoff before entering the storm drain.

Parking Areas
Vegetated swales and inlet filters shall minimize the offsite transport of pollutants from parking areas by treating parking area runoff (Attachment 6). Please see Section 3.1 for Site Design BMPS, Section 3.2 for Source Control BMPs, and Section 3.4 Treatment Control BMPs for a more specific discussion of mitigation measures.

Private Roadways
Onsite drive aisles and roadways (private) will be treated by grass swales and inlet filters delineated on the "Preliminary SWMP Exhibit" (see Attachment 6). All private BMPs will be maintained privately and will not be maintained by the City.

Public Roadways
This project is proposing the on-site public road extension of Pala Road up to the northerly property boundary. Low points in Pala Road will drain into curb inlets. The following is a quote from the City's plan check comments: "Treatment of roadways to be determined by the City – at this point, inlet filters are unacceptable due to performance and maintenance issues. Potential opportunity for pilot study of BMP (permeable friction course application to roadways). Further information may be required for potential Pala road extension north of the property boundary." All water quality issues related to runoff from public streets will be the responsibility of the City of Oceanside.

3.4 Treatment Control BMPs

This City of Oceanside has developed the *Commercial Urban Runoff Requirements Manual* as part of the City's Jurisdictional Urban Runoff management Program (JURMP) and the City's Clean Water Program. Chapter 1 page 2 of the urban runoff manual states: "According to Item E of the NPDES Order (pg 13, Table 3), BMPs for all commercial activities should achieve the Maximum Extent Practicable (MEP) performance standard. In general, implementation requirements for commercial activities are primarily non-structural BMPs such as, controlling sources of pollutants and altering operational activities to reduce the potential for pollution. Structural BMPs such as treatment systems and devices are typically required when non-structural BMPs alone cannot achieve adequate reduction of pollution potential."

A combination of treatment control BMPs shall be incorporated into the project. The project has been designed so that runoff is treated by multiple Site Design BMPs prior to Structural Treatment BMPs. Primary pollutants will be treated with multiple BMPs in series.

Site Constraints

The project site is located just east of the San Luis Rey River levy. If the levy were not in place the whole site would be flooded with water. The grading and draining of the site relies on placing the buildings one foot above the flood plain by filling the site with about 4 feet of soil. Surface drainage is used as much as possible to lessen the need to increase the fill amount. Also, there is a 200 foot wide utility corridor along with the abandoning of utilities in Old Foussat that complicate the grading and draining. The site is almost entirely soil type C.

Treatment BMPs that were considered due to their high removal efficiencies for bacteria are:

- Infiltration trenches (TC-10)
- Infiltration basins (TC-11)
- Retention Irrigation (TC-12)
- Wet Ponds (TC-20)
- Constructed Wetlands (TC-21)
- Bioretention (TC-32)

Infiltration trenches and basins were not chosen because of site constraints as discussed above under ***Site Constraints***. High failure rates accompany these BMPs when used in soil and subsurface conditions present on this project. Infiltration trenches and basins require a minimum soil infiltration rate of 0.5 in/hr, not appropriate for soil class C and D. Infiltration trenches and basins are not suitable for fill sites. Infiltration trenches and basins are not feasible from both an economic standpoint as well as an engineering stand point.

Wet ponds and constructed wetlands were not chosen because of the site constraints discussed above as well as issues with vector control, vegetation management, and concern that endangered species would become resident and hinder maintenance activities. Wet ponds should be on average 4-6 feet deep; this is not feasible per the ***Site Constraints*** discussed above. Wet ponds and constructed wetlands should not be designed where there is public access for safety reasons. Mosquito and midge breeding as well as undesirable odors are likely to occur in ponds and wetlands. Wet ponds and wetlands typically will need supplemental water if water level is to be maintained. They require large footprints especially if pond depths are shallow (see above ***Site Constraints***) and may require approval from the State Division of Safety of Dams. The look and feel of the Pavilion at Oceanside does not match the "swampy" feel of wetlands and ponds. Wet ponds and constructed wetlands are not feasible from both an economic standpoint as well as an engineering stand point.

Bioretention was not chosen because of the site constraints discussed above as well as issues with vector control. Bioretention is not appropriate in locations where the water table is within 6 feet of the ground surface. According to the *Preliminary Geotechinical Engineering Study, Siegal Property, Expressway 76 and Mission Avenue, Oceanside, California* dated March 1, 2005 by Eberhart / United Consultants, the groundwater table is roughly 15 feet below the ground surface. Although the groundwater is deeper than the minimum, the groundwater elevation might fluctuate depending on the amount of recharge. The excavated depth for the bioretention system should be 4 feet. In areas where the native soil permeability is less than 0.5 in/hr an underdrain should be provided. Because of the site constraints listed above, excavating 4 feet and draining the bottom of the bioretention system would cause the whole site to raise at least 4 feet from its current elevation. Bioretention is not feasible from both an economic standpoint as well as an engineering standpoint.

Treatment BMPs that were considered due to their medium removal efficiencies for bacteria are:

- Extended Detention Basins (TC-22)
- Media Filter (TC-40)

Extended detention basins were not chosen because of the site constraints discussed above under ***Site Constraints*** as well as issues with vector control, vegetation management, and concern that endangered species would become resident and hinder maintenance activities. Extended detention basins are used in rural applications where large drainage basins (5 acres or more) can drain into a detention basin. The proposed drainage basins do not meet this criterion. Length to width ratios of 1.5:1 cannot be accommodated because of site constraints. Hydraulic head and depth cannot be accommodated for because of the site constraints listed above. No detention basins are proposed thus the application for an extended detention basin for BMP purposes is not feasible and unnecessary.

Media filters were considered due to their medium removal effectiveness for bacteria. Media filters were not selected over the BMPs chosen because they require 4 feet of hydraulic head to operate properly, see the ***Site Constraints*** section above. Other reasons why media filters were not considered are: they require more maintenance, they have a high potential of clogging and therefore flooding buildings (that are only 1.0 feet above the flood elevation), they are more expensive, and they can be a source of standing water where mosquito and midge breeding is likely to occur. Media filters are not feasible from both an economic and engineering standpoint.

In short, any BMP requiring more than the hydraulic head or structure necessary other than surface flow or flow through an inlet filter at an inlet will not drain. This includes any underground BMPs or BMPs requiring an elevation difference other than surface flow through vegetated buffer strips, swales, and inlet filters at inlets. This is because, even with filling the whole site with 4 feet of fill, all proposed storm drains are at a minimum slope and just barely drain. Infiltration trenches, infiltration basins, retention irrigation, wet ponds, bioretention, media filters, and detention basins need at least one of the following that disqualifies it for use as a treatment control BMP: ponding depth, hydraulic head, detention volume, and filtration volume.

According to Table 1 of Bioretention TC-32 in the New Development Redevelopment CASQA Manual, the removal rate of bacteria is 90%. Studies show that the proposed inlet filters have the same efficiency for bacteria removal and thus can be considered as HIGHLY EFFECTIVE. All other MEDIUM EFFECTIVE BMPs treating bacteria are NOT as effective as the proposed inlet filters.

Vegetated Buffer Strips

Vegetated transition areas will be planted with grass to treat runoff from buildings and parking areas. Vegetated buffer strips have high removal efficiency for sediment in addition to being effective in removing other pollutants. Vegetated buffer strips shall treat runoff from a maximum tributary area of 60 feet. The slope of vegetated buffer strips shall not exceed 15%. The minimum length, in the direction of flow, shall be 15 feet. Flow shall not exceed 1 FPS. Vegetated buffer strips shall have a longitudinal width equal to the tributary width of area being treated for water quality. In some cases, vegetated buffer strips will be used in series with other treatment control BMPs to treat for the primary pollutants.

Vegetated Swale

Vegetated swales will be constructed and utilized to treat the low-flow runoff. There are multiple swales of varying lengths, but all water being treated by vegetated swales shall flow through at least 100 feet of swale before entering the storm drain system. Slopes of the swales will create velocities less than 2 FPS. Longitudinal slopes shall not be less than 0.5% and no greater than 2.5%. The considerable length and low velocity will allow maximum pollutant removal. The pollutants that the vegetated swale will efficiently remove include sediment, nutrients, trash, metals, oil, grease, and organics. Vegetated swales have been chosen to treat for the primary pollutant bacteria because bacteria thrive in oil, grease, trash, nutrients, and organics. Vegetated swales have been chosen to treat for the primary pollutant chloride because chloride comes from nutrients. Typical water quality calculations for vegetated swales are included in this report (Attachment 7).

Inlet Filters

The vast majority of the site will be treated by vegetated swales designed for water quality flows. Inlet filters with bacteria treating inserts will treat areas that cannot be treated by these swales. In some cases, inlet filters will be installed to provide multiple BMPs in series to treat for bacteria and chloride; specifications for these filters are included in Attachment 8. A "Structural BMP Summary Table" has been provided in Attachment 13.

Inlet Filters (Public)

This project is proposing the public road extension of Pala Road. Low points in Pala Road will drain into curb inlets. Inlet filters will be constructed in these curb inlets to treat street (public) runoff. Because the storm drain is public, the City will be responsible for the maintenance of these public utilities. Public runoff will not be mixed with private onsite runoff. All water quality issues related to runoff from public streets will be the responsibility of the City of Oceanside.

4.0 MAINTENANCE, MONITORING, AND INSPECTION

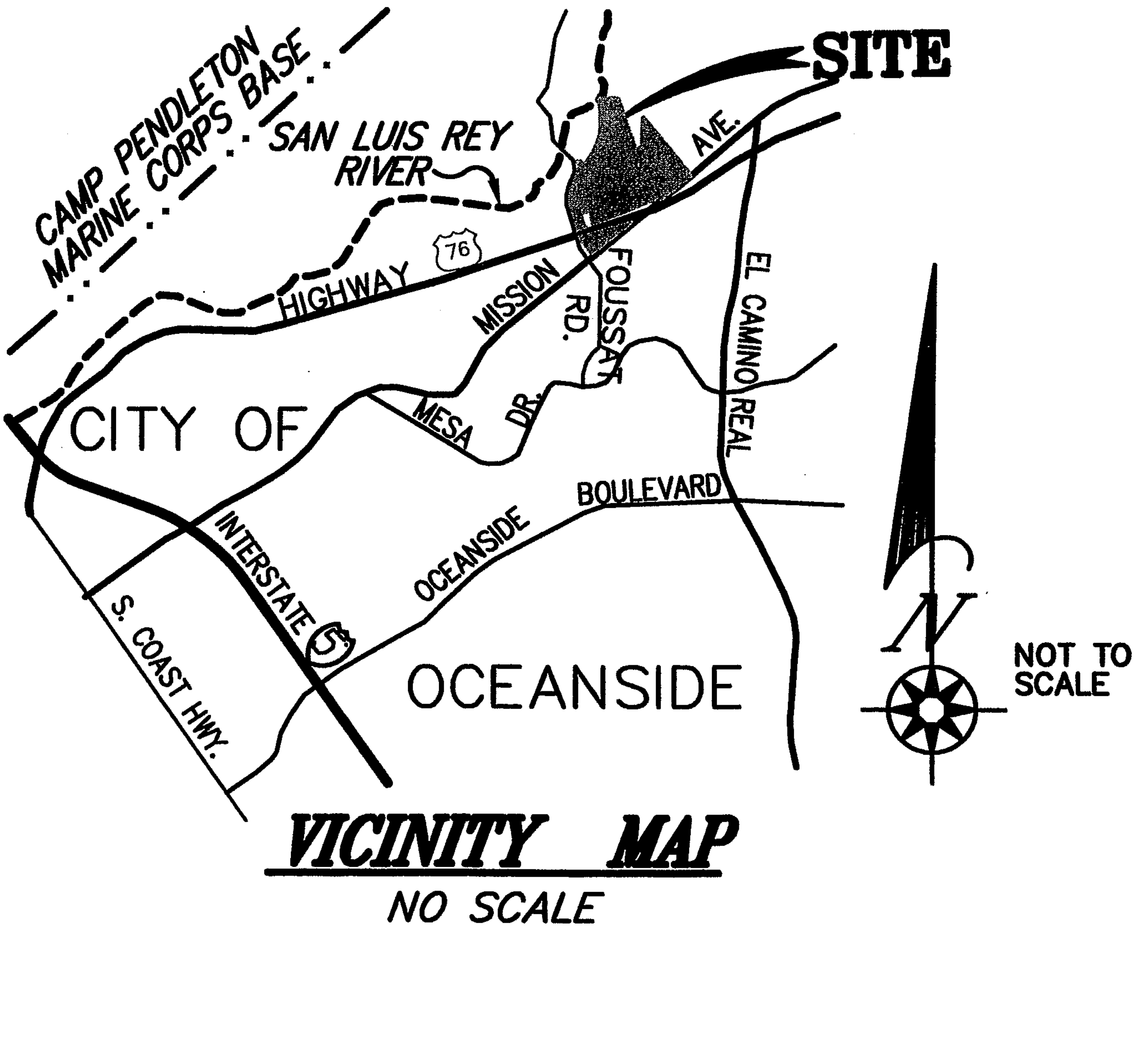
The BMP Summary table on the SWMP exhibit (Attachment 6) shows a summary of the BMPs to be used and their corresponding monitoring and maintenance frequency.

BMPs will be inspected periodically per the chart on the SWMP Exhibit (Attachment 6) The Owner/Developer will be responsible for the monitoring and maintenance of the BMPs.

All treatment control BMPs associated with this SWMP will be located on private property unless otherwise noted. Inlet Filters are proposed in the public right of way of Pala Road and will be owned, maintained, monitored, and inspected by the City of Oceanside into perpetuity.

The City may enter into a contract with the project proponent obliging the project proponent to maintain, repair, and replace the storm water BMP as necessary into perpetuity. Security may be required.

All BMPs proposed in public right of way will be maintained, monitored, and inspected by the City of Oceanside into perpetuity. Public street runoff shall not be mixed with private onsite runoff. All water quality issues related to runoff from public streets will be the responsibility of the City of Oceanside.



VICINITY MAP

NO SCALE

Table 2-2. BENEFICIAL USES OF INLAND SURFACE WATERS

Inland Surface Waters[1,2]	Hydrologic Unit Basin Number	BENEFICIAL USE														
		MUN	AGR	IND	PROC	GWR	FRSH	POW	REC1	REC2	BIOL	WARM	COLD	WILD	RARE	SPWN
San Luis Rey River Watershed - continued																
unnamed intermittent streams	3.16	+	●	●					●	●		●		●		
Moosa Canyon	3.14	+	●	●					●	●		●		●		
Moosa Canyon	3.13	+	●	●					●	●		●		●		
Turner Lake	3.13	See Reservoirs & Lakes- Table 2-4														
South Fork Moosa Canyon	3.13	+	●	●					●	●		●		●		
Moosa Canyon	3.12	+	●	●					●	●		●		●		
Gopher Canyon	3.12	+	●	●					●	●		●		●		
South Fork Gopher Canyon	3.12	+	●	●					●	●		●		●		
San Luis Rey River	3.11	+	●	●					●	●		●		●	●	
Pilgrim Creek	3.11	+	●	●					●	●		●		●	●	
Windmill Canyon	3.11	+	●	●					●	●		●		●		
Tuley Canyon	3.11	+	●	●					●	●		●		●		
Lawerence Canyon	3.11	+	●	●					●	●		●		●		
Mouth of San Luis Rey River	3.11	See Coastal Waters- Table 2-3														
San Diego County Coastal Streams																
Loma Alta Creek	4.10	+							O	●		●		●		
Loma Alta Slough	4.10	See Coastal Waters- Table 2-3														

● Existing Beneficial Use

O Potential Beneficial Use

+ Excepted From MUN (See Text)

[1] Waterbodies are listed multiple times if they cross hydrologic area or sub area boundaries.

[2] Beneficial use designations apply to all tributaries to the indicated waterbody, if not listed separately.

REGION	TYPE				PRIORITY	ESTIMATED SIZE AFFECTED	PROPOSED TMDL COMPLETION
9	C	Pacific Ocean Shoreline, San Dieguito HU	90511000	**Bacteria Indicators** *Impairment located at San Dieguito Lagoon Mouth, Solana Beach.* **Nonpoint/Point Source**	Low	0.86 Miles	
9	C	Pacific Ocean Shoreline, San Joaquin Hills HSA	90111000	**Bacteria Indicators** *Impairment located at Cameo Cove at Irvine Cove Dr./Riviera Way, Heisler Park-North* **Urban Runoff/Storm Sewers** **Unknown Nonpoint Source** **Unknown point source**	Low	0.63 Miles	
9	C	Pacific Ocean Shoreline, San Luis Rey HU	90311000	**Bacteria Indicators** *Impairment located at San Luis Rey River Mouth.* **Nonpoint/Point Source**	Low	0.49 Miles	
9	C	Pacific Ocean Shoreline, San Marcos HA	90451000	**Bacteria Indicators** *Impairment located at Moonlight State Beach.* **Nonpoint/Point Source**	Low	0.5 Miles	
9	C	Pacific Ocean Shoreline, Scripps HA	90630000	**Bacteria Indicators** *Impairment located at La Jolla Shores Beach at El Paseo Grande, La Jolla Shores Beach at Caminito Del Oro, La Jolla Shores Beach at Vallecitos, La Jolla Shores Beach at Ave de la Playa, Casa Beach (Childrens Pool), South Casa Beach at Coast Blvd., Whispering Sands Beach at Ravina St., Windansea Beach at Vista de la Playa, Windansea Beach at Bonair St., Windansea Beach at Playa del Norte, Windansea Beach at Palomar Ave., Tourmaline Surf Park, Pacific Beach at Grand Ave.* **Nonpoint/Point Source**	Medium	3.9 Miles	
9	C	Pacific Ocean Shoreline, Tijuana HU	91111000	**Bacteria Indicators** *Impairment located from the border, extending north along the shore.* **Nonpoint/Point Source**	Low	3 Miles	
9	R	Pine Valley Creek (Upper)	91141000	**Enterococci** **Grazing-Related Sources** **Concentrated Animal Feeding Operations (permitted, point source)** **Transient encampments**	Medium	2.9 Miles	

Table 1. Anticipated and Potential Pollutants Generated by Land Use Types

	General Pollutant Categories								
Priority Project Categories	**Sediments**	**Nutrients**	**Heavy Metals**	**Organic Compounds**	**Trash & Debris**	**Oxygen Demanding Substances**	**Oil & Grease**	**Bacteria & Viruses**	**Pesticides**
Detached Residential Development	X	X			X	X	X	X	X
Attached Residential Development	X	X			X	P[1]	P[2]	P	X
Commercial Development > 100,000 ft^2	P[1]	P[1]		P[2]	X	P[5]	X	P[3]	P[5]
Automotive Repair Shops			X	X[4][5]	X		X		
Restaurants					X	X	X	X	
Hillside Development > 5,000 ft^2	X	X			X	X	X		X
Parking Lots	P[1]	P[1]	X		X	P[1]	X		P[1]
Streets, Highways & Freeways	X	P[1]	X	X[4]	X	P[5]	X		

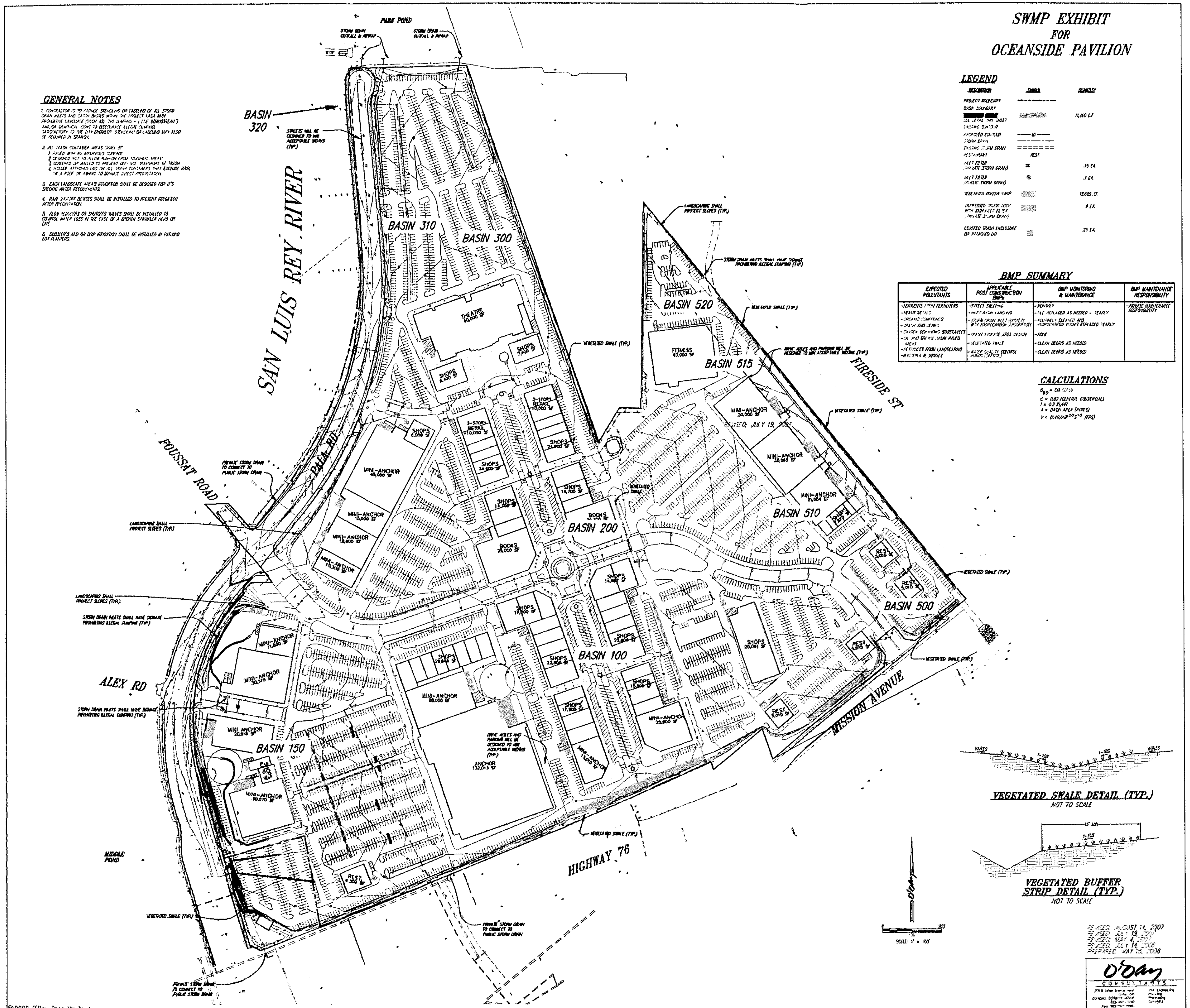
X = anticipated
P = potential

1. A potential pollutant if landscaping exits on-site.
2. A potential pollutant if the project includes uncovered parking areas.
3. A potential pollutant if land use involves food or animal waste products.
4. Including petroleum hydrocarbons.
5. Including solvents.

For projects where no primary pollutants of concern exist, those pollutants identified through the process described in Section 3.1.1 shall be considered secondary pollutants of concern.

3.1.3 IDENTIFY CONDITIONS OF CONCERN

Common impacts to the hydrologic regime resulting from development typically include increased runoff volume and velocity; reduced infiltration; increased flow frequency, duration, and peaks; faster time to reach peak flow; and water quality degradation. These changes have the potential to permanently impact downstream channels and habitat integrity. A change to a priority project site's hydrologic regime would be considered a condition of concern if the change would impact downstream channels and habitat integrity.


SWMP EXHIBIT
FOR
OCEANSIDE PAVILION
LEGEND
PROJECT BOUNDARY
BASIN BOUNDARY
11,400 LF
PROPOSED CONTOUR
STORM DRAIN
EXISTING STORM DRAIN
REST.
VEGETATED BUFFER STRIP
COVERED TRASH ENCLOSURE OR ATTACHED LID
25 EA.
BMP SUMMARY
EXPECTED POLLUTANTS
APPLICABLE POST CONSTRUCTION BMPs
BMP MONITORING & MAINTENANCE
BMP MAINTENANCE RESPONSIBILITY
-STREET SWEEPING
-CLEAN DEBRIS AS NEEDED
-CLEAN DEBRIS AS NEEDED
-PRIVATE MAINTENANCE RESPONSIBILITY
CALCULATIONS
C = 0.82 (GENERAL COMMERCIAL)
A = BASIN AREA (ACRES)
GENERAL NOTES
PARK POND
BASIN 320
BASIN 310
BASIN 300
SAN LUIS REY RIVER
THEATRE
BASIN 520
FITNESS 40,000 SF
BASIN 515
FIRESIDE ST
MINI-ANCHOR 30,000 SF
FOUSSAT ROAD
PALA RD
BASIN 510
BOOKS
BASIN 200
BASIN 500
BASIN 100
ALEX RD
MISSION AVENUE
MINI-ANCHOR
BASIN 150
ANCHOR 132,243 SF
HIGHWAY 76
MIDDLE POND
VEGETATED SWALE DETAIL (TYP.)
NOT TO SCALE
VEGETATED BUFFER STRIP DETAIL (TYP.)
NOT TO SCALE
SCALE: 1" = 100'
REVISED: JULY 19, 2007
O'Day CONSULTANTS
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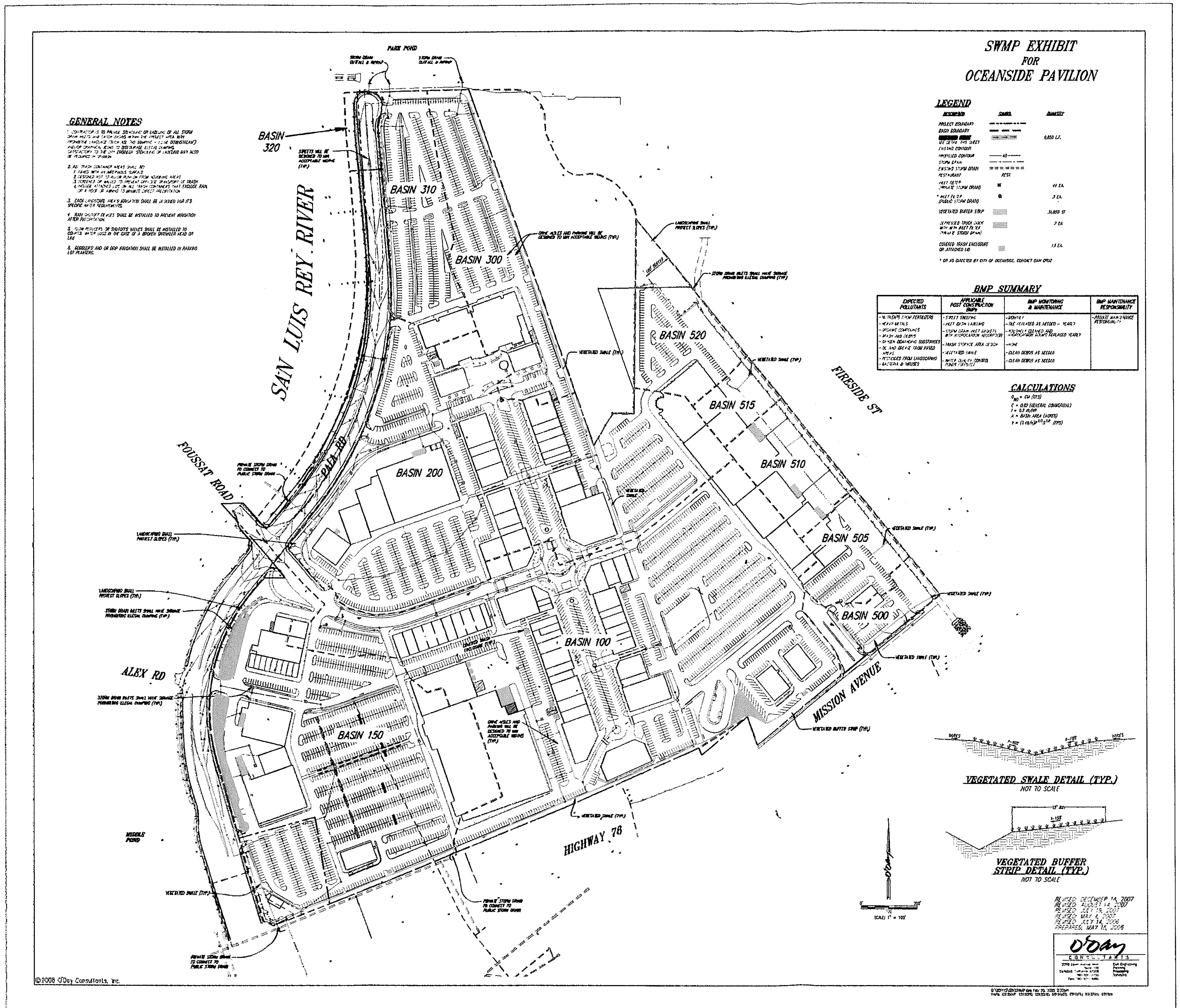

SWMP EXHIBIT
FOR
OCEANSIDE PAVILION
LEGEND
PROJECT BOUNDARY
BASIN BOUNDARY
9,850 L.F.
VEGETATED BUFFER STRIP
COVERED TRASH ENCLOSURE OR ATTACHED LID
BMP SUMMARY
EXPECTED POLLUTANTS
APPLICABLE POST CONSTRUCTION BMPs
BMP MONITORING & MAINTENANCE
BMP MAINTENANCE RESPONSIBILITY
CALCULATIONS
C = 0.82 (GENERAL COMMERCIAL)
A = BASIN AREA (ACRES)
GENERAL NOTES
BASIN 320
BASIN 310
BASIN 300
BASIN 200
BASIN 100
BASIN 150
BASIN 520
BASIN 515
BASIN 510
BASIN 505
BASIN 500
SAN LUIS REY RIVER
FOUSSAT ROAD
ALEX RD
FIRESIDE ST
MISSION AVENUE
HIGHWAY 76
PARK POND
VEGETATED SWALE (TYP.)
VEGETATED BUFFER STRIP (TYP.)
VEGETATED SWALE DETAIL (TYP.)
NOT TO SCALE
VEGETATED BUFFER
STRIP DETAIL (TYP.)
NOT TO SCALE
PREPARED: MAY 18, 2006
REVISED: DECEMBER 14, 2007
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Table 2. Priority Project Storm Water BMP Requirements Matrix

Priority Project Category	Site Design BMPs	Source Control BMPs	Requirements Applicable to Individual Priority Project Categories (1)											Treatment Control BMPs(2)
			Private Roads	Residential Driveways & Guest Parkin	Dock Areas	Maintenance Bays	Vehicle Wash Areas	Outdoor Processin Are	Equipment Wash Areas	Parking Areas	Roadways	Fueling Areas	Hillside landscaping	
Detached Residential Development	R	R	R	R									R	R
Attached Residential Development	R	R	R											R
Commercial Development > 100,000 ft^2	R	R			R	R	R	R						R
Automotive Repair Shops	R	R			R	R	R		R			R		R
Restaurants	R	R			R				R					R
Hillside Development > 5,000 ft^2	R	R	R										R	R
Parking Lots	R	R								R(2)				R
Streets, Highways & Freeways	R	R									R			R

R = Required

(1) Projects are subject to the requirements of all priority project categories that apply.
(2) Select one or more applicable and appropriate treatment control BMPs from Appendix C.
(3) Applies if the paved area totals >5,000 square feet or with > 15 parking spaces and is potentially exposed to urban runoff.

hydrologically functional project design that attempts to mimic the natural hydrologic regime. Mimicking a site's natural hydrologic regime can be pursued by:

- Reducing imperviousness, conserving natural resources and areas, maintaining and using natural drainage courses in the storm water conveyance system, and minimizing clearing and grading.
- Providing runoff storage measures dispersed uniformly throughout a site's landscape with the use of a variety of detention, retention, and runoff practices.

Smart Sponge® Plus Antimicrobial Technology

Background & Field Test Results

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February 26, 2004

Background

AbTech Industries, Inc. is a manufacturer of proprietary products designed to protect the environment from contaminants carried by stormwater into rivers, lakes and oceans. One area of the Stormwater market that is receiving increased publicity and attention is the water pollution caused by microorganisms (bacteria). Polluted Stormwater runoff can expose boaters and swimmers to bacteria, viruses and protozoas. A recent Southern California epidemiological study revealed that individuals who swim in areas adjacent to flowing storm drain outfalls were 50 percent more likely to develop a variety of symptoms than those who swim further away from the same drains. These situations are the cause for thousands of beach closings every year affecting public health and local economies dependent upon tourism and recreation. According to a report of the Natural Resources Defense Council (NRDC) issued in July 2002, 13,410 beach closings and advisories were issued in 2001, a 19% increase over the previous year. NRDC's report stated that 87% of closings and advisories were due to the presence of bacteria that typically comes from sewage discharges or Stormwater runoff. NRDC predicts that these numbers will go even higher as monitoring improves and expands – as it must do by 2004 under the Federal BEACH Act.

Technology Description

AbTech's Smart Sponge®

AbTech Industries, Inc. has developed a patented technology over the past seven years based on a proprietary blend of synthetic polymers aimed at removal of hydrocarbons and oil derivatives from surface water. AbTech's process creates a porous structure (see Figure A) with hydrophobic and oleophilic characteristics capable of selectively removing hydrocarbons while allowing high flow rates. This structure is highly porous; as hydrocarbons are absorbed into its structure, the Smart Sponge® swells while maintaining porosity and filtering capabilities.

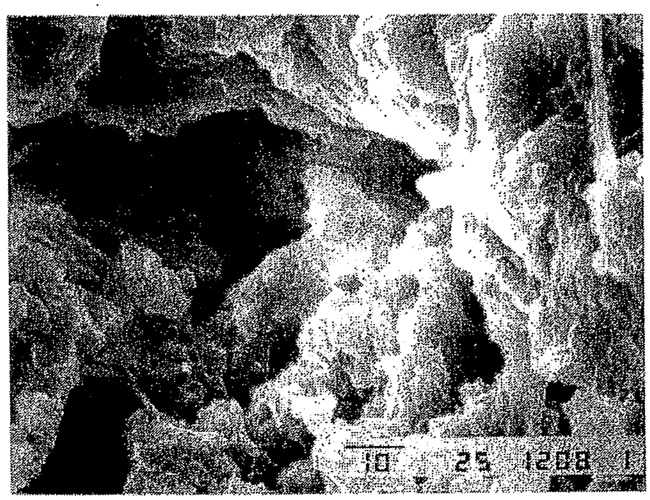
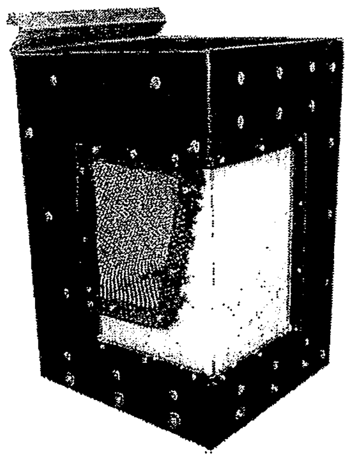


Figure A (1,000 X)

Field and laboratory tests have confirmed the Smart Sponge® capability to absorb, depending on the type of oil contaminant, up to five times its own weight and remove 75% to 98% of the hydrocarbons present in Stormwater runoff, typically in the range of 5 to 30 mg/liter (ppm). The absorption is permanent and the saturated product does not leach or leak contaminants (lab results are available upon request), transforming the contaminant – in most cases – into a solid waste with lower disposal costs.



UUF CO1414N

AbTech's Smart Sponge® technology is applied in a range of products, primarily the Ultra-Urban® Filter (UUF), a catch basin insert capable of removing sediment, trash, debris and hydrocarbons from Stormwater runoff.

Smart Sponge® Plus

Over the past 24 months, AbTech Industries has worked on the development of a new solution named Smart Sponge® Plus capable of treating microorganisms as well as hydrocarbons. AbTech has developed a technology capable of binding an Antimicrobial Agent to its proprietary polymers thereby modifying their surface and adding micro biostatic features while maintaining the oil absorbing capabilities.

The Agent used for this innovative technology is an Organosilane derivative (see its chemistry in Figure B), which is widely used in a variety of fields including medical, consumables, pool equipment and consumer goods.

Antimicrobial Agent

Organosilane quaternary amine
CAS: 27688-52-6
Molecular Structure:

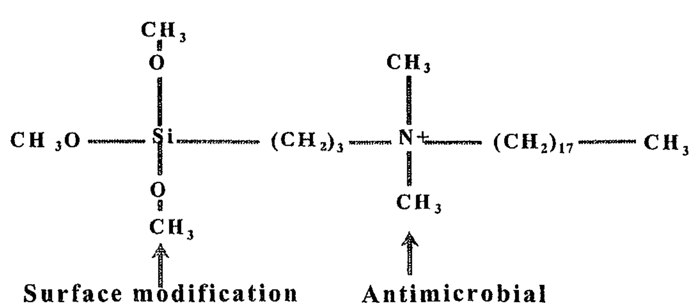


Figure B

Its mode of action is very simple (no chlorine or heavy metals involved) and - in surface-bound applications – it neither introduces chemicals into the treated water nor produces toxic metabolites. Its chemical structure ensures long-term stability to natural agents and reduced degradation. This Antimicrobial Agent is registered with EPA for a variety of other (non-Stormwater) applications and has been proven successful in those applications against several microorganisms (see Figure C).

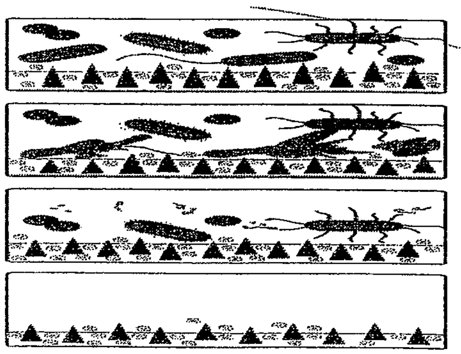
Tested Positively on:

- Aspergillus Niger
- Trychophyton Mentagrophytes
- Penicillium Pinophilum
- Chaetomium Globosum
- Trichoderma Virens
- Aureobadisium Pullulans
- Staphylococcus Aureus
- Escherichia Coli
- Pseudomonas Aeruginosa
- Candida Albicans
- Salmonella
- Klebsiella Pneumoniae

Figure C

In the Smart Sponge® Plus, the Antimicrobial Agent is chemically and permanently bound to the polymer surface and it does not leach or leak, therefore avoiding any downstream toxicity issues (toxicity tests on Ceriodaphnia, Selenastrum and Fathead Minnow are available upon request). The antimicrobial mechanism is based on the Agent's electromagnetic interaction with the microorganism cell membrane, causing the microorganism disruption and destruction (see Figure D), but no chemical or physical change or degradation in the agent. Antimicrobial activity does not reduce the agent capability or cause its depletion and, therefore, maintaining long-term effectiveness.

Antimicrobial Action Mechanism



1. **Active agent attached permanently to the surface**
2. **Microorganisms contact the surface and are destroyed**
3. **Further growth of microorganisms is inhibited**
4. **Clean surface**

Figure D

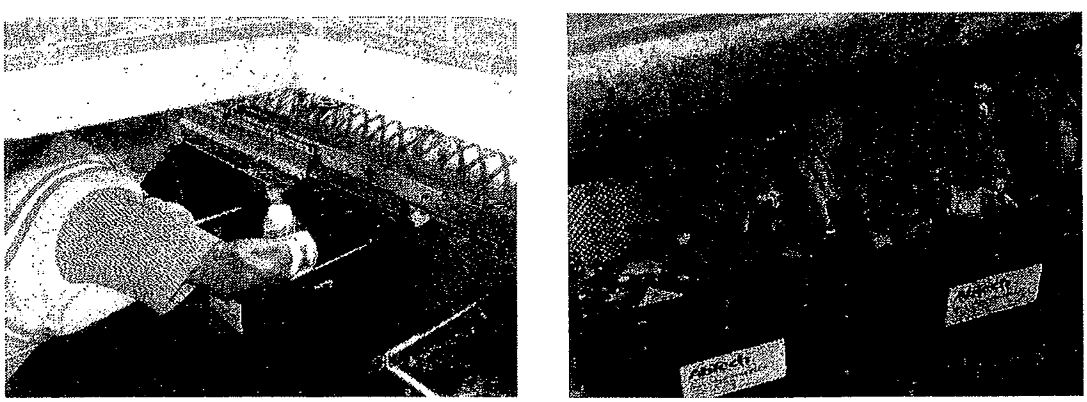
Smart Sponge® Plus laboratory efficiency testing has verified its micro biostatic effectiveness on several microorganisms, including E.coli (see example, Figure E).

Microbiological Analysis	
AbTech Smart Sponge® Plus	Bacterial Reduction (%) 1 hour
ACX10P-Plus-AEG	>99.99%
ASTM E2149-01 "Dynamic Shake Flask"	1 g sample 50 ml 0.3 mM KH_2P-+O_4 solution 1x10^5 E.coli/ml 0.01% Q2-5211 wetting agent

Figure E

Project Description

Following laboratory validation, AbTech Industries pursued field validation for the Smart Sponge® Plus technology. While many test markets are available, Southern California is considered the most critical – for economic impact and profile. AbTech, in cooperation with its California Distributor, Asbury Environmental Services, contacted several municipalities and selected many sites in Los Angeles County and Orange County to be retrofitted with our catch basin inserts, i.e. UUF® Plus. Installation began in mid 2003 and testing subsequently started.



Southern California Antimicrobial UUF Installation

All selected sites were in critical locations regarding downstream effect on the local watershed.

Protocol

Reliable field data in Stormwater applications is difficult to obtain due to difficult sampling and unpredictable rain events. Additionally, when dealing with microorganisms, sampling and counting at street level has always been very complicated due to multiple contamination possibilities and sources. A detailed protocol was developed, in cooperation with Asbury Environmental Services and LA City, Dept of Public Works/Sanitation (see Attachment I: Testing Protocol). Microbial reduction efficiency was measured on "Coliforms and Enterococcus" as they are the standard microorganisms monitored by Municipalities, Counties and States in assessing water quality.

Field Results

Below is a summary table of the first group of tests performed on the UUF® Plus in the second half of 2003.

Location	Sample No.	Sampling Event D=Dry W=Wet	Contaminant Type	Influent Concentration (CFU/100 ml)	Effluent Concentration (CFU/100 ml)*	Reduction Rate (log)	Reduction %
1	1	D	Total coliform	1.64×10^6	2×10^4	2	>98
			Enterococcus	8×10^5	ND**	>4	>99
	2	D	Total coli form	3×10^3	ND	>2	>98
			Enterococcus	6×10^2	ND	>1	>90
	3	D	Total coli form	1.3×10^4	ND	>3	>99
			Enterococcus	1.3×10^5	ND	>4	>99
2	1	D	Total coli form	7×10^2	ND	>1	>90
			Enterococcus	1.5×10^4	4×10^3	1	>70
	2	D	Total coli form/ E.coli	7.2×10^3	ND	>2	>99
			Enterococcus	1×10^3	ND	>2	>95
	3	D	Total coli form	4.1×10^4	ND	>3	>99
			Enterococcus	5×10^3	ND	>2	>98
3	1	D	Total coli form	1.3×10^2	ND	>1	>60
	2	D	Enterococcus	1×10^3	ND	>2	>95
4	1	D	Total coli form	1.7×10^6	5×10^2	4	>99
	2	D	Total coli form/ E.coli	1.3×10^5	ND	>4	>99
			Enterococcus	1×10^3	ND	>2	>95

- *Detection limit = 100 cfu/100 mil
- **ND = Non Detect (below 100 cfu/100 mil)

This table evidences that reduction efficiency is consistent for all samples and various contaminant levels. These data confirm the outcome in laboratory testing as well as work done in other fields with the same antimicrobial agent.

Conclusions

Laboratory and field testing have demonstrated the Smart Sponge® Plus capability to reduce the microbial contamination of Stormwater runoff. Extensive deployment of the UUF® Plus throughout the entire watershed will result in substantial water quality improvement and reduce the impairment of affected waterways, thus restoring the economic vitality of tourism in recreational areas.

Attachment I
Testing Protocol

1. Sampling Procedure

This sampling program is aimed at determining the amount of bacterial pollutants flowing through the storm drains identified for this pilot study. Samples will be collected and tested for the following pollutants of concern: bacteria. This procedure is written for individuals who are familiar with good laboratory practices regarding sample collection, handling and delivery.

a. When a rain event is expected, AES Sampling Coordinator will notify personnel assigned to sample collection and inform them of possible sampling.
b. The lab will be notified by AES that samples may be delivered within 6 hours for lab analysis and request that samples will be processed within 2 hours of receipt.
c. As the storm approaches, personnel will report to the site in preparation for the first flush.
d. Once there is flow, first flush samples will be collected from the inlet and outlet points three times during the first flush (0:00, 0:15, 0:30). The effluent sample will be collected at one (1) thru three (3) minutes after collecting the influent Sample. Refer to the table below for sampling schedule:

Time	Container Type	Sample Volume	Constituents
Start of runoff 0:00	Plastic	125 ml	Fecal Coliform; E. Coli; Enterococcus

Sampling to be repeated according to the above schedule at, 0:15, 0:30, 1:00, 1:30, 2:00, 2:30 (depending on the actual rain duration).

e. At the inlet point, samples are to be scooped off from the gutter runoff prior to entering UUF®. At the outlet point, after the runoff passes through the UUF® and filter units, grab samples will be collected by hand within one minute of the influent sampling.
f. Samples to be labeled with date, time, location, and constituents.
g. Samples should be stored in the ice chest, packed with ice, and delivered along with the chain of custody to the Laboratory.

2. Equipment

a. Vehicle
b. Disposable gloves
c. Ice chest
d. Ice (necessary to transport sample at 4°C.)
e. Sampling bottle for indicator bacteria (125-mL, autoclaved)
f. Sampling labels
g. Field collection sheet
h. Indelible marker
i. Nylon rope (25 ft. of 1/8 in. line)
j. Sampling weight (4-8 oz.)

3. Sampling Location

Manual sampling will be performed for the collection of bacteria samples. Grab samples will be collected from the incoming surface flow prior to contact with Smart Sponge® polymer and effluent flow after contact with treatment unit. The influent flow will be collected with a sterilized plastic bottle. The effluent sample will be collected from a downstream manhole with a sampling pole. The laboratory bottle will be attached to the sample pole and lowered into the drain for effluent collection. Traffic control must be set up prior to opening the maintenance hole cover. Follow all safety rules when working around the open maintenance hole.

4. Scheduling the coordination of resources for proper sample receiving and testing.

Sample arrival times should be arranged to allow enough time for lab personnel to begin the Idexx Quanti-tray testing for total coliform, E-Coli, and Enterococcus.

5. Sampling

Sampling should be conducted from the street level or in the drain depending on the drain size. Sampling individuals must handle all sample bottles carefully to avoid cross-contamination. When on-site, the general plan for sampling a drain is:

a. Label the bottles with the waterproof labels using an indelible marker.
b. Collect grab sample bacterial testing:
   - Use the nylon line and sampling weight to make a rope loop around the 125-mL sampling bottle for lowering into the wet well. The weight is necessary to overcome the buoyancy of the empty bottles.
   - Record collection time.
   - Place sample on ice in ice chest.
c. Deliver samples for laboratory testing:
   - Drive to the EMD Microbiology Lab:
   - Relinquish samples to lab personnel with the appropriate signatures at the bottom of the field collection sheet.
   - Leave the signed field collection sheet with lab personnel for sample login and tracking.
   - Fill out Chain of Custody (COC) form.
   - For bacterial testing, request that the 125-mL bottle be tested for total coliform, E-Coli, and Enterococcus using the Chromogenic method within 2 hours of receipt of sample.

6. Dry weather sampling

Simulated dry weather sampling may be necessary during this period in order to reach a statistically meaningful number of samples. A flow rate of thirty gallons (30/gallons per minute) shall be maintained through out the sampling process and all sampling bottles should contain a de-chlorinating agent.

7. Safety

When sampling, be alert to the potential dangers around you. Pay attention to your footing. Use common sense when determining whether a sampling situation is safe or not. If conditions are not safe, do not sample the site. Record this information on the field collection sheet.

8. Maximum Number of Events

A maximum of 12 rainfall events may be sampled. The rainfall depth for the event, measured at the site, must be greater than 0.25 inches. Grab samples will be collected for both the influent, and the effluent over the duration of the runoff event. There shall be a minimum of 72 hours between qualified sampling events. Rain events that are considered for sampling are: 1) if 0.25 inch of rain or greater is predicted, and 2) if there is a dry period of at least 72 hours preceding the rain event to increase the likelihood that pollutant levels would be detectable.

9. Decontamination

Decontamination of the sampling equipment will be necessary so that no residual concentrations of contaminants exist within sample bottles and other equipment. Use sterilized bottles.

Report

Hydrocarbon removal efficiency by AbTech Industries, Inc. Ultra-Urban® Filter in simulated stormwater runoff conditions

Prepared by:

Millsaps College Sorbent Laboratory

Allen Johnson
Allison Williams
Katrina Byrd
Stan Galicki, Ph.D.

November 21, 2003

Introduction

Regulations intended to reduce the amount of pollution discharged into rivers and wetland areas have been in place for almost 40 years. Issues related to the discharge of contaminant laden stormwater runoff are increasingly receiving attention from regulatory agencies and the public. Oil, grease, and other hydrocarbons are a major contaminant of stormwater and can be transported in suspension or attached to sediment particles. According to the National Research Council May 2002 Report, over 15,000,000 gallons of oil is discharged into the ocean each year from North American street runoff and wastewater operations. Per the University of Maryland Cooperative Extension Service (CES) 1987 Report, one quart of oil can contaminate up to 250,000 gallons of drinking water.

Objective

AbTech Industries, Inc. in Scottsdale, Arizona manufactures a catch basin insert (Ultra-Urban® Filter) which is designed to qualify as a stormwater Best Management Practice (BMP) device for the removal of oil, grease, and trash from stormwater. It is an industry accepted concept that the "First Flush" (first 10%) of urban stormwater runoff carries over 90% of the pollutants. The Ultra-Urban Filter, featuring the proprietary media Smart Sponge®, is the only catch basin insert that effectively filters all runoff passing through it. AbTech contacted the Millsaps College Sorbent Laboratory and requested independent testing of the Ultra-Urban Filter's hydrocarbon removal capability. The objective of the research conducted at the Millsaps College Sorbent Laboratory was to evaluate the efficiency of the Ultra-Urban Filter Series in removing hydrocarbons from stormwater runoff.

Methods

Testing was conducted in October and November 2003 on a flume constructed at the Millsaps College Sorbent Laboratory in Jackson, Mississippi. The flume was designed specifically to evaluate the efficiency of the UUF for removing contaminants from stormwater (**Figs. 1 and 2**). The tank has a maximum capacity of 275 gallons and is capable of discharge rates ranging up to 130 gallons per minute (gpm).

Figure 1 - Tank and flume system with Ultra-Urban Filter in place.

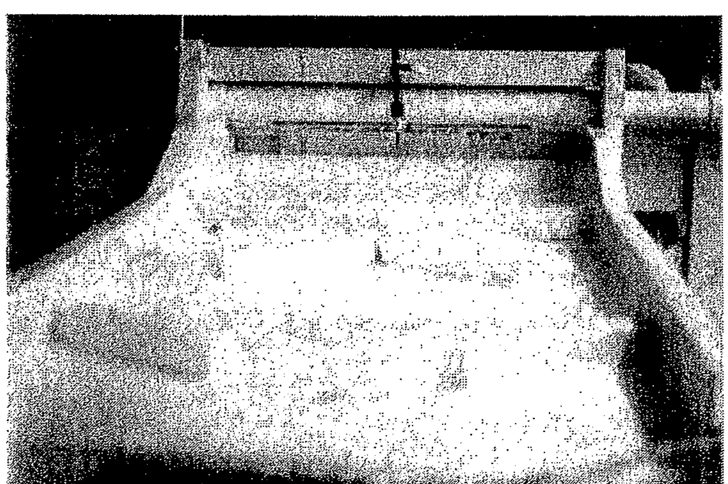


Figure 2 - Flume in operation at 22 gpm discharge. Note oil stain on side of flume and in the center foreground of photograph. System was thoroughly cleansed between tests.

The Ultra-Urban Filter model chosen for this test was the most widely used model; the CO1414. Four slightly different versions of the CO1414 were used and they are identified as 1) NS; 2) NHD; 3) NL1; and 4) NL2. Each model was the standard size (14"x14"x19") and was lined with Smart Sponge on all filtering surfaces. Each filter was evaluated at flow rates of 6 and 22 gpm with inflow hydrocarbon concentrations varying from 15 ppm to 526 ppm. As a reference, a storm event producing ¾" per hour of precipitation will runoff at a rate of 5.7 gpm per acre through a single drain. The flume table, stainless steel troughs, intake assemblies, and hoses were cleansed following each test. All surfaces were wiped with a polypropylene sorbent pad and flushed with clean water. The hoses were flushed with soapy water followed by fresh water.

Flow tests were conducted over a four-minute period with sampling taking place for 15 sec. each minute. Tests were conducted at flow rates of 6 and 22 gpm. Two, one liter samples (one inflow and one outflow) were taken by an SS201 Global Stormwater Sampler directly into amber colored glass bottles. The sample of the inflow water stream was taken from a 14" stainless steel trough mounted at the end of the flume table just above the mouth of the UUF (**Fig. 3**). The outflow sample was taken from a similar trough placed below the UUF. A galvanized metal diversion plate was used to direct all outflow through the trough. Two replicates were done at each flow rate and the results averaged. The hydrocarbon removal efficiency during each test was calculated as the percentage of the hydrocarbon removed from the simulated stormwater runoff. All results and average efficiencies are reported in Tables 1 through 4 at the end of this report.

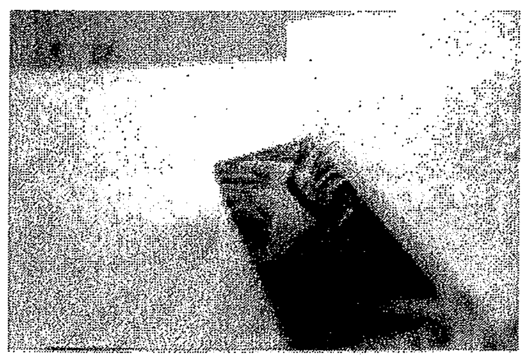


Figure 3 - Stainless steel sampling trough at end of flume. Foam in trough is test hydrocarbon mix.

The contaminant used was a 50/50 mixture of #2 diesel fuel and used motor oil. Tests were done using two different volumes of the oil mix (either 25 ml or 50 ml) dispensed into a pool created at the head of the flume from a 50 ml burette (**Fig. 4**). The rate of the contaminant was regulated manually so that it was dispensed over the entire test period. A total of 16 tests using the contaminant were conducted on each filter (2 replicates at each of the flow rates and concentrations). The final test on each filter was done using only water at 22 gpm. The flush test was done to check for possible contamination in the system and also as a reference for identifying the potential for leaching of hydrocarbons from the filter. Sample analysis was done by Argus Laboratories in Jackson, Mississippi using EPA Method 1664A. The limit of detection for the Oil and Grease determination is 2.0 ppm.

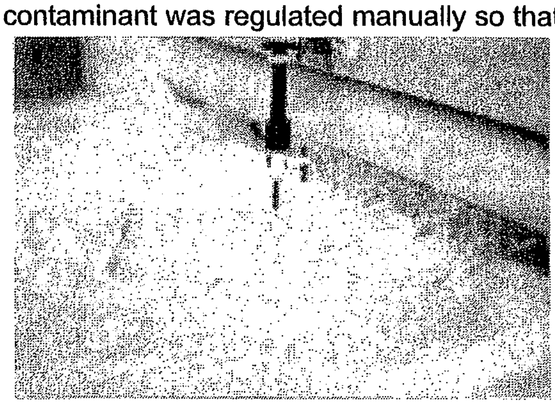


Figure 4 - Burette discharging used motor oil/diesel mix into 22 gpm flow.

Results

Individual test results based on flow rate are displayed in Tables 1 through 4. The limit of detection is 2.0 ppm. Regardless of hydrocarbon concentration or flow rate, hydrocarbon removal efficiency of the models tested ranged from 71% to 98% with an average of 84%.

Figure 5
Inflow Concentration vs. Removal Efficiency

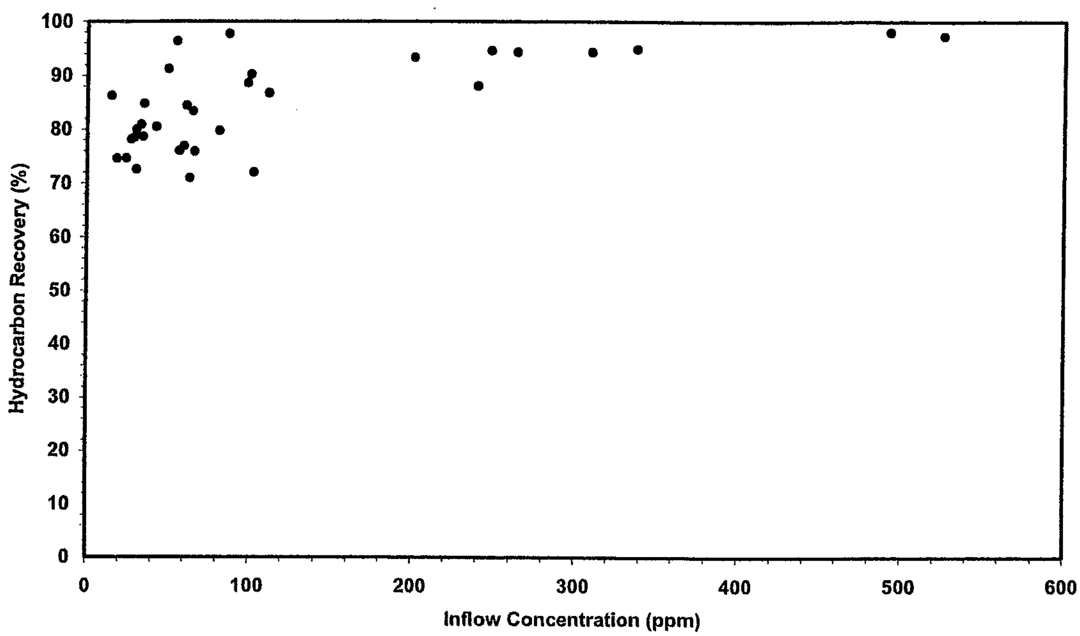


Figure 5 above displays the inflow concentration versus hydrocarbon removal efficiency for all 32 tests conducted. The trend displayed by the data indicates increased efficiency at higher inflow concentrations. The average removal efficiency for inflow concentrations under 100 ppm is 81%, and the average removal efficiency for inflow concentrations over 100 ppm is 91%.

Figures 6a and 6b below are the inflow concentration versus removal efficiency for tests done at 6 and 22 gpm respectively. The average removal efficiency was 89% at a discharge rate of 6 gpm (17-526 ppm range; 195 ppm avg.) and 82% at a discharge rate of 22 gpm (15-87 ppm range; 42 ppm avg.).

The flush tests conducted during the course of the experiment indicated inflow contamination values not exceeding 5.0 ppm; all outflow values were below the detection limit.

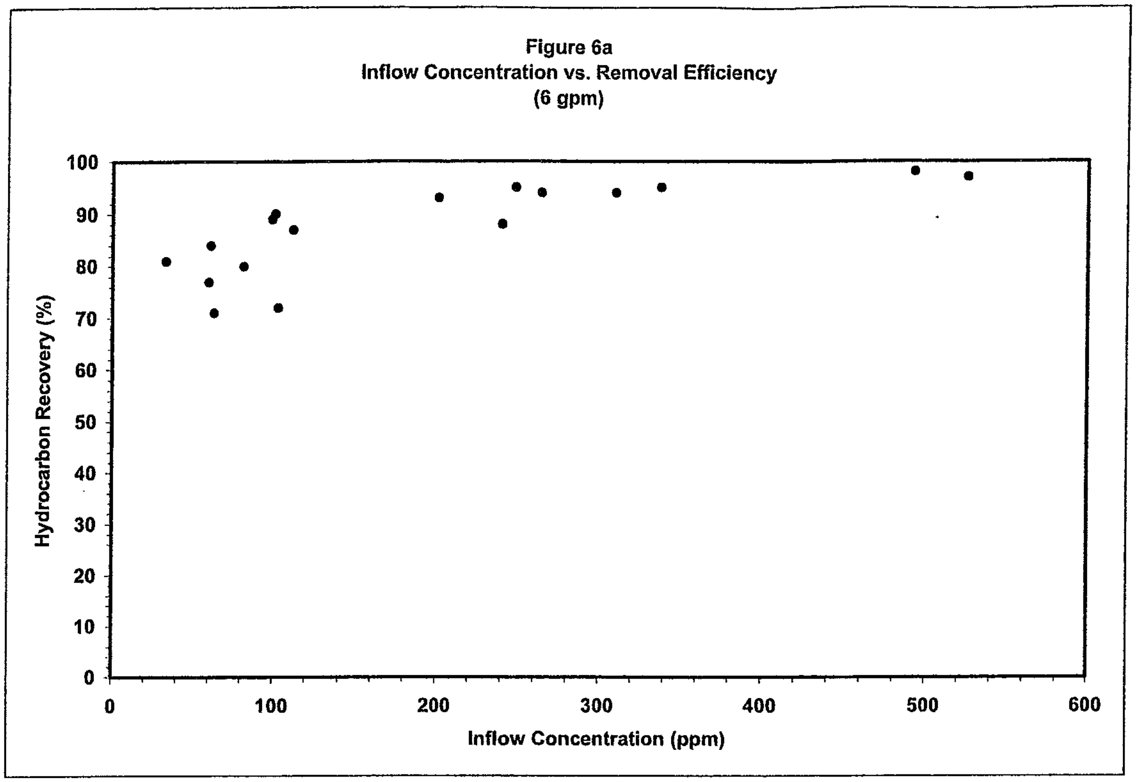


Figure 6a
Inflow Concentration vs. Removal Efficiency
(6 gpm)
Hydrocarbon Recovery (%)
Inflow Concentration (ppm)
0
10
20
30
40
50
60
70
80
90
100
0
100
200
300
400
500
600

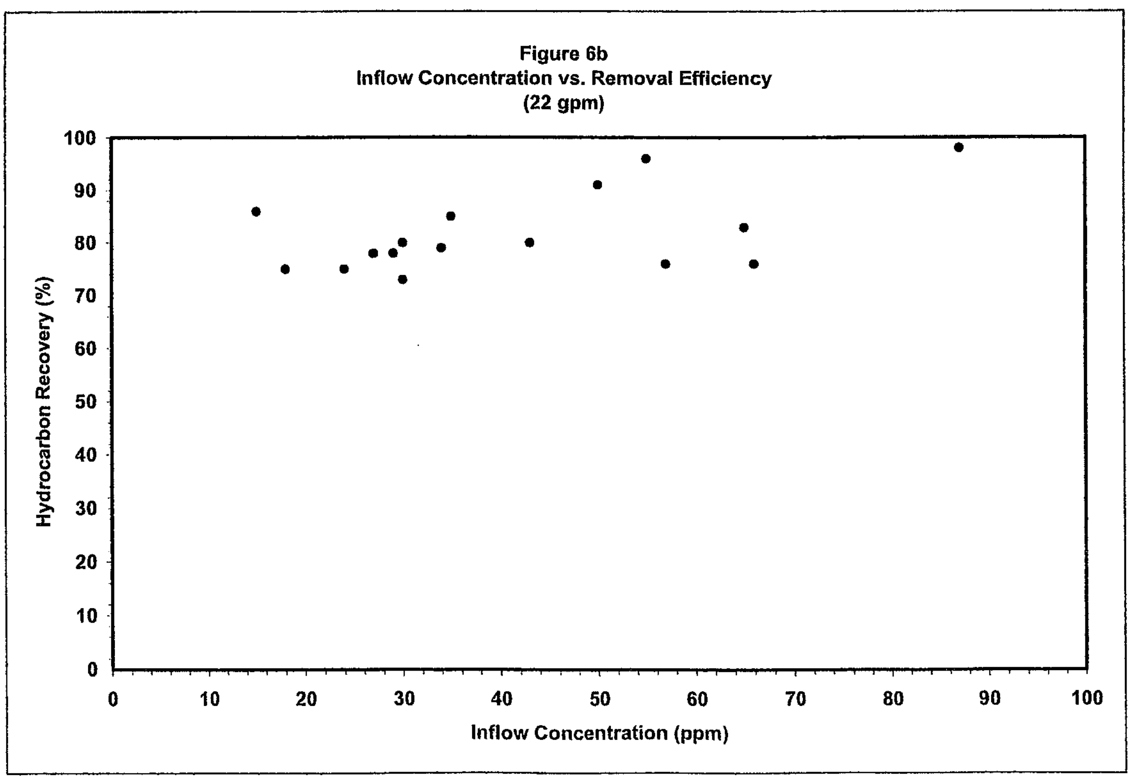


Figure 6b
Inflow Concentration vs. Removal Efficiency
(22 gpm)
Hydrocarbon Recovery (%)
Inflow Concentration (ppm)
0
10
20
30
40
50
60
70
80
90
100
0
10
20
30
40
50
60
70
80
90
100

Discussion

The UUF models evaluated effectively remove between 80 and 91% of the hydrocarbons from simulated stormwater runoff under varying inflow concentrations and flow rates. While the sediment retention capability of the UUF has been documented, tests using both hydrocarbons and sediment combined have not. The removal of contaminant-scavenging fine-grained sediment, such as clays, from runoff should only increase the UUF's overall efficiency.

Although the average concentration of hydrocarbons in stormwater is normally below 100 ppm, testing indicates that the filters in the UUF series are capable of removing hydrocarbon concentrations of over 500 ppm in simulated runoff conditions.

Additionally, outflow hydrocarbon concentration values below the detection limit (2.0 ppm) in flush tests are indicative of the Smart Sponge's non-leaching characteristics. Oil sorbents that are true "absorbents" incorporate hydrocarbons into the structure of the material, whereas adsorbents simply attract hydrocarbons to exterior surfaces. As indicated in testing, absorption inhibits the re-release of captured hydrocarbons during subsequent storm events.

Tables

AbTech UUF, Table 1
UUF CO1414 NS

Millsaps Sample ID	Argus ID	Rate (gpm)	Oil/Diesel Added (ml)	Oil & Grease (ppm)	Oil Removed (%)	**Average Oil Removed (%)**
AT-110103-38I	BB59437	6	25	112	87	
AT-110103-38O	BB59438			14.8		
AT-110103-39O	BB59439	6	25	99	89	**88**
AT-110103-39O	BB59740			11.3		
AT-110103-42I	BB59444	6	50	526	97	
AT-110103-42O	BB59445			14.1		
AT-110103-43I	BB59446	6	50	264	94	**96**
AT-110103-43O	BB59447			15		
AT-110103-44I	BB59448	22	25	34.8	85	
AT-110103-44O	BB59449			5.3		
AT-110103-45I	BB59450	22	25	28.8	78	**82**
AT-110103-45O	BB59451			6.2		
AT-110103-40I	BB59441	22	50	87	98	
AT-110103-40I	BB59442			10.2		
AT-110103-41I	BB59443	22	50	54.9	96	**97**
AT-110103-41I	BB59454			9		
AT-110103-46I	BB59452	22	0	3.8		**No Contamination**
AT-110103-46O	BB59453			ND		

The sample numbers are AT for AbTech, the date, test #, then "I" for inflow and "O" for outflow.
ND=Below the detection limit of 2 ppm

AbTech UUF, Table 2
UUF CO1414 NHD

Millsaps Sample ID	Argus ID	Flow Rate (gpm)	Oil/Diesel Added (ml)	Oil & Grease (ppm)	Oil Removed (%)	**Average Oil Removed (%)**
AT-112403-54I	BB60795	6	25	63.2	71	
AT-112403-54O	BB60796			18.2		
AT112403-55I	BB60797	6	25	103	72	
AT112403-55O	BB60798			28.5		
AT-101403-12I	BB58650	6	25	59.7	77	**74**
AT-101403-12O	BB58651			13.8		
AT-101503-13I	BB58652	6	50	310	94	
AT-101503-13O	BB58653			17.5		
AT-101503-14I	BB58654	6	50	493	98	**96**
AT-101503-14O	BB58655			11.2		
AT-101503-15I	BB58656	22	25	18.1	75	
AT-101503-15O	BB58657			4.6		
AT-102003-16I	BB58791	22	25	14.6	86	**80**
AT-102003-16O	BB58792			3.8		
AT-102003-17I	BB58793	22	50	27	78	
AT-102003-17O	BB58794			5.9		
AT-102003-18I	BB58795	22	50	42.5	80	**79**
AT-102003-18O	BB58796			8.3		
AT-102003-19I	BB58797	22	0	ND		**No Contamination**
AT-102003-19O	BB58798			ND		**No Leaching**

The sample numbers are AT for AbTech, the date, test #, then "I" for inflow and "O" for outflow.
ND=Below the detection limit of 2 ppm

AbTech UUF, Table 3
UUF CO1414 NL1

Millsaps Sample ID	Argus ID	Rate (gpm)	Oil/Diesel Added (ml)	Oil & Grease (ppm)	Oil Removed (%)	**Average Oil Removed (%)**
AT-102803-29I	BB59189	6	25	101	90	
AT-102803-29O	BB59190			9.89		
AT-102803-30I	BB59191	6	25	61.3	84	**87**
AT-102803-30O	BB59192			9.56		
AT-102803-31I	BB59193	6	50	201	93	
AT-102803-31O	BB59194			13.4		
AT-102803-32I	BB59195	6	50	248	95	**94**
AT-102803-32O	BB59196			13.3		
AT-102903-33I	BB59219	22	25	30.2	80	
AT-102903-33O	BB59220			6		
AT-102903-34I	BB59221	22	25	34.2	79	**79**
AT-102903-34O	BB59222			7.3		
AT-102903-35I	BB59223	22	50	49.6	91	
AT-102903-35O	BB59224			4.33		
AT-102903-36I	BB59225	22	50	65.1	83	**87**
AT-102903-36O	BB59226			10.8		
AT-102903-37I	BB59227	22	0	4.9	Flush	**4.9 PPM INFLOW**
AT-102903-37O	BB59228			ND		**No Leaching**

The sample numbers are AT for AbTech, the date, test #, then "I" for inflow and "O" for outflow.

ND=Below the detection limit of 2 ppm

AbTech UUF, Table 4
UUF CO1414 NL2

Millsaps Sample ID	Argus ID	Rate (gpm)	Oil/Diesel Added (ml)	Oil & Grease (ppm)	Oil Removed (%)	**Average Oil Removed (%)**
AT-102203-20I	BB58835	6	25	33	81	
AT-102203-20O	BB58834			6.3		
AT-102203-21I	BB58837	6	25	81.5	80	**80**
AT-102203-21O	BB58836			16.5		
AT-102203-22I	BB58839	6	50	338	95	
AT-102203-22O	BB58838			17.2		
AT-102603-23I	BB59056	6	50	240	88	**91**
AT-102603-23O	BB59057			28.6		
AT-102603-24I	BB59058	22	25	23.8	75	
AT-102603-24O	BB59059			6.04		
AT-102603-25I	BB59060	22	25	30.08	73	**74**
AT-102603-25O	BB59061			8.24		
AT-102603-26I	BB59062	22	50	56.8	76	
AT-102603-26O	BB59063			13.6		
AT-102603-27I	BB59064	22	50	66.1	76	**76**
AT-102603-27O	BB59065			15.9		
AT-102603-28I	BB59066	22	0	4.1	Flush	**4.1 PPM**
AT-102603-28O	BB59067			ND		**No Leaching**

The sample numbers are AT for AbTech, the date, test #, then "I" for inflow and "O" for outflow.

ND=Below the detection limit of 2 ppm

MILLSAPS COLLEGE

Final Report: Sediment Removal from Stormwater Runoff by AbTech Industries, Inc. Ultra-Urban® Filter Series in Laboratory Flume Tests

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June 31, 2003

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Introduction

Regulations intended to reduce the amount of pollution discharged into rivers and wetland areas have been in place for almost 40 years. Issues related to the discharge of contaminant laden stormwater runoff are increasingly receiving attention from regulatory agencies. Sediment is a major component of stormwater and can be transported in suspension (suspended load) or along the bottom of the channel (bed load). Although clay particles in suspension can scavenge and adsorb contaminants, and are easily transported, both loads have the potential to cause environmental problems in freshwater and marine ecosystems. The volume of sediment in suspension is related to the flow rate, or discharge capacity, and velocity of water in the stream, channel, culvert, sewer line, parking lot, or roadside gutter.

AbTech Industries, Inc. in Scottsdale, Arizona manufactures a catch basin insert (Ultra-Urban® Filter) which is designed to qualify as a stormwater Best Management Practice (BMP) device for the removal of oil, grease, and trash from stormwater. AbTech contacted the Millsaps College Sorbent Laboratory and requested independent testing of the Ultra-Urban Filter's potential for sediment removal. AbTech provided two generations of the Ultra-Urban Filter and an experimental prototype for testing. The objective of the research conducted at The Millsaps College Sorbent Laboratory was to evaluate the potential of the 14" Ultra-Urban Filter Series for removing sediment from stormwater runoff.

In an effort to establish protocol for emerging stormwater treatment technologies the Washington State Department of Ecology has published "Guidelines for Evaluating Emerging Stormwater Treatment Technologies" (July 2002). The most recent edition requires that 80% of suspended solids should be removed from stormwater with total suspended solid concentrations less than 200 mg/l. The Washington State Department of Ecology recommended that laboratory based sediment removal tests be conducted using U.S. Silica's Sil-Co-Sil 106 ground silica product. This product was chosen because of its similarity to the particle size distribution of sediment in western Washington area stormwater.

Tests conducted at Millsaps used the Sil-Co-Sil 106 ground silica but in order to provide a wider perspective and basis for comparison, a local, readily available and popular fill material from central Mississippi was also selected. The particle size distribution for the Red Sand is considerably different from Sil-Co-Sil with a greater percentage of coarse particles as displayed in **Fig. 1**. The particle size distribution for each material tested is listed in Appendix A (p. 1). Two samples of Red Sand were used and are designated Red Sand I and II. Although the particle sizes are similar, Red Sand I contains a greater percentage of the coarsest (0.212 mm) fraction.

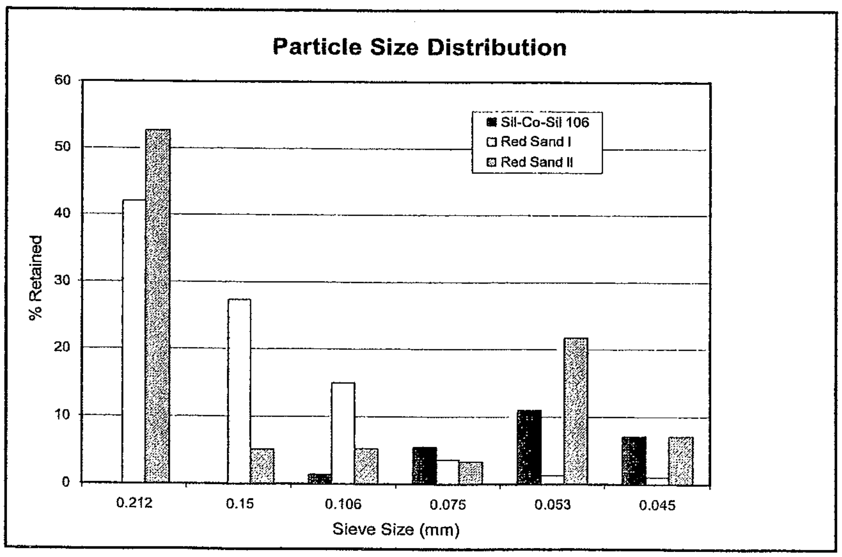


Figure 1. Particle Size Distribution for Sil-Co-Sil, Mississippi Red Sand I and Mississippi Red Sand II. Graph displays the particle size in millimeters retained on each sieve.

Testing was conducted in May, June, and July 2003 on a flume constructed at the Millsaps College Sorbent Laboratory in Jackson, Mississippi which was designed specifically to evaluate the efficiency of the Ultra-Urban Filter for removing sediment from stormwater (**Fig. 2**). The tank has a maximum capacity of 275 gallons and is capable of discharge rates ranging up to 130 gallons per minute (gpm) (**Fig. 3**). The tests were conducted on the 14" Ultra-Urban Filter Series which consists of the following units:

1) CO 1414 - Old Generation
2) CO1414N - Current Generation (**Fig. 4**)
3) CO1414NS - Experimental Prototype

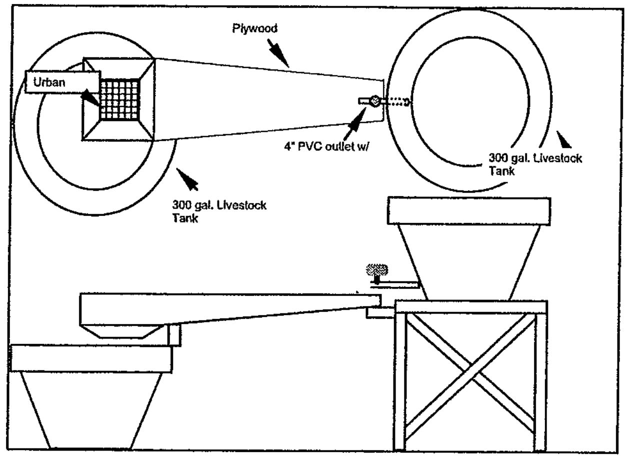


Figure 2. General plan of flume for Urban Filter testing.

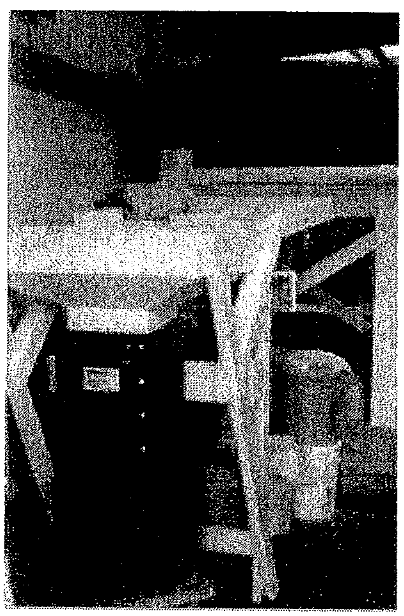


Figure 3. Tank and flume table with Ultra-Urban Filter in place. Small diameter PVC pipe with 90° bend

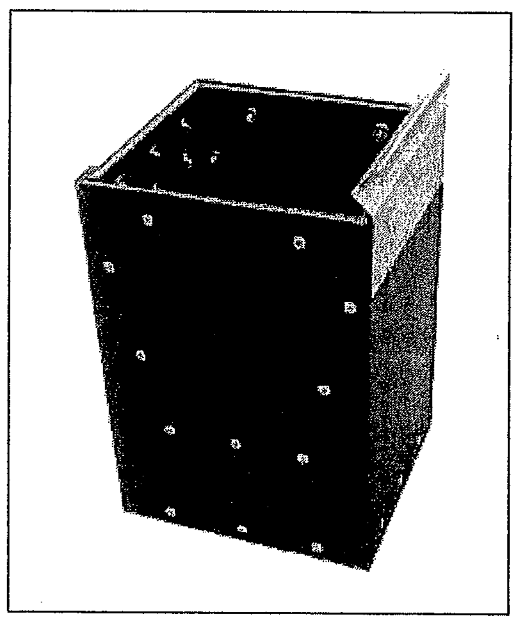


Figure 4. AbTech Ultra-Urban® Filter CO1414N

An additional series of tests, done only on the CO1414N, were devised to simulate sediment build up in field conditions allowing insight as to how sediment removal efficiency and flow capacity change with sediment accumulation in the unit.

Methods

Tests were conducted at flow rates ranging from 6 to 113 gpm and inflow suspended sediment concentrations ranging from 197 to 548 ppm. To maintain dispersal of the Sil-Co-Sil 106 a submersible electric pump was placed in the tank (**Fig. 5**). All tests were run at similar flow settings to facilitate comparison of removal efficiency. Two 1-liter samples were taken during each run, the inflow sample was taken through a port placed on the flume just before the water flows into the filter; the effluent was sampled at the discharge pipe. The test number, date, flow rate, and total discharge were noted on the label.

Figure 5. Photograph of tank with pump on maintaining sediment in suspension

Samples were taken to the lab where the concentration of total suspended solids (TSS) was calculated gravimetrically. During continuous agitation using a magnetic stirrer, three - 100 ml volumes were extracted from each bottle using a pipette and dispensed into pre-weighed beakers. The beakers were then placed into a laboratory oven set at 90° C to evaporate the water overnight. The difference in weight between the inflow and outflow sample was calculated as the amount of sediment removed from the test stream per 100 ml. The raw data from each test is provided at the end of this report in Appendix A (p. 2-15); a summary of results are presented in Tables 1, 2, and 4 for the Sil-Co-Sil, Red Sand, and Sediment Accumulation tests respectively.

In tests using the Red Sand a slight alteration to the protocol was necessary. Because the Red Sand could not be kept in suspension in the supply tank it was added to the flume table at the point of water release. Approximate 2.2 kg samples of the Red Sand were sifted into the discharge at the head of the flume table during release. Even at the lowest flow rate (6 gpm) the water readily moved the sand off the flume. One-liter samples were collected as previously described; however, the analysis was different. Each 1-liter bottle was filtered through Fann Hardened Filter Paper (2-5 micron pass range) using a Millipore vacuum filtration system. The filter cake and pre-weighed paper were placed in a laboratory oven overnight to dry and were then weighed. The sediment retention was calculated as a percent of the material removed as indicated by the difference between the final weight and the initial weight.

Results

<u>Retention tests with Sil-Co-Sil</u>

In the first series of tests the CO1414 filter's potential for the removal of Sil-Co-Sil was evaluated at seven flow rates ranging from 6 to 113 gpm with TSS values ranging from 197 to 548 ppm. As summarized in **Table 1** the filter was capable of removing up to 11% of the TSS in the flow stream. The "NA" reported for the 42.5 and 50 gpm tests are the result of higher TSS values detected in the discharge flow stream than in the inflow stream and are invalid. This is possible because the filter was not changed between each test. The unit was rinsed; however, material not rinsed free could have become dislodged during successive test runs. It is also possible that the range in precision of the gravimetric technique is greater than the amount removed from the flow stream.

The second series of tests were conducted using Sil-Co-Sil and the CO1414N filter. Six flow tests were conducted with discharge ranging from 6 to 81 gpm and TSS ranging from 242 to 526 ppm. As summarized in Table 1, the filter removed up to 42% of the TSS with the greatest efficiency at a discharge of 6 gpm. Again the results were inconclusive at 42.5 and 62.5 gpm tests. Other tests ranged between 7 and 10 % TSS removal.

Table 1 Sil-Co-Sil

Rate	CO1414	CO1414N	CO1414NS
(gpm)		% Removed	
6	5.2	42.2	12
13	9.8	6.7	4
34	10.7	10.1	2
42.5	NA	NA	NA
62.5	NA	NA	6
81	3.1	7.3	6
113	9.5	ND	ND

ND = No Data NA = Not Applicable

The final series of tests using Sil-Co-Sil were on the experimental prototype CO1414NS filter. Inflow TSS concentrations ranged from 312 to 530 ppm. As summarized in Table 1 the retention rates ranged up to 12% with the greatest retention at the 6 gpm rate. No test on the 113 gpm setting was conducted and the retention values at 42.5 gpm were negative.

<u>Retention tests with Red Sand</u>

Only the CO1414N and CO1414NS filters were tested using the Mississippi Red Sand. As summarized in **Table 2** the retention values for Red Sand I are generally greater than Red Sand II. The tests done using Red Sand I are single runs; tests using Red Sand II are the average of two runs for each flow rate. The retention values ranged from a minimum of 35% to a maximum of 94% with no apparent correlation to flow rate. Both trials at 42.5 gpm for CO1414N were anomalously low relative to other flow rates; at present this cannot be explained. It is possible that current eddies on the flume table affect the volume of sediment entering the sampling port. Future tests will closely examine the hydraulics on the flume table. Based on these retention tests there does not appear to be an observed difference in performance difference between the CO1414N and CO1414NS filters. The average retention rate for the CO1414N was 83% for Red Sand I and 62% for Red Sand II. The average retention for the CO1414NS was 75% and 72% for Red Sand I and II respectively. The slightly greater retention values observed in tests using Red Sand I are attributed to the greater percentage of coarse particle sizes observed in that sand.

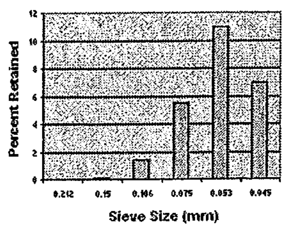
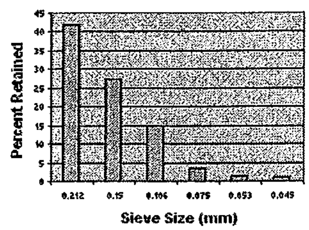
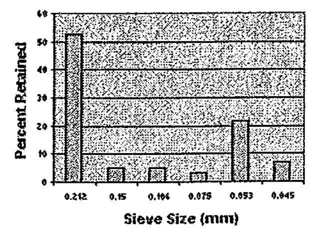
Table 2 Red Sand

	Red Sand I		Red Sand II	
Rate	CO1414N	CO1414NS	CO1414N	CO1414NS
(gpm)	% Removed		% Removed	
6	88	86	64	91
13	72	72	58	57
34	87	57	73	57
42.5	94	78	69	63
62.5	67	84	24	74
81	89	75	77	76
113	NA	NA	87	84
Average	**83**	**75**	**65**	**72**

Table 3 summarizes the results of using CO1414N using Sil-Co-Sil and Red Sand.

Table 3

Sediment Removal Rate with UUF CO1414N

<table>
<tr><td>Original Particle Size Distribution</td><td>Sil-Co-Sil 106
</td><td>Red Sand I
</td><td>Red Sand II
</td></tr>
<tr><td rowspan="8">Flow Rate (gpm)</td><td colspan="3">Removal Efficiency (Percentage)</td></tr>
<tr><td>6 42%</td><td>88%</td><td>64%</td></tr>
<tr><td>13 7%</td><td>72%</td><td>58%</td></tr>
<tr><td>34 10%</td><td>87%</td><td>73%</td></tr>
<tr><td>42 N/A</td><td>94%</td><td>69%</td></tr>
<tr><td>62 N/A</td><td>67%</td><td>24%</td></tr>
<tr><td>81 7%</td><td>89%</td><td>77%</td></tr>
<tr><td>113 N/A</td><td>N/A</td><td>87%</td></tr>
</table>

Sediment Accumulation Tests

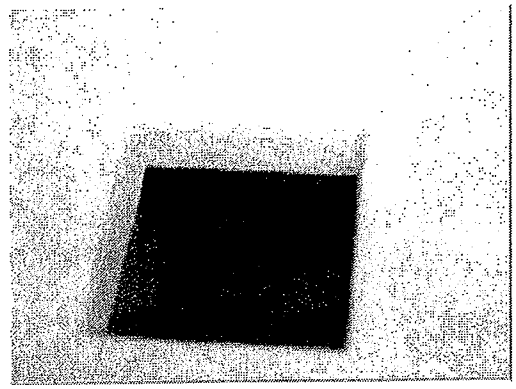


Figure 6. Perspective looking into Ultra Urban Filter filled with sand following test.

The sediment build up test using the CO1414N filter and Sil-Co-Sil 106 in suspension investigated the potential for TSS removal during sediment accumulation and also the change in discharge capacity with increased sediment. Washed play sand (83% greater than 0.25 mm) was used to fill the bottom of the filter to depths of 2", 4", 6", and 8" (**Fig. 6**). As the depth of the sand increased tests in the higher flow rates were eliminated because the capacity of the filter was exceeded (**Fig. 7**). Results are summarized in **Table 4**.

Tests conducted with 2" of sand used discharge values that ranged from 6 to 81 gpm with input TSS values between 338 and 489 ppm. TSS removal ranged from 8 to 42% with the most efficient removal at 6 gpm discharge. The percent of TSS removed at flow rates between 13 and 62.5 gpm averaged 22%.

Table 4
CO1414N: Sediment Build Up

2" Rate (gpm)	**% Retained**
6	42
13	22
34	27
42.5	12
62.5	29
81	8
4" Rate (gpm)	**% Retained**
6	32
13	21
34	22
6" Rate (gpm)	**% Retained**
6	26
13	20
8 "Rate (gpm)	**% Retained**
6	44

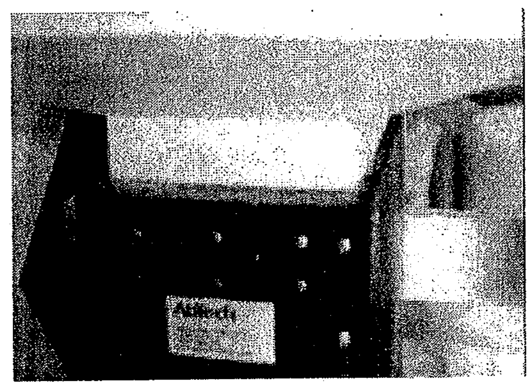


Figure 7. Overflow during sediment testing.

Tests using 4" of sand were conducted using discharge rates from 6 gpm to 34 gpm with TSS values of 242 to 385 ppm. Tests at higher flow rates exceeded the sanded filters capacity and were not recorded. The removal of TSS ranged from 21 to 32%. The TSS removal was again greatest at the lowest discharge. The 6" test was only conducted on the 6 and 13 gpm rates, TSS values were 325 and 386 ppm. The amount of TSS removed ranged from 20 to 26% with the greatest percentage again removed at the lowest flow rate. The last sediment test conducted was using 8" of sand. The discharge was limited to 6 gpm; the TSS was reduced by 44%.

Discussion

The Ultra-Urban Filter design does have capability to remove suspended solids from stormwater. In laboratory tests the Ultra-Urban Filter model CO1414N outperformed the CO1414 and CO1414NS filters when Sil-Co-Sil was the primary suspended solid. Although there was not a clear correlation between TSS removal and discharge the greatest retention of Sil-Co-Sil by the filters was observed at the lowest discharge rate tested (6 gpm); no relationship was observed between flow rate and retention using Red Sand. At 6 gpm the CO1414N filter removed up to 40% of the Sil-Co-Sil, which was the greatest observed in that test series. Because the Ultra Ultra-Urban Filter Series is a **flow through filter** the coarser particle sizes are selectively retained due to the pore throat size and packing of the Smart Sponge polymer as its filtration media.

The accumulation of sediment in the Ultra-Urban Filter appears to increase the removal of TSS from stormwater however the discharge capacity of the filter is ultimately compromised with increasing sediment depths. The greatest amount of TSS removed during testing was 44%, which was observed at 6 gpm with 8" of sediment in the filter; higher flow rates overflowed the filter.

The Ultra-Urban Filter was primarily designed to remove hydrocarbons from stormwater runoff; however, tests conducted at Millsaps College indicate that the filter does have the ability to remove suspended and coarser, bed load, sediment from stormwater runoff. The Sil-Co-Sil 106 ground silica may reflect the particle size distribution of the suspended fraction in stormwater runoff but its chemical behavior relative to contaminants is considerably different relative to the clay minerals typically suspended in natural waters. Tests using only the suspended ground silica proxy also do not address the removal of potentially harmful bed load sediments.

In tests using a locally available and popular construction fill material in Mississippi the Ultra-Urban Filter removed over 80% of the sediment from flow. In excess of 50% of the particles in the Red Sand were too large to remain suspended in the test tank but were readily transported across the flume and effectively removed from the flow stream.

The mechanical filtration of suspended solids presents a difficult engineering problem; filters capable of retaining fine sediment would ultimately compromise discharge capacity and would be prone to frequent plugging. It is critical in design and use to consider that to maintain optimal performance any mechanical device filtering sediment would require regular maintenance.

FIELD TEST RESULTS

Smart Sponge®
Ultra-Urban® Filter Catch Basin Insert

Selected Airport Operations Areas

Westchester County Airport
White Plains, NY

AVPORT

Prepared by:

AbTech
INDUSTRIES

4110 N. Scottsdale Road, Suite 235
Scottsdale, Arizona 85251
Tele: 800-545-8999FAX: 480-970-1665

May 30, 2003

Project Description:

AVPort operates and maintains the Westchester County Airport for the Westchester County Department of Transportation. As such they are active in participating with the Airport and Westchester County Department of Environmental Facilities in ensuring that the facilities are operated and maintained in compliance with various State and Federal regulations as well as utilizing industry Best Management Practices (BMPs). Following a review of various industry standards, AVPort and the Airport elected to evaluate the application of an innovative technology to improve the efficiency of their existing environmental protection and pollution prevention programs.

AVPort selected products from AbTech Industries to reduce the possibility of contamination of stormwater from ever-present hydrocarbons, reduce the quantity of sediment, trash and debris introduced into the Westchester County stormwater system and significantly improve the operation and efficiency of their Oil Water Separator (OWS). The Airport and AVPort selected AbTech New York to conduct and evaluate the project over a two year period.

The objective of the project is to allow the passing of surface water (stormwater) through the drains while preventing passing of hydrocarbons. An additional objective is to capture or minimize the amount of trash, sediment and debris that enters the Airport drainage system. There are multiple benefits to the successful application of these products; minimizing hydrocarbon contamination of stormwater, improving the efficiency of an installed OWS and reduction of maintenance and cleaning of an installed OWS are just a few.

After an initial survey, 17 drains inlets were selected as locations for catch basin inserts. The AbTech Ultra-Urban® Filter (UUF) catch basin inserts were installed in these selected drains (see attached Site Map). The performance of the products will be monitored and evaluated over a two-year period. Results will be reported and presented. Periodic replacement and inspection of the products will be necessary depending upon operational conditions and exposure to contaminated stormwater.

This report presents data from the first measurement and change out event of the drains (see results presented below).

Project Results:

The installation of UUFs occurred over an eight month period – between February 2002 and September 2002. During that time a total of 21 UUF's were installed in 17 drain inlets. Given the varied and unique sizes of the drains, installation included design and manufacture of customized mounting collars for each of the drain inlets. The mounting collars and respective UUFs (DI2020, DI1414, & DI1420 units) were installed by AbTech New York field crews with the assistance and oversight of AVPORT (Mike Parletta). Drains at the following Airport locations were protected with UUFs: DOT Yard, Terminal Area, Flight Line (east of the Deicing Pad area), Rental Car Parking Area, selected Parking Lot Areas, and the Castleton Fueling Area.

Fuel Spill Event Report

In February 2003, AVPort reported to AbTech New York a fuel spill adjacent to a catch basin. The fuel entered catch basin DI#6. Signature Flight Support conducts fueling on this portion of the flight line. Accompanied by Mr. Michael Parletta, a representative of AVPort, AbTech New York inspected the catch basin and removed and replaced the existing filter. The spent filter was taken to the Main DOT Garage Building #10 for examination.

The DI1420 filter was filled with snow and ice (the temperature on the day of the spill was approximately 20°F). The filter was placed in a plastic bag inside a plastic container and allowed to dry out and drain over a two (2) day period before being re-examined by AbTech New York. The filter weight was recorded at 67 lbs. (see attached photo). Between 3-4 gallons of residual fuel and water were noted as a result of the melted snow and ice collected in the bag.

The dry weight of a typical DI1420 is 23 lbs. The weight gain after capture of the jet fuel was approximately 43 lbs., which equates to approximately 6.76 gallons of fuel (estimated to be approximately 9 gallons including the fuel trapped in the snow and ice).

The results of this event clearly demonstrate the ability of the AbTech UUF to capture hydrocarbons effectively, as the Airport reported the size of this spill at an estimated 5 to 10 gallons.

Castleton OWS Drain Inspection

In April 2003, the unit at the Castleton OWS was inspected and replaced. The following results were noted:

Weight of the DI2020 as installed	34.00 lbs.
Weight of the DI2020 after 6 months	42.00 lbs.
Weight of the DI2020 after one year	121.40 lbs.
Weight of oil captured	73.20 lbs.
Gallons of oil captured at 6.7 lbs/gal	10.92 gal.
Sediment captured	14.20 lbs.

The Airport has experienced improved performance of the oil/water separator that is downstream of the UUF. The solids captured in the UUF were prevented from entering the separator. The separator has not required cleaning since the UUF was installed (approximately one year ago).

Program-wide Drain Inspection

In May 2003, all drain inlets with UUFs installed were inspected, weighed and either cleaned or replaced with new units installed. The results of this activity are presented below:

Number	UUF	UUF Weight (lbs.)	Total Weight w/ UUF (lbs.)	Solids Weight (lbs.)	Hydrocarbon Weight (lbs.)	Comments
1	DI1414	22.0	54.8	28.0	4.8	Terminal Area
2	DI2020 Dbl	68.0	466.3	337.5	60.8	Terminal Area
3	DI1420 Dbl	46.0	340.8	276.4	18.4	Terminal Area
4	DI1420	23.0	71.4	5.2	43.2	Flight line
5	DI1420	23.0	50.7	3.1	24.6	Flight line
6	DI1420	23.0	62.1	6.1	33.0	Flight line
7	DI1420	23.0	85.2	33.0	29.2	Flight line
8	DI1420	23.0	76.0	15.0	38.0	Flight line
9	DI1420	23.0	62.3	3.9	35.4	Flight Line
10	DI2020H Dbl	66.0	109.4	33.6	9.8	Hertz lot
11	DI1420 Dbl	46.0	100.2	44.3	9.9	Hertz lot
12	DI2020H	22.5	45.7	23.2	0.0	Parking lot
13	DI2020H	22.5	32.5	10.0	0.0	Parking lot
14	DI2020H	22.5	30.5	8.0	0.0	Parking lot
15	DI2020H	22.5	89.5	11.0	56.0	Parking lot
16	DI2020	34.0	126.2	2.2	90.0	Front of Bldg#10
Gas Pump	DI2020	34.0	121.4	14.2	73.2	Castleton
TOTAL				854.7	**526.3** *78.55 gals at 6.7 lbs/gal*	***Does not include Fuel Spill of 2/03***

Summary of Hydrocarbon Capture

Total volume of hydrocarbon from all UUF's including Fuel Spill and Castleton unit:

Total from Fuel Spill (2/03) (Includes UUF and residual from melt)	9.76 gals
Total from Castleton UUF	10.92 gals
Total from Inspection Survey (5/03)	78.55 gals
Total	**99.23 gals**

Results Summary

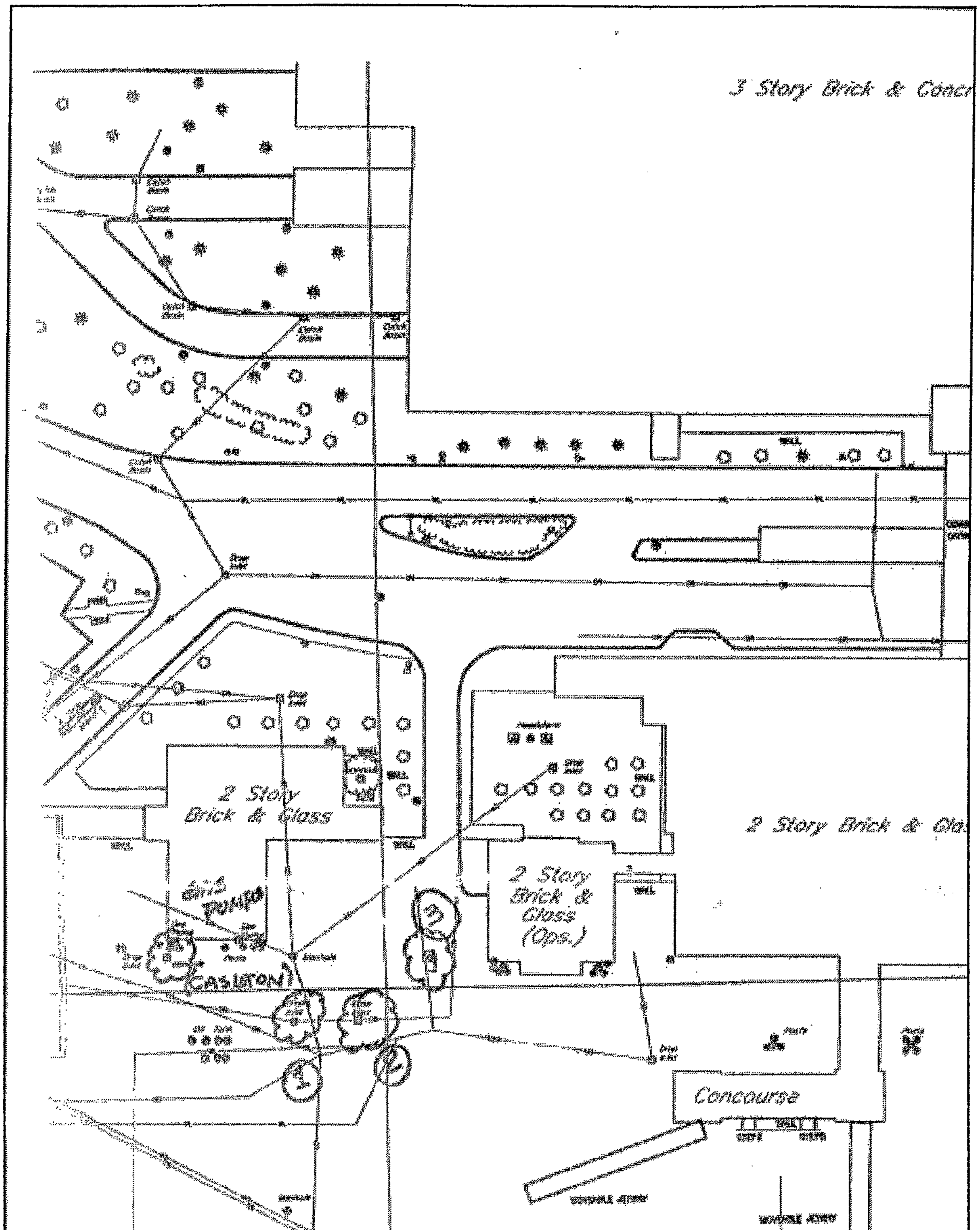
The UUF's installed to date are performing at or above expectation. The Airport, AVPort, and AbTech Industries /AbTech New York are pleased with the performance and results up to date.

Since the installation of the AbTech UUFs in the 17 drain inlets, over 850 lbs of sediment and almost 100 gallons of hydrocarbons have been prevented from entering the Westchester County stormwater system. Solid waste profiling and characterization currently being performed by a third party testing laboratory to determine whether this waste can be handled as a solid waste versus a special or hazardous waste.

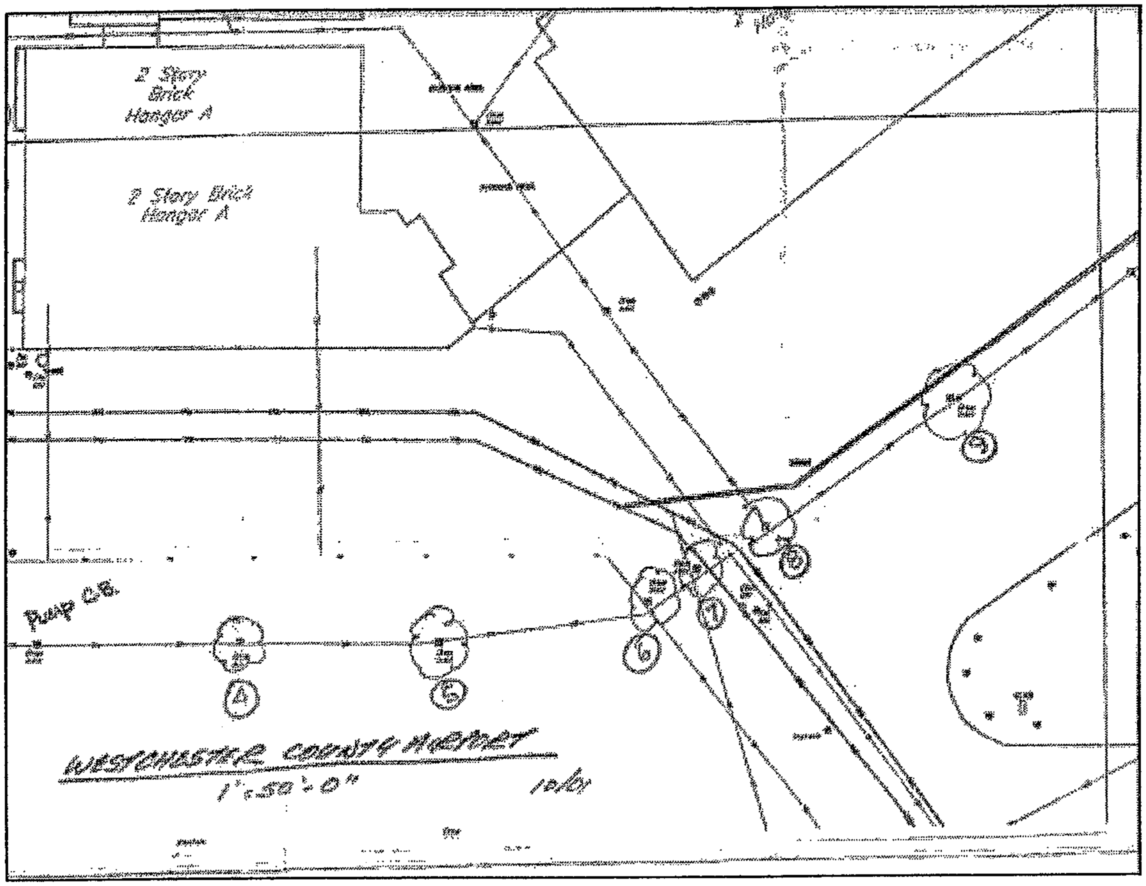
Based on the results of the project, the Airport and AVPort intend to expand the scope of the project to include another 50 drain inlets on the Airport property.

The project evaluation and monitoring phase will continue and include the addition of these additional drain inlets.

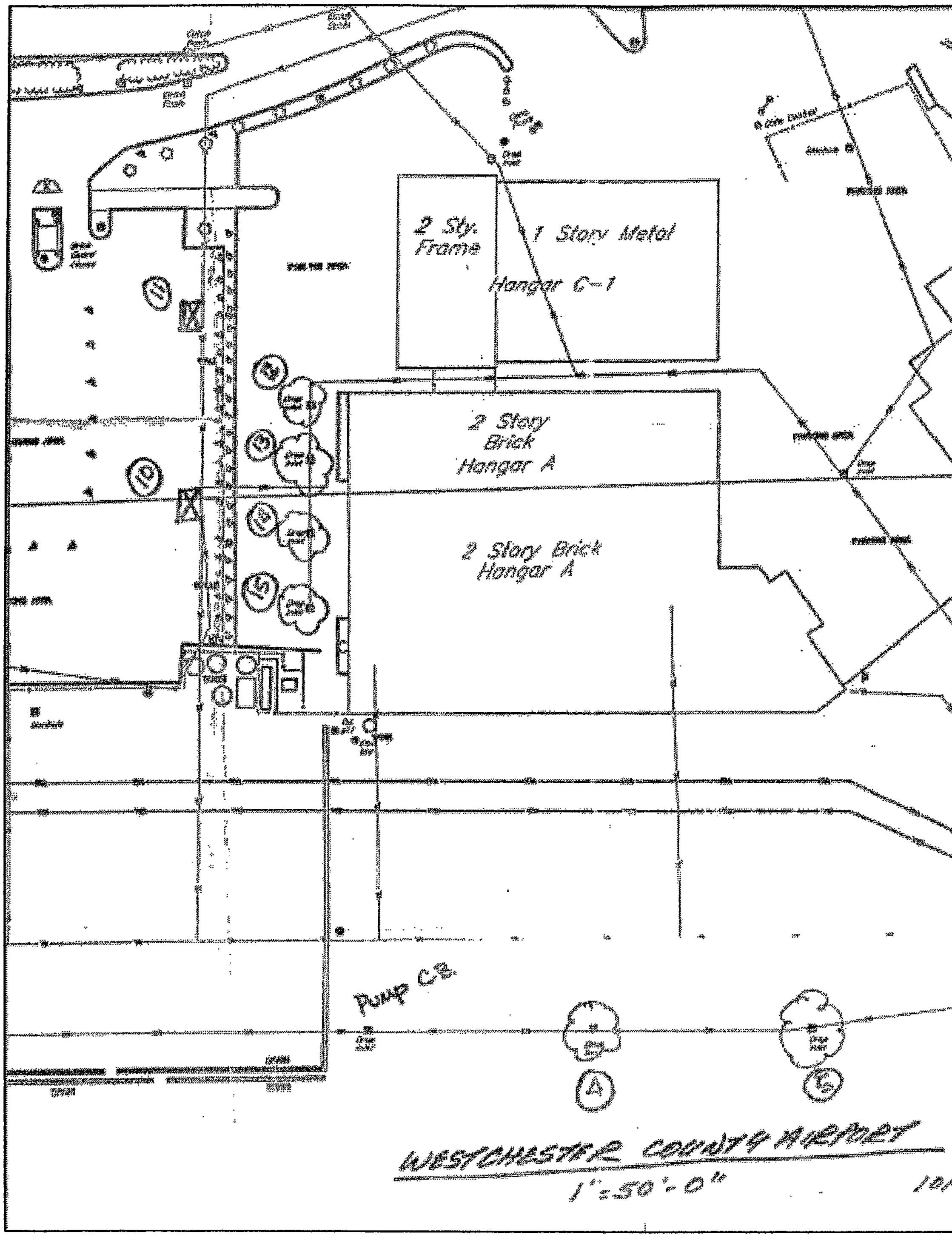
Site Drawings of Westchester County Airport – UUF Installations



Drawing 1

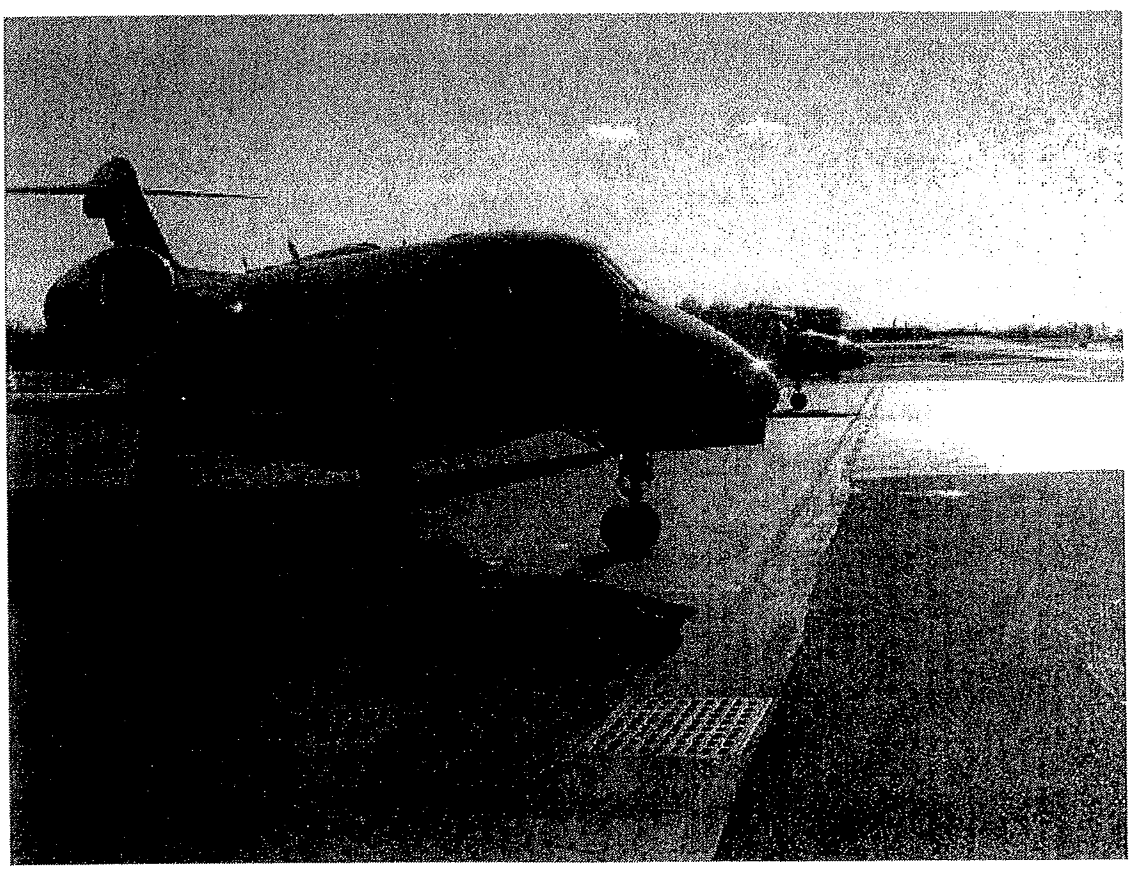

2 Story Brick Hangar A
2 Story Brick Hangar A
Pump C.B.
WESTCHESTER COUNTY AIRPORT
1"=50'-0"
10/01

Drawing 2


2 Sty.
Frame
1 Story Metal
Hangar C-1
2 Story
Brick
Hangar A
2 Story Brick
Hangar A
Pump C.B.
WESTCHESTER COUNTY AIRPORT
1" = 50'-0"

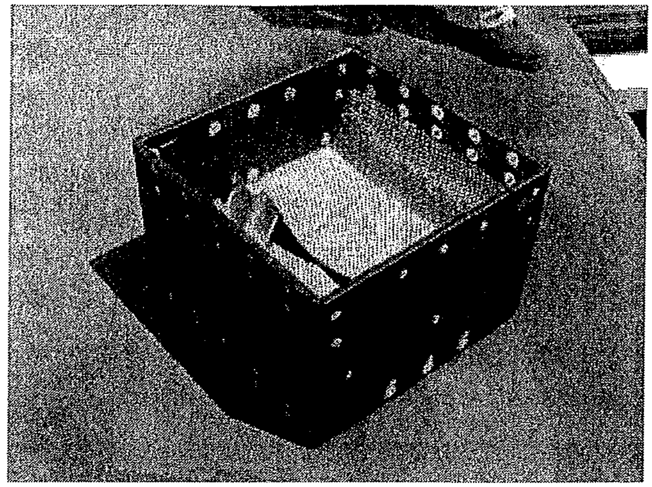
Drawing 3

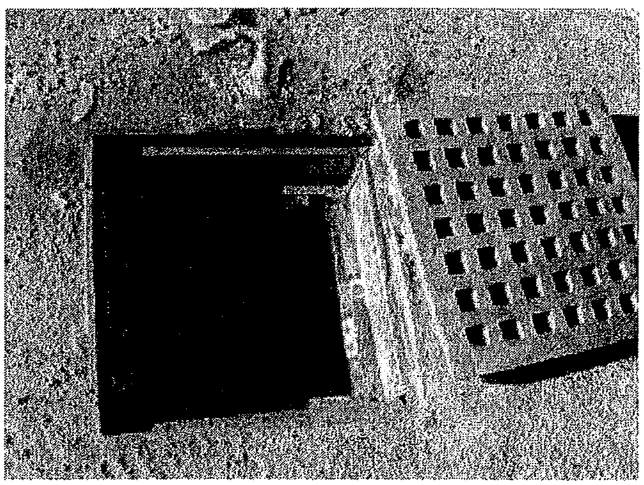
Selected Photos from the Project



Flight line at Westchester County Airport – Ramp Storm Drain (Typical)
AbTech UUF Catch Basin Insert Installed Under Grate

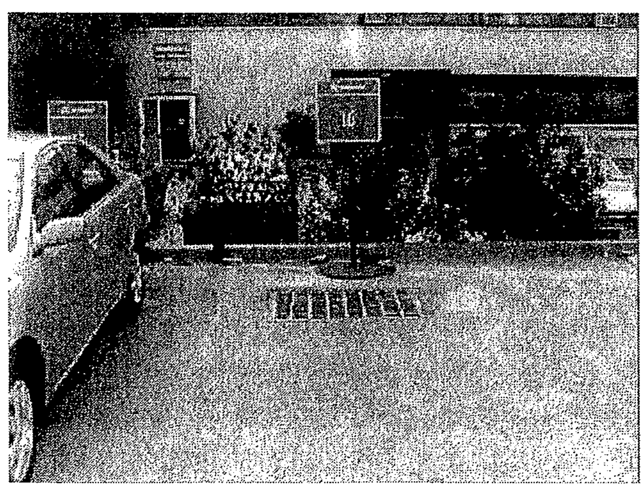
Typical Abtech UUF DI2020 prior to installation – without mounting collar assembly

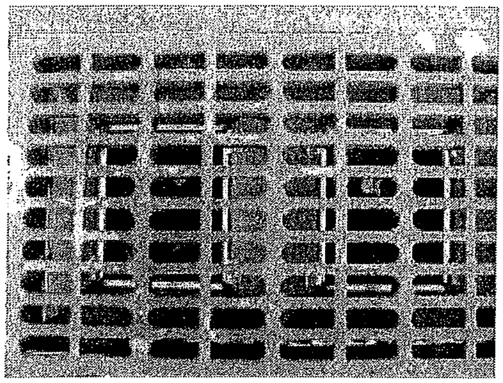
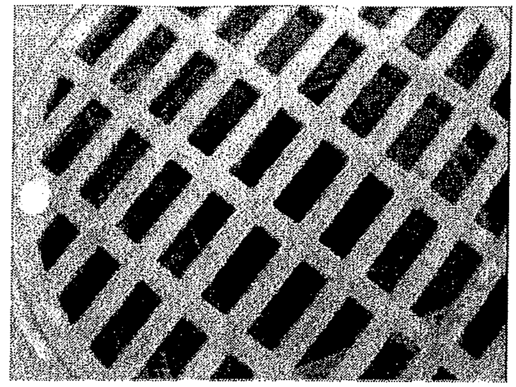




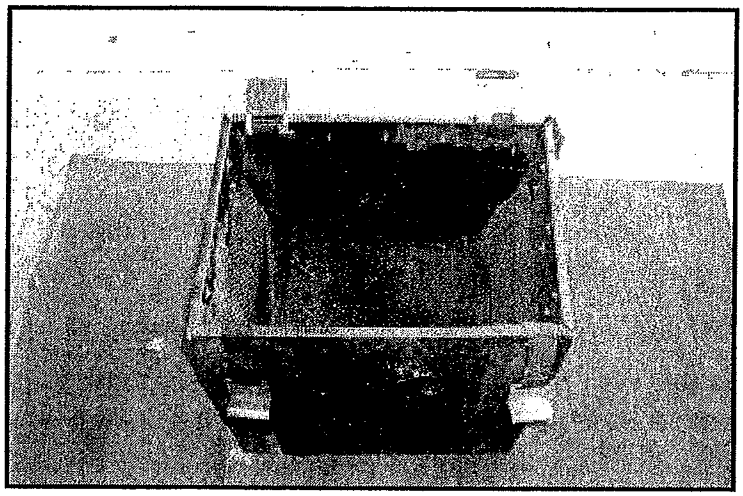
Installation of AbTech UUF (w/ stainless steel mounting collar assembly) at Westchester Airport - DOT Yard

Installation of AbTech UUF National Car Rental Parking Lot

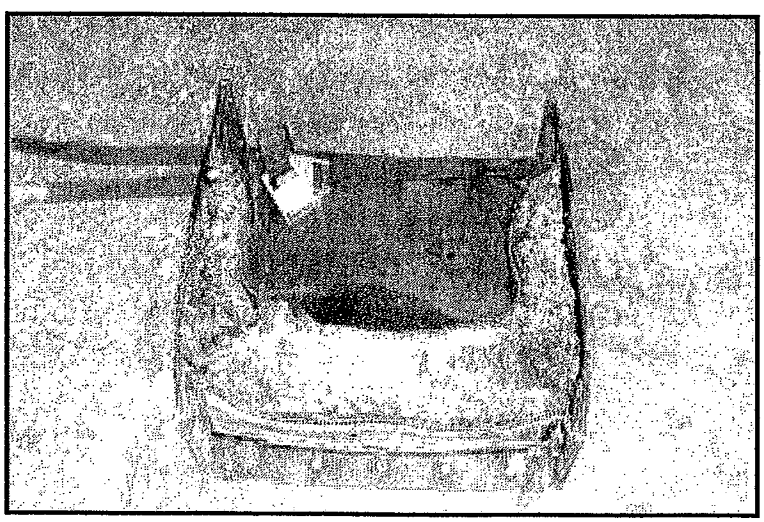


Installed AbTech UUFs under Selected Drain Grates at Westchester Airport



AbTech UUF DI 1420 from Drain Inlet #6 – after Fuel Spill of 2/03

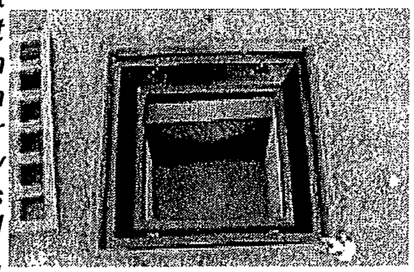


Same unit in section to show UUF interior
Demonstrates saturation and capture/retention of fuel by AbTech Smart Sponge

Product Description:

AbTech Industries has extensive experience with utilizing the Smart Sponge® technology in a variety of applications to address the capture/filtering of hydrocarbons out of stormwater flows (e.g., catch basin inserts, line skimmers, passive skimmers, etc.). Description and specification sheets for these various products are available.

The Ultra-Urban Filter® is an innovative, low cost Best Management Practice (BMP) designed to meet National Pollution Discharge Elimination System (NPDES) requirements for non-point source pollution control. It is a catch basin or storm drain insert for removing pollutants from stormwater runoff. It is easy to install and easy to maintain; no structural changes to the catch basin or stormwater system are needed for installation. The product removes oil, grease, sediment, trash and heavy metals from stormwater runoff.



Catch Basin Insert

The technology is a specially designed box that fits inside catch basins and storm drains. The inside of this box is lined with a proprietary blend of hydrocarbon-absorbing polymers which allows water to filter through it. As stormwater flows into the box, trash, debris, and sediment are captured, in addition to heavy metals that adhere to these solids. As the stormwater flows out of the sides and bottom of the box, oil and grease are absorbed in the filtration media that lines the box. These absorbed hydrocarbons are bonded within the proprietary polymer and do not leak or leach back into the environment, a benefit that polypropylene products cannot offer. Because the Ultra-Urban Filter reportedly safely "locks up" absorbed hydrocarbons and will not leak or leach, it can remain in place until fully saturated.

Since the absorbed hydrocarbons are bonded within the polymer filtration media, this material safely passes EPA's Toxicity Concentrate Leachate Procedure (TCLP) and Paint Filter Tests, which are required for disposal purposes to determine whether a material is hazardous or not. The ability to pass these disposal tests means that the Ultra-Urban Filter's saturated filtration media can be disposed of as a non-hazardous substance --- a significant cost savings compared to disposal costs if it were categorized as a hazardous substance.

AbTech
INDUSTRIES

Technical Review of the AbTech Ultra-Urban® Filter

By

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January 4, 2002

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ULTRA-URBAN® FILTER

This report summarizes operational experience accumulated to-date on the Ultra-Urban® filter manufactured by AbTech Industries of Scottsdale, Arizona. AbTech manufactures a number of products used in the removal of pollutants from stormwater, however, this reports focuses on the performance of only the Ultra-Urban® filter.

THE ULTRA-URBAN® FILTER

The filter is illustrated in Figure 1, as installed in a catch basin and Figure 2 which depicts the two different models manufactured by Abtech.. The model shown in Figure 1 consists of a plastic skirt (collar) with two straps that extend down and around the box. The straps hold a box that extends down into the catch basin. The box in effect serves the function of a catch basin sump and holds the sorptive media. The box is constructed of recycled corrugated plastic. The fasteners are of stainless steel. AbTech manufacturers various sizes including: 14" by 14", 14" by 20", and 20" by 20" with depths of either 21" or 13". These are approximate outside dimensions. The inside width and length are approximately 1" less. The media is positioned (as described below) such that the inside open depth of the box is about 15". The weight of the boxes when new ranges from 15 to 25 pounds.

AbTech also manufactures a model shown in Figure 2 with a metal bracket that allow the box to be hung on the inlet wall of recessed vaults to accommodate catchbasins located under sidewalks

The media called Smart Sponge® is held in place by the inner frame of the box. The media is a polymer. Typically, polymer is granular. In other catch basin inserts the polymer granules are placed in open mesh net bags that are tethered to the bottom. AbTech Industries has developed a process that binds together the granules while retaining the porosity. This allows the media to be formed into something akin to a structural sheet or pad. The media is positioned so as to cover two sides and the bottom in the form of a U as shown in Figure 2. Over the media sheet is ¼" mesh plastic frame to provide additional support and protection. The two sides of the media are sloped rather than flat against the wall of the box. As a result, water flows through the area of the media, then to and out the bottom of the box. The bottom of the box is enclosed but with openings for the water to exit. In the event of plugging, overflow is over the top of the box. As illustrated in Figure 3 the top of the box hangs about 3" below the bottom of the skirt (via slack in the straps).

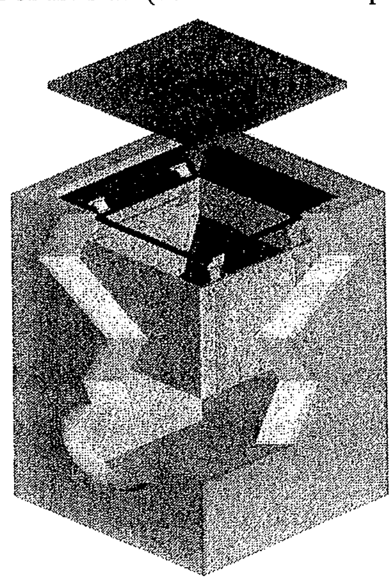

Figure 1 Ultra-Urban® filter installed in a catchbasin

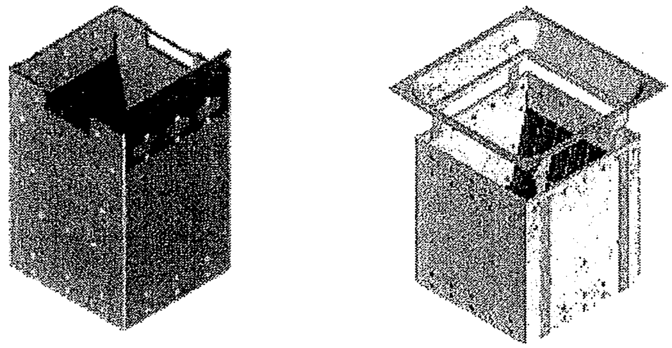

Figure 2 Ultra-Urban® filter models CO1414 and DI2020

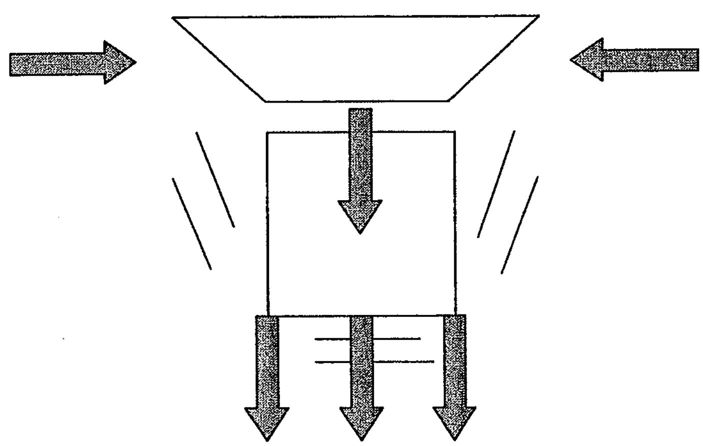

FIGURE 2 Illustration of positioning of the media and water flow

The media is about two inches thick on the side walls and four inches thick on the floor of the filter. It functions both as a physical filter, for the removal of suspended solids and litter, and as a sorptive filter for the removal of petroleum hydrocarbons. Pollutants attached to the suspended solids or sediment and litter are also removed such as metals and nutrients. The media repels water and therefore does not become saturated like, for example, Absorbent W. Sediment and litter are also trapped in the filter box.

Smart Sponge® is obtained by a combination of various polymers selected because of their crystalline and amorphous phases, original composition, and in the appropriate molecular weight and molecular weight distribution. These synthetic polymers are first mechanically processed to obtain a rigorously controlled particle sizes distribution, critical for the final architecture. Once this starting material is prepared, it goes though a proprietary process which exploits the rheological properties of the raw materials and, through finely controlled application of shear and heating, produces the desired polymer architecture. This process selectively targets the different rheological behavior of each polymer chain and their glass transition, melting and softening characteristics. The resulting structure is made of permanent, flexible and elastic domains utilizing the key raw materials properties, i.e. oleophilic and hydrophobic. It allows the Smart Sponge® to be:

- Oil absorbing but not gellifying;
- Expanding as the hydrocarbons are absorbed;
- Porous until saturation occurs;
- Locking in hydrocarbons and not leaching them.

The polymer absorbs, rather than adsorbs, petroleum hydrocarbons. The hydrocarbons enter the molecular structure of the media, rather than simply reside on the exterior surface as is the case with polypropylene. Hence, leaching is not an issue. Further, the polymer has the inherent ability to "recover" its capacity at the media surface following each storm. Between events the hydrocarbons initially sorbed to the exterior surface of the media pass "into" the microscopic channels in the polymer. Given a short rest period the surface area of the channels becomes available for more absorption at the same initial rate. The removal efficiency of the polymer can theoretically decrease during a storm event as the exterior surface sorbs petroleum hydrocarbons. But it is shown in this report that any decrease is likely inconsequential given the typical concentrations of free oil (i.e. not bound to sediments) in stormwater.

POSSIBLE APPLICATIONS

The insert is intended to be used in a variety of circumstances with the primary objective of removing sediments and petroleum hydrocarbons.

Retrofitting existing developments

The inserts are used in existing developments particularly where petroleum hydrocarbons are of concern. It can be used in commercial and industrial developments where petroleum hydrocarbons are at a concentration of concern (say, greater than 5 or 10 mg/L). However, they are perfectly suitable at lower concentrations where the objective is to remove the sheen.

Pretreatment in new or existing developments

The filter can be placed in all upstream catch basins in the drainage system or at one location immediately prior to the standard treatment system (e.g. swale or wet pond). In this configuration the filter can function as a removal of coarse sediments, easing maintenance. It is less costly to clean the filter than to dredge a pond on wet vault. The filter can also remove free petroleum hydrocarbons, which if not removed causes sheen even at very low concentrations. The filter also removes litter.

Use in high-use (oil) designated areas

For "high-use" areas traditional oil-water separators are typical treatment systems at this time. However, they are very costly. There is little operational data on oil-water separators. A combination wet pond/oil-water separator had an average removal of 56% with concentrations over seven storms ranging from 1.8 to 33 mg/l (mean of 12 mg/L)[17]. Another study analyzed effluent from a pond entering an oil-water separator. Influent concentrations were low: less than the detection limit (1 mg/L) to 7 mg/L. Removal efficiencies ranged from -100% to 85%, with a mean of 20%.

SUMMARY OF USES

Use as a retrofit device for TPH removal

A reasonable standard should be modest, on the order of 25 to 50% TPH removal. To expect a higher efficiency would likely necessitate the use of an oil-water separator which is not typically considered reasonable except in extreme (i.e. very high TPH) situations.

The analysis of the reports provided by AbTech Industries, summarized and analyzed in this report, indicate that the Ultra-Urban® filter is capable of removing pollutants. Laboratory data indicate that the device whether new or fresh can remove in excess of 75% of the TPH, possibly as high as 90%. But the laboratory setting possesses ideal conditions not found in the field, and it is difficult to create an artificial stormwater that properly mimics actual stormwater, particularly with respect to the tendency of TPH to sorb to sediments. Limited field tests indicate the device is likely capable of removing in excess of 50% of the TPH. Looking at efficiencies only is misleading. Effluent concentration is what matters. From this perspective it appears that the device should be able to reduce TPH concentrations to the range of 2 to 4 mg/L, but certainly below 10 mg/L, when influent concentrations range from 8 to 30 mg/L, if the area treated is not excessive. With respect to maintenance, analysis of the sorption capacity of the media indicates that a device treating the typical area for a catch basin (10,000 ft^2) is capable of operating from four to eight years, depending on the locale. AbTech however recommends that the media be replaced every two years in as much as without specific on-site data, free TPH concentrations may be higher than assumed in this analysis.

Use as a pretreatment device

This report does not analyze directly the capability of removing metals and other pollutants if the device is used as a pretreatment device. However, the data indicate the device is capable of removing fine sands (200 sieve) and larger. It likely removes some finer material within the media itself by filtration but this aspect has not been studied directly, only inferred from field studies. Removal efficiencies are likely comparable to a pretreatment device but for a limited area. Such an area requires that the media be replaced more frequently than indicated above (for 10,000 ft^2) possibly as frequently as twice annually. Tests show that the device is capable of handling large shock loadings, i.e. spills, of oil products. Bench tests show reductions from about 500 mg/L to 3 mg/L.

Interim short-term designation in high-use areas

With respect to conditional-designation as a oil-water separator, limited data indicate that the device should be capable of reducing the TPH to below the standard of 10 mg/L (storm average), if the use of the device is limited to a drainage area of a few acres. However, additional field testing is needed to confirm the preliminary conclusion. Certainly given what appears to be less then stellar performance by standard oil-water separators, consideration of substitutes is warranted. Hence, the conditional-designation as an oil-water separator appears reasonable.

17. Refers to numbered report in References

EVALUATION OF THE PERFORMANCE DATA

As with all stormwater treatment systems, even public-domain systems such as wet ponds, performance data area limited and/or subject to caution given the variety of design criteria. Preengineered products are similarly limited with respect to the paucity of data. However, for most catch basin inserts there are no data with the exception of the simple beaker saturation test. This general observation concerning data is made because, while the performance data for the UltraUrban® filter are limited, the amount of data far surpasses in detail and geographical extent that available for other similar products, including oil-water separators.

The conclusions presented below are presented from a dozen studies, both field and laboratory studies. With one exception, all studies were conducted by the staff of AbTech industries or firms and universities hired by AbTech Industries. Each study is summarized in Appendix A.

Conclusions from laboratory studies

In a laboratory study (Study #7[23]) of a new unit the removal efficiency averaged 81%, ranging from 46 to 91% depending on the test run. Test runs varied by flow rate (15 and 35 GPM) and, TPH concentration, from about 10 to about 30 mg/L. A mixture of motor and diesel oil was used. As expected, efficiencies declined with decreasing influent concentrations. It was observed with each test of about 120 minutes that the performance gradually dropped, by roughly 10 to 20% depending upon the particularly influent concentration. However, these tests were run at free TPH concentrations from five to 10 times what might be expected in stormwater.. It is further important to not conclude that, say, after 140 hours of storms the efficiency will drop on the order of 10 to 20%. This is because during the dry period between storms the captured petroleum hydrocarbons gradually move into the interior of the media, freeing exterior sorption areas. This observation is supported to some extent by laboratory studies of used units (Studies #6[3] and #7[23]). In Study #6[3], a unit that had been in the field was tested in the laboratory at a flow rate of 12 GPM and an influent concentration of about 30 mg/L. The removal efficiency ranged from 78 to 96%, over six runs. A test of a used unit in Study #7 found a lower efficiency, 73%, which is favorable considering that the influent concentration was 8.4 mg/L. Therefore, the lower efficiency in this test is expected. In fact it is possible that a unit that has been in the field for a few months will perform better than a fresh unit because the routes through the media tend to swell from of the presence of oil and fine sediments. This phenomena has been observed with the sock-type insert[14].

The caveat with the above studies is that most of the TPH present in stormwater is likely affixed to the sediments, generally to the fine sands, silts and clays. Various studies have reported from 50 to 95% of the TPH sorbs to the sediments[10, 11, 22]; or stated differently, about 5 to 50% remains "free" to be sorbed to sorptive media. The reason(s) for the high variation in the observations concerning fraction of TPH in stormwater itself has never been explained. It may be due to differing laboratory techniques. Of critical relevance is the practice of waiting 24 to 48 hours before analyzing the samples. This lag time leaves a substantial period for sorption to occur. Hence, it is possible that the studies cited on the question of TPH sorption in stormwater overstate the fraction of TPH that sorbs to sediments, thereby understating the fraction of free petroleum hydrocarbons.

Recognizing the important role of sediment, AbTech Industries conducted laboratory tests (Summarized as Studies #5[2]), in which sediment and debris (leaves, small rocks, twigs) were added with the petroleum mixture at 28 mg/L. Removal efficiencies of individual tests ranged from 78 to 87%, averaging 83%. There was no difference in performance between tests with sediment/debris and those without (three tests of each), although the efficiencies in general were somewhat lower than observed in the studies cited above. However, two observations suggest that these tests may overstate field performance. The size of the sediment was not specified. If larger than fine sand, there may have been relatively little sorption to the sediment. Secondly, the sediment and litter were added with the petroleum mixture just momentarily before entering the test device leaving little time for sorption to the sediment/litter. Both aspects suggest that the fraction of petroleum hydrocarbons that remain unsorbed in the test may have been relatively high in comparison to what might occur in the field. However, the uncertainty of how much of the TPH actually sorbs to sediments in the stormwater itself is open to dispute for the reasons noted above. Regardless, an important question is the relationship between the size distribution of sediment and TPH. Analysis[19] of sediment that was vacuum swept from a Seattle cargo container yard found 53% of the TPH associated with fine sand and larger sediments, and 47% affixed to clays and silts (<63 microns). These data suggest that if a device removes all of the fine sediment and larger material that about 50% of the particulate TPH is removed. The removal will be greater than 50% to the extent that the device removes silts and clays. In Study #6[3], removal was tested of sediment of medium size sand and larger. Efficiencies ranged from 31 to 99% depending on size and the particular test

If much if not most of the TPH sorbs to the sediments in stormwater it is important that the sediment be removed in addition to whatever sorbs to the media. It therefore follows that two important removal mechanisms are the settling of the sediments in the treatment unit and the filtration as the stormwater passes through the sorption media. Study #12[1] suggests that the unit is not capable of removing fine material (silts and clays) where much of the TPH is likely sorbed. The analysis of sediment captured by the unit indicated that only 1.7% of the sediment was silt and clay, but that 54% was fine sand. However, the analysis of sediment size in Study #12[1] did not take into consideration the removal of fine material in the media where it is remains unless forcibly removed by washing. Hence, Study #12[1] may understate the removal of fine sediments. As noted previously, a significant fraction of the TPH is sorbed to the larger sediments. Study #10[15] evaluated the effect of dumping a solution of highly concentrated oil: 100 to 250 mg/L. Removal efficiencies for four of five tests ranged from 97.7 to 99%; one test was 85%.

Conclusions from field studies

While laboratory data provide insight to the performance of a treatment device, field data is always preferable recognizing the difficulties of obtaining such data and the uncertainty of the results. Attempts to mimic stormwater in the laboratory even for the seemingly simple nature of sediment and petroleum products possesses considerable uncertainty.

Only one field study has been conducted that directly evaluated the performance of the AbTech insert[16], summarized as Study #8[16]. The study, conducted by faculty of the UCLA, concluded that the device removed 21% of the TSS; there was no assessment of TPH removal. The low TSS removal suggests low TPH removal but this is unknown. However, as noted in Appendix A the observation on TSS removal is of no value as the authors failed to described the test site.

A study (Summarized as Study #9[7]) in Springfield Massachusetts did not examine removal efficiency. However, the researchers did examine the accumulation of sediment and TPH in the filters. Twenty-three inserts owned by the City of Springfield were installed in streets around the city on October 8, 1999. The sites were selected purposely with the intent of experiencing a wide range of pollutant loadings. On the final test date, approximately 13 months after installation, the sediment and litter were removed; the filters were washed or flushed to dislodge fine sediments in the media. After two days of air-drying the weight of the retained petroleum was determined by comparing the final weight of each insert to its original weight. Over a period of 13 months the amount of presumably TPH accumulated in the media (of 15 inserts) itself ranged from 5.2 to 29.3 pounds with an average of 20.8 pounds. The amount of fine sedment washed from the media averaged 11.4 pounds or a third of the accumulated weight in the media.

The above study however did not evaluate influent or effluent concentrations. Nor did it indicate the area draining to each catch basin and the aggregate rainfall. The authors were approached for this information[8]. It was indicated that a total of 48.7 inches of rainfall fell. The widths of the streets could not be provided but the number of traffic lanes and parking lanes were. The distance between catch basins was typically 300 feet. Using this information removal efficiencies were estimated based on different assumed influent concentrations. The results are shown in Table 1. The analysis provides the odd result that at low assumed TPH concentrations, less than about 10 mg/L, more TPH is removed than enters the units. The most reasonable average influent concentration is in the range of 5 to 15 mg/L, suggesting an efficiency of 76 to 115%. What these efficiencies suggest is that despite the flushing of the media before weighing there was likely some fine sediments remaining in the media. It is also possible that two days of air-drying was insufficient to remove all moisture. Nonetheless, the analysis suggests that efficiencies of 50 to 75% are possible: certainly greater than 25%.

TABLE 1

UNIT	LANES	INTERS	AREA	ASSUMED INFLUENT TPH (lbs.) At 5mg/L	At 10mg/L	At 15mg/L	At 20mg/L	Weighed TPH lbs	ESTIMATED REMOVAL % At 5mg/L	At 10mg/L	At 15mg/L	At 20/mg/L
1	3	1	11700	14.82	29.65	44.47	59.29	22.9	154%	77%	51%	39%
2	4	1	15600	19.76	39.53	59.29	79.06	18.4	93%	47%	31%	23%
3	4	1	15600	19.76	39.53	59.29	79.06	29.7	150%	75%	50%	38%
4B	4	1	15600	19.76	39.53	59.29	79.06	28.45	144%	72%	48%	36%
5	4	1	15600	19.76	39.53	59.29	79.06	22.1	112%	56%	37%	28%
7	6	0.5	11700	14.82	29.65	44.47	59.29	20.4	138%	69%	46%	34%
8	6	1	23400	29.65	59.29	88.94	118.59	23.05	78%	39%	26%	19%
10A	2	0.5	3900	4.94	9.88	14.82	19.76	16.15	327%	163%	109%	82%
10B	2	0.5	3900	4.94	9.88	14.82	19.76	25.6	518%	259%	173%	130%
11	2	0.5	3900	4.94	9.88	14.82	19.76	5.2	105%	53%	35%	26%
12	2	1	7800	9.88	19.76	29.65	39.53	12.7	129%	64%	43%	32%
13	3	0.5	5850	7.41	14.82	22.24	29.65	26.1	352%	176%	117%	88%
14	3	0.5	5850	7.41	14.82	22.24	29.65	14.6	197%	98%	66%	49%
20	2	0.5	3900	4.94	9.88	14.82	19.76	29.25	592%	296%	197%	148%
21	2	0.5	3900	4.94	9.88	14.82	19.76	17.35	351%	176%	117%	88%
			AVERAG	**12.52**	**25.04**	**37.55**	**50.07**	**20.80**	**229%**	**115%**	**76%**	**57%**

Length	300			
Width	13			
Rainfall				
Oil conc	20	15	10	5

If 5 mg/L	**229%**
If 10 mg/L	**115%**
If 15 mg/L	**76%**
If 20 mg/L.87	**57%**

EVALUATION OF HYDRAULIC DATA

Study #10[15] (Appendix A) examined the effect of accumulated litter (one cubic foot) on hydraulic capacity of a 20" by 20" filter. At 400 GPM essentially all of the litter was retained; at 600 GPM 90% of the litter remained in the box. This reduced to 42% at 800 GPM. Water began to flow over the filter at 800 GPM. As sediment will not be dislodged like litter, given its greater density, 560 GPM is the capacity of a unit where capture of sediment is the primary concern. These flow rates understate the capacity with respect to the retention of sediment given its greater density.

MAINTENANCE REQUIREMENTS AND RECOMMENDATIONS

There are two separate maintenance activities: removal of sediments and debris, and replacement of the media. The frequency depends upon the site: the area of the drainage catchment and the level of pollution. Absent site specific information, AbTech Industries recommends that the box be cleaned of sediment and debris semi-annually. They further recommend that the media be replaced every two years. Calculations below indicate that this is conservative. Cleaning of the box is accomplished with an eductor (vactor) truck or by removing the box from the catch basin and dumping to contents into a suitable receptacle. Replacement of the media is achieved by replacement of the box and straps (the skirt or collar need not be replaced). There are two disposal alternatives for the box. It can be disposed to a sanitary landfill, unless the level of petroleum contamination exceeds local health department standards. This is not likely unless a significant spill has occurred. The second alternative is to shred the box and dispose to a suitable energy generation facility.

The capacity of the media with respect to free petroleum hydrocarbons is conservatively stated as two grams per gram of media[5], The nominal capacity of the media is therefore 15,000 grams of petroleum hydrocarbons grams. Assuming a catchment area of 10,000 ft^2, and an influent free (not sorbed to sediments) oil concentration on the order of 1 to 5 mg/L (average of 3 mg/L): the filter media in a typical 14'x20"x20" unit (with 7.5 kilograms of media) can function from four to eight years before the onset of total exhaustion, depending upon the locale.. As the petroleum does not likely completely penetrate to all sorptive areas the calculation may overstate this calculated life. In addition, petroleum hydrocarbons degrade particularly on the exterior surfaces where access by bacteria is feasible[20]. Nonetheless, the recommended replacement period of two years (noted above) appears reasonable.

Study #9[7] included a companion evaluation of maintenance time[8]. An experiment by a maintenance crew of Springfield, Massachusetts (location of Study #9) determined that it took about five minutes to clean a standard catch basin, but less than one minute to clean an Ultra-Urban® filter, presumably because of easier access. A secondary but significant benefit was that the cleaning of the filter eliminated the pickup of water that occurs when cleaning a normal sump. The crew observed that water normal accounts for about 80% of the volume removed from catch basin sumps. Avoidance of the water extends the time in the field by a factor of five before the truck must be diverted to offload debris at a suitable disposal site.

COSTS

The initial cost of a typical unit (DI1420) is $550 when purchased in single units. Replacement cost is $450. If replaced every two years, the annualized cost is $250. The cost to remove accumulated sediment depends upon the area being treated and specific site conditions. Generalizations therefore cannot be provided. See the discussion of maintenance on page 8.

INSTALLATIONS TO-DATE

A total of about 900 inserts have been or are about to be installed elsewhere in the United States at 25 sites in seven states. The first installations occurred in 1999. Types of applications and land use settings include city streets, vehicle and truck parking lots, construction sites.

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2. AbTech Industries, undated, Hydrocarbon Removal Effectiveness – New filter, Technical Note #2.
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APPENDIX A
SUMMARIES OF STUDIES

The section summarizes the findings of various laboratory and field reports as well as owners of AbTech units. The reports and studies are listed and summarized in Table A-1. A brief summary is provided below.

Laboratory studies

#1 Sorbent tests[21]: Tests were conducted by Dr. Schrader in the Sorbent Laboratory of Millsaps College in Jackson, Mississippi for AbTech Industries. For diesel fuel the capacity was 1.44 grams of oil per gram of sorbent. This test involved the use of molded pads of the media[5].

#2 Sorbent tests[6]: Tests were conducted by Adherent Technologies in Albuquerque, New Mexico for AbTech Industries. For diesel fuel the capacity was 9.92 grams of oil per gram of sorbent. The sorption capacity was also determined for chlorinated hydrocarbons with capacities ranging from 2.36 to 4.16 g/g depending upon the particular compound. This test involved the use of powdered media[5], suggesting the reason for the greater capacity.

#3 AbTech Tech Note #4, Leach test[4]: Tests were conducted by Foss Environmental in Seattle, Washington for AbTech Industries. The procedure was identical to that followed by King County[18] in its test of several media. A portion of the media was placed in a beaker for 20 hours containing a 50/50 mixture of diesel and motor oil. Excess oil was removed. Water was passed through the media for 10 minutes at 0.5 GPM. The concentration of oil in the water exiting the media ranged from 2.2 to 1.3 mg/L, decreasing over the 10 minute test. The test indicates that oil was leached. The test however is not realistic of a field situation since saturation is not likely to occur in the field. Further, the oil that was "released" is likely to have been oil that was "sitting" (due to the large amount of oil) on the media in excess of its sorption capacity.

#4 Leach test[9]: Tests were conducted by Del Mar Analytical in Irvine California for AbTech Industries. The objective of the study was to determine whether metals would leach from used media. The media was obtained from a unit placed in the field in the Santa Monica study (see below)[5]. The test followed State of California procedures[5]: basically a waste extraction TCLP test. Six of the 17 metals evaluated produced detectable results.

#5 AbTech Tech Note 2 - Hydrocarbon removal effectiveness – New filter[2]: Tests were conducted by AbTech Industries. The objective was to determine the effectiveness of a fresh insert under laboratory conditions. A mixture of used motor oil and diesel fuel was introduced into water flowing at 12 GPM. Two series of tests were run: with the oil mixture only, and in the presence of sediment and debris. The influent concentration of oil and grease was 28 mg/L. Removal efficiencies of individual tests ranged from 78 to 87%, averaging 83%. There was no apparent difference in removal whether or not sediment and debris were present in the artificial stormwater. The sediment concentration was not measured but based on the total flow and total sediment added, the concentration was about 650 mg/L. Size distribution of the sediment was not noted. Effluent TSS was not measured.

[21] Refers to numbered report in the bibliography.

TABLE A.1 Summary of studies of the UltraFilter®

STUDY TITLE	AUTHOR	POLLUTANTS EXAMINED	PERIOD OF STUDY	LOCATION	LAB OR FIELD	GENERAL NATURE OF STUDY
1. Sorbent tests	Millsaps College	Diesel oil	1998	Mississippi	Lab	Total sorption capacity tests
2. Sorbent tests	Adherent Technologies	Diesel oil	1997	New Mexico	Lab	Total sorption capacity tests
3. Leach test	Foss Environmental	TPH	mid-1997	NA	Lab	Fresh media saturated with oil to ascertain if residual oil would leach from the media.
4. Leach test	DelMar Analytical	Metals	1998	California	Lab	Used media evaluated for leaching of metals
5. Tech Note #2: Hydrocarbon removal effectiveness	AbTech	Oil and grease	1998	Arizona	Lab	Laboratory test of a fresh unit
6. Tech Note #3: Hydrocarbon removal effectiveness	AbTech	Oil and grease	1998	California	Llab	A unit removed from a site in Santa Monica and tested in the lab.
7. Pollutant removal by a prototype AbTech stormwater CB insert device	Stenstrom et al. (UCLA)	PAHs, TPH, TSS	1997-1998	California	Field and lab	
8. Catch basin inserts to reduce pollution from stormwater	Lau et al. (UCLA)	PAHs, TPH, TSS And ??????	1997-1998	California	Field and lab	Same study as Stenstrom but some graphics are different.
9. Storm water report	Astro Environmental	Oil and grease, TPH, metals, sediments	1999-2000	Massachusetts	Field and lab	23 inserts placed in streets and sampled periodically for material accumulation. Some units brought into lab for further testing.
10. Catch Basin Insert Evaluation	HydroQual, Inc.	Litter	2000-2001	New York	Lab	Litter of specified composition added to water and passed through insert. Tests made of removal efficiency and filter clogging.
11. Santa Monica Bay … Evaluation of potential catch basin retrofits	Woodward-Clyde	Debris/litter, oil and grease	1997-1998	California	Field and lab	
12. Tech Report #1 Santa Monica study						

#6 AbTech Technical Note 3 - Hydrocarbon removal effectiveness – Used filter[3]: The tests were similar to that described above. However, in this case a used insert was obtained from the field. The unit had been in the field for two months. Removal efficiencies ranged from 78 to 96%, averaging 91% over six separate tests. Influent oil concentrations ranged from 28 to 32 mg/L. Sediment was not added in this test.

#7 Pollutant removal by a prototype AbTech stormwater CB insert device[23]: Tests were conducted by Professor Stenstrom and research assistants at UCLA for AbTech Industries. Both fresh and used units were tested. The used units were obtained from sites in Santa Monica where they were being evaluated as part of the study presented in Report #11. The used unit was in the field for about four months and experienced about of 7.5 inches of rainfall in seven storms. The data show the following:

- Fresh units averaged 81% removal of oil/grease, ranging from 46 to 91%.
- Efficiency removal of oil/grease seems to decrease with decreasing influent concentration. The effluent concentration appears to remain relatively constant (about 4 mg/L) irrespective of the influent concentration (10.7 to 24.7 mg/L).
- Flow rates were 15 and 35 GPM with the fresh units.
- Efficiency of oil/grease removal drops with time in fresh units tested in the lab. The efficiency of a fresh unit dropped from 85% to 70% after 120 minutes of flow at 35 GPM.
- The efficiency of one unit take from the field was 73% at an influent concentration of 8.5 mg/L and a flow rate of 15 GPM.

The drop in efficiency in only 120 minutes seems overstated. Its appears to be much greater than the used field unit (in the field for four months) whose efficiency was still 73%, but at a relatively low influent concentration. The efficiency was in fact higher than the fresh unit tested at a similar influent concentration (10.7 mg/L).

The units were also evaluated for their ability to remove sand, but these were separate tests and the sand was not mixed with the petroleum solution. Three sizes of sediment were evaluated in three separate tests, but duplicated (at influent concentrations of 46 and 47 mg/L). The removal efficiencies were: 40 mesh, 65 and 99%; 60 mesh, 53 and 96%; and 100 mesh, 31 and 78%. All tests were performed at 35 GPM. No explanation was provided as to the wide variation of results at seemingly the same conditions.

Field studies

#8 Catch basin inserts to reduce pollution from stormwater[16]: Tests were conducted by Professor Stenstrom and research assistants at UCLA for Woodward-Clyde Consultants, consultant to the City of Santa Monica. The data were gathered as part of the study reported in Report #11 below. However, a greater amount of data is report in this Study #8. In Report #11 seven storms were sampled. However, an additional seven storms were sampled for Study #8 for a total of 14 storms.

This study concluded from field data that is not in the report that the AbTech device removed 21% of the TSS. There was no conclusion on TPH. The data however are of little use because information concerning the site(s) that were evaluated is confusing and incomplete. The authors imply that two commercial sites were studied and an unstated number of residential sites. But one table provides influent data on two commercial sites and two residential sites, whereas another table provides sediment quality data on five commercial sites and three residential sites.

It is not made clear if the conclusion on TSS removal stems from data of only one site, or averaging of several sites. The report states that the areas of the residential and commercial sites were about 15,000 m^2 (~50,000 ft^2) and 5,000 m^2 (16,500 ft^2), respectively. Regardless, the area(s) of the site(s) upon which the conclusion on TSS removal was derived was not given. Hence, low removals may have been due to treating an area that was too large, or simply because influent TSS concentrations were quite low; or a combination of both. Attempts to contact the authors to request additional information were fruitless.

#9 Storm water report[7]: Tests were conducted by Astro Environmental Inc of Springfield, Massachusetts. The inserts (23) owned by the City of Springfield were installed in streets around the city on October 8, 1999. The sites were selected purposely with the intent of experiencing a wide range of pollutant loadings. Various tests were performed with the inserts on four occasions during the next 13 months. The types of information included amount and chemistry of accumulated sediment and debris, and the amount of petroleum sorbed by the media.

The 23 inserts were removed and weighed on three separate occasions. The data are shown in Table A-2. On each occasion the debris was disposed. However, the last examination on October 24, 2000 was performed differently. In the last examination after the debris was removed the devices were washed. Also, the inserts were air-dried for two days before final weighing. Both of these steps were not done on the first two examination dates. The weight of material removed by washing averaged 11.4 pounds: compared to 20.8 pounds of TPH. The dislodged materials was fine sediment. This indicates that a portion of the "petroleum weight" measured on the two preceding dates included fine sediments, possibly on the order of 33%, corresponding to the ratio observed on October 24th. This is not to say however that these fine sediments did not contain petroleum as petroleum hydrocarbons sorb to the sediments. The 20.8 pounds observed on October 24th tends to most accurately represent the free oil that was removed over the 12-month period.

TABLE A-2 ACCUMULATED WEIGHT OF MATERIAL

SAMPLE DATE	PERIOD	RAIN FALL	DEBRIS/SEDIMENT WT EACH TEST DATE		ACCUMULATED PETROLEUM WEIGHT	
			AVERAGE	RANGE	AVERAGE	RANGE
Dec 29, 1999	82 days		39.4 lbs		8.5 lbs	
Mar 23, 2000	86		27.8		16.5	
Oct 24, 2000	215		68	19.6 – 118.8	20.8	5.2 – 29.3

The study also evaluated the ability of the device to withstand a spill. Five units that had been in the field for about two months were used in this test. The sediment and litter were left in the units. Two tests used a solution containing 250 mg/L of vegetable, diesel and fuel oil, and three tests used a solution of 100 mg/L of motor and diesel oil only. The units were taken out of the catch basins and placed on a stand. The solution was dumped through each unit. Oil/grease concentrations were reduced to a range of <1 mg/L to 3.6 mg/L, except for one test where the effluent was 38 mg/L (influent of 250 mg/L). The volume of the solution was not indicated.

#10 Catch basin insert evaluation[15]: The objective of the study was to determine how well the insert retains litter in the presence of high flows. A fresh insert was placed in a catch basin in a New York city location.. A cubic foot of dry litter consisting of 200 pieces of various types of litter was placed in the insert. The types of litter included plastic bags, straws, bottle lids, juice and water bottles, utensils, coffee stirrers, and vitamin bottles. Water was discharged into the insert at 75, 175, 500, 600, 800, and 1,100 GPM. The litter would have (it was not given) a depth of about 8 inches. The insert was found to retain all litter up to a flow of 175 GPM, 99.5% at 400 GPM, 91% at 600 GPM, and 42% at 800 GPM. The water reached the top at 600 GPM and overflowed 800 GPM but litter was lost at lower flow rates (as low as 500 GPM) likely because of turbulence and splashing even though the top of the box was not reached.

#11 Santa Monica Bay ... Evaluation of potential catch basin retrofits[24]: The field evaluation was limited to identifying the amount of debris/litter/sediment removed and not petroleum hydrocarbons. No data was apparently obtained from field studies: only general observations. The data from laboratory studies is reported in Report #7 above.

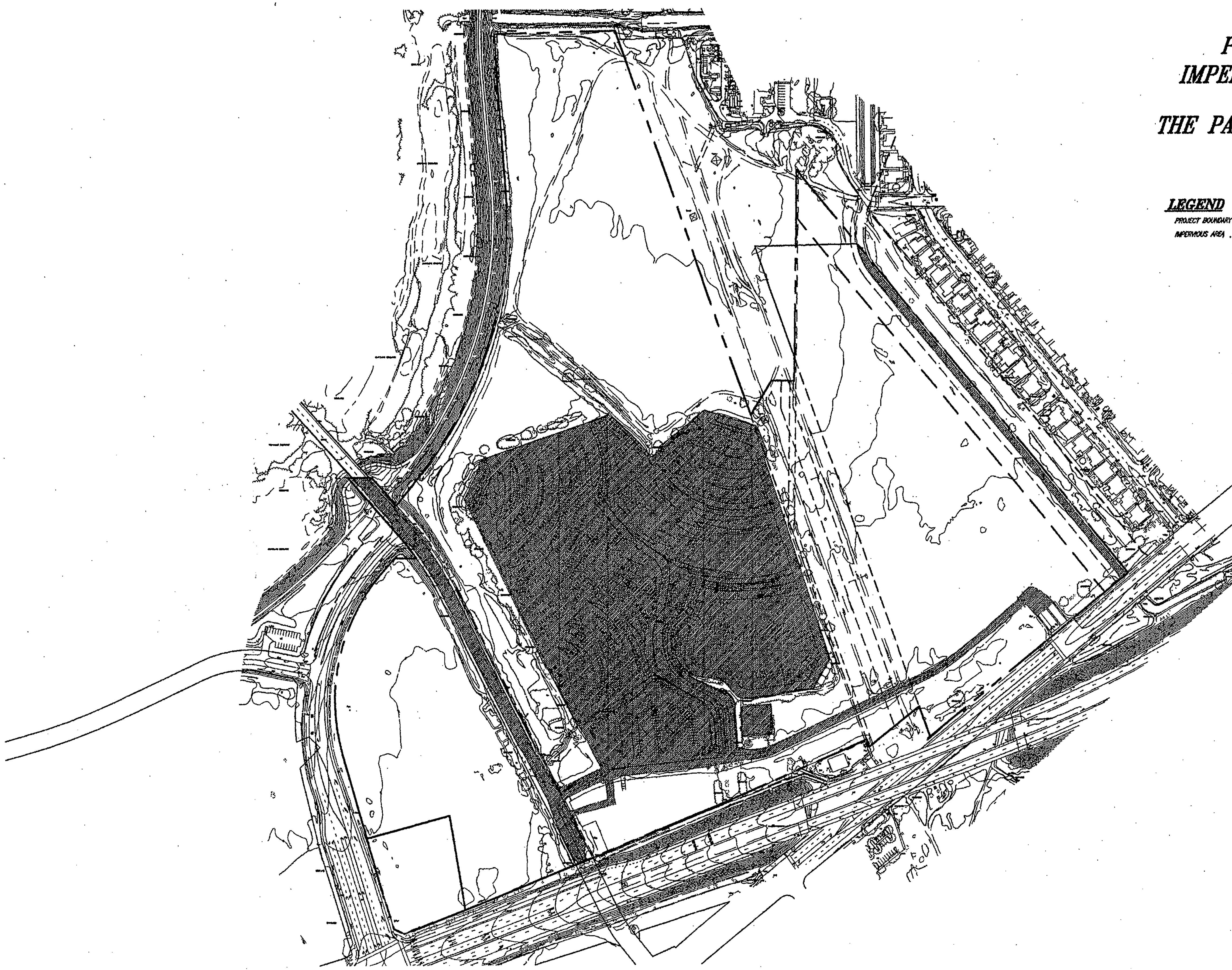
#12 AbTech Technical Note 1 - Santa Monica field tests[1]: Reports the quantity of material (675 pounds of sediment and trash) removed over seven months. The configuration of the system in this study were several units latched in parallel along a curb-side inlet. An analysis of the size distribution of the sediment captured indicated that about 44% was medium sand or larger, 54% was fine sand, and about 1.7% was silt; there was no clay size material.

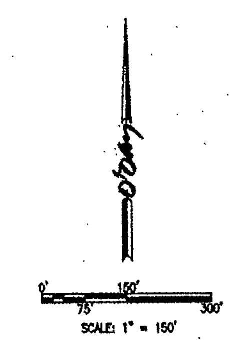
PRE-DEVELOPMENT IMPERVIOUS AREA EXHIBIT FOR THE PAVILION AT OCEANSIDE

LEGEND

PROJECT BOUNDARY

IMPERVIOUS AREA





PREDEVELOPMENT IMPERVIOUS AREAS = 25.7 ACRES
PREDEVELOPMENT PERVIOUS AREAS = 66.3 ACRES

TOTAL SITE AREA = 92.0 ACRES

PREPARED: JULY 14, 2006

O'Day CONSULTANTS
2710 Loker Avenue West
Suite 100
Carlsbad, California 92010
760-931-7700
Fax:760-931-8680
Civil Engineering
Planning
Processing
Surveying

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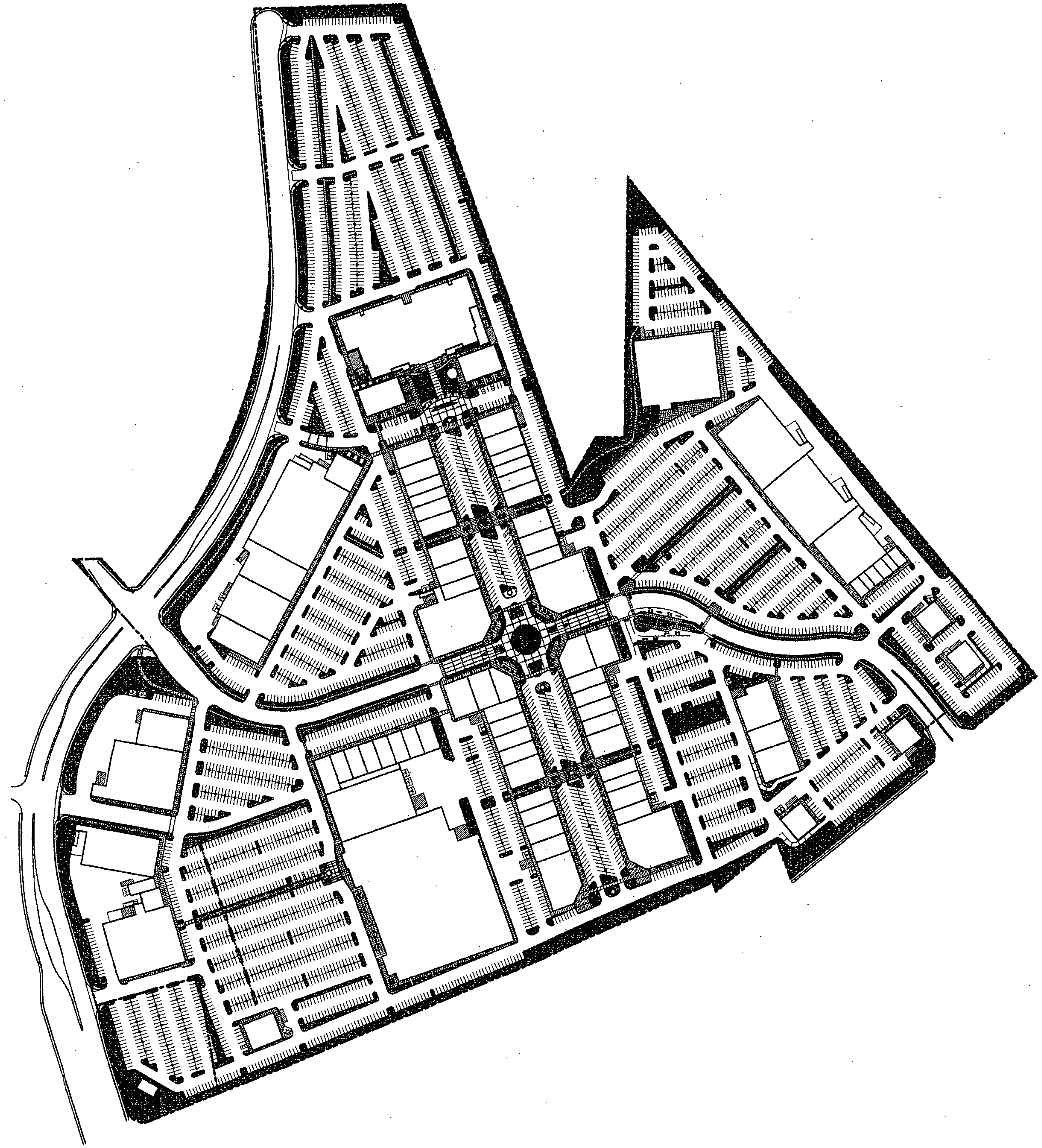
Xrefs: 0515TP02; 0515MAP

POST DEVELOPMENT IMPERVIOUS AREA EXHIBIT FOR THE PAVILION AT OCEANSIDE

LEGEND

PROJECT BOUNDARY

PERVIOUS AREA



POST DEVELOPMENT IMPERVIOUS AREAS = 78.2 ACRES
POST DEVELOPMENT PERVIOUS AREAS = 13.8 ACRES

TOTAL SITE AREA = 92.0 ACRES

REVISED: AUGUST 21, 2007
REVISED: MAY 4, 2007
PREPARED: JULY 14, 2006

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Suite 100
Carlsbad, California 92010
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Fax:760-931-8680
Civil Engineering
Planning
Processing
Surveying

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POST DEVELOPMENT IMPERVIOUS AREA EXHIBIT

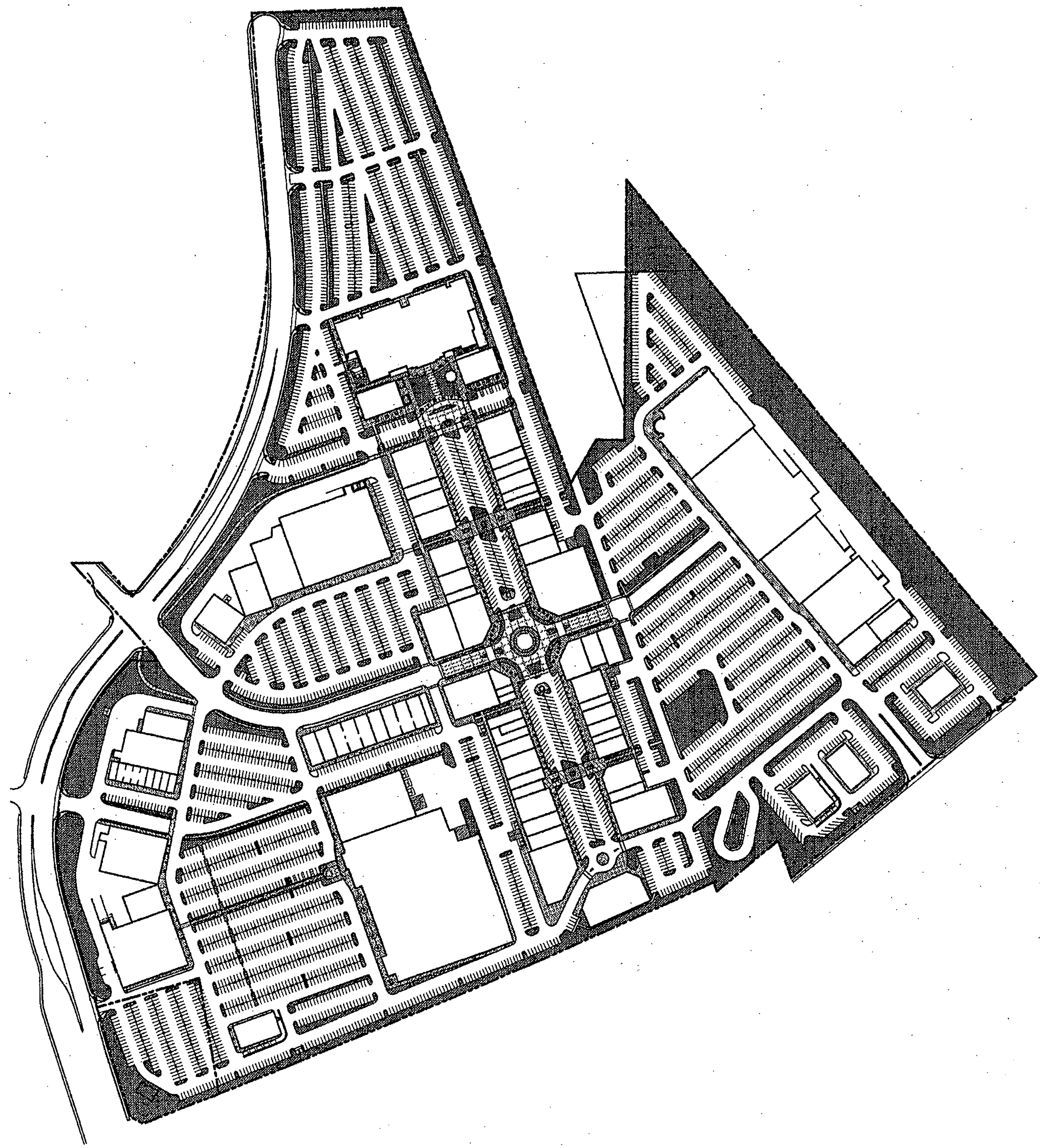
FOR

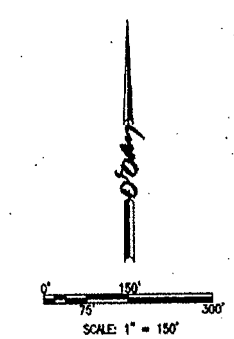
THE PAVILION AT OCEANSIDE

LEGEND

PROJECT BOUNDARY

PERVIOUS AREA





POST DEVELOPMENT IMPERVIOUS AREAS = 76.2 ACRES
POST DEVELOPMENT PERVIOUS AREAS = 15.8 ACRES

TOTAL SITE AREA = 92.0 ACRES

REVISED: DECEMBER 13, 2007
REVISED: AUGUST 21, 2007
REVISED: MAY 4, 2007
PREPARED: JULY 14, 2006

O'Day CONSULTANTS

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Civil Engineering
Planning
Processing
Surveying

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ATTACHMENT 11

Excerpt from the *Hydrology Report for The Pavilion at Oceanside* prepared by Tory R. Walker Engineering, Inc dated June 6, 2006.

Table 1. Summary of Discharges

Subarea	Node	Description	A (ac)	Q_2 (cfs)	Q_{10} (cfs)	Q_{50} (cfs)	Q_{100} (cfs)
100	109	Flow leaving site upstream of Caltrans 60" RCP	28.6*	40	57	79	87
100	115	Flow to 60" RCP upstream of Foussat Road	18.8*	29	41	57	63
100	119	Flow to Middle Pond	59	75	109	152	169
200	213	Flow leaving site to existing 48" RCP	28.5	33	48	67	74
200	217	Flow to 48" RCP under levee	32.4	38	55	76	84
300	307	Flow to Park Pond Channel	5.93	7.3	11	15	16
310	319	Flow to Park Pond Channel	4.51	6.6	9.4	13	14
320	323	Flow to Park Pond Channel	0.81	1.3	1.8	2.5	2.7
500	503	Flow to triple 8'x4' RCB (Park Pond)	1.98	3.5	5	6.9	7.6
510	511	Flow to triple 8'x4' RCB (Park Pond)	3.81	6.8	9.8	13	15
515	519	Flow to triple 8'x4' RCB (Park Pond)	2.12	3.9	5.6	7.6	8.4
520	523	Flow to triple 8'x4' RCB (Park Pond)	2.17	4.2	6	8.2	9

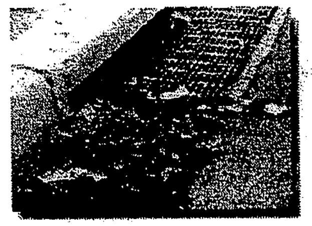
(*) Note: These areas are included in the area at Node 119. Total analyzed area = 112.7 acres

*The Volume of runoff calculated for Detention Analysis is 7.1 ac*ft*

Grease and Urban Runoff

Requirements for Oceanside Eating and Drinking Establishments

Table of Contents



Urban runoff pollutants come from many different sources: leaking cars, chemicals, building materials, yard waste, soil erosion and litter. For instance, powerwashing the street and sidewalk allows soaps, trash, dirt, metals and bacteria to enter a storm drain and eventually flow into a waterway without treatment. Additionally, Eating and Drinking Establishments that do not regularly clean their parking lots, allow oil and grease from cars to wash into the nearest storm drain and eventually to our ocean during a rain event.

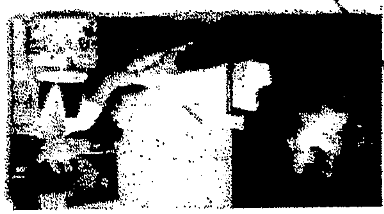
The good news is that urban runoff pollution is preventable! As Oceanside business owners and/ or residents, we simply need to work together and change a few habits to benefit our families, customers and community.

1.2 Background

In February 2001, the California Regional Water Quality Control Board (RWQCB) issued requirements for all San Diego Cities to control the amount of pollution entering our local waterbodies (Order 2001-01). As part of the requirements, all cities must require Eating and Drinking Establishments to eliminate pollutant discharges entering the street, sidewalk, gutters and storm drains by use of the appropriate Best Management Practices (BMPs). BMPs are activities, practices, procedures, or facilities used to avoid, prevent, or reduce pollution entering our streets, sidewalks, gutters, storm drains or waterbodies.

Los agentes contaminadores que vienen con los derrames urbanos provienen de muchas fuentes: Carros que gotean algun tipo de líquido, productos químicos, materiales de construcción, desechos de jardineria, erosión de tierra y basura. Por ejemplo el lavado eléctrico de las calles y aceras, permite que jabones, basura, tierra, metales y bacteria entren al drenaje de la calle y que eventualmente lleguen hacia fuentes de agua, sin haber pasado por un proceso necesario. Adicionalmente, establecimientos de comida y bebida que no limpian regularmente sus estacionamientos de carros, contribuyen a que durante época de lluvias, aceites y grasas de los carros lleguen a los drenajes más cercanos y eventualmente a nuestro océano.

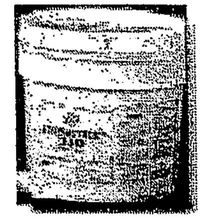
Lo bueno es que se puede prevenir la contaminación de derrames urbanos! Como dueños de negocios y/o residentes en Oceanside, nosotros simplemente nececitamos trabajar juntos y cambiar algunos de nuestros hábitos para beneficiar a nuestras familias, nuestros clientes y a nuestra comunidad.



1.2 Formación

En Febrero del año 2001, el Consejo Regional de Control de la Calidad del Agua en San Diego (RWQCB), instituyó requisitos para controlar la cantidad de contaminación que éntra a nuestras cuencas locales (Orden 2001-01) en todas las ciudades de San Diego. Como parte de estos requisitos, todas las ciudades deben de exigir que sus establecimientos de comida y bebida usen las Mejores Practicas de Control (BMPs), cuando eliminen desechos que contienen agentes contaminadores, y que llegan a las calles, aceras, surcos y drenajes de lluvias. Las BMPs son actividades, prácticas, procedimientos, o facilidades que se usan para evitar, prevenir, o reducir la contaminación que llega a nuestras calles, aceras, surcos, drenajes de lluvias, ríos, riachuelos, lagunas y el mar.

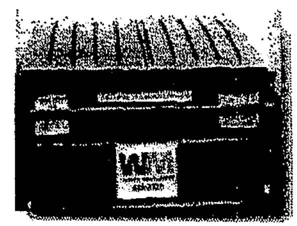
2.3 Materials Management



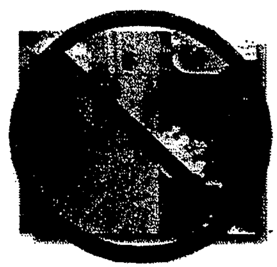
- Label all hazardous materials and store them off the ground. If possible, keep them covered to avoid contact with rain.
- Keep lids closed on drums and other containers.
- Report spills that cannot be contained or cleaned without entering the street or storm drain to the City's Clean Water Program hotline at 760-435-5800.

- Equipment (mats, grease filters, etc.) wash water cannot enter the street, sidewalk, gutter, storm drain or a waterbody.

2.4 Dumpster and Trash Areas

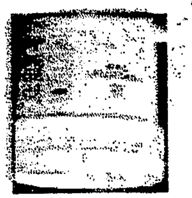


- Keep trash and dumpster areas clean and labeled.
- Inspect trash areas daily.
- Keep trash and dumpster lids closed when not is use.



- Replace or repair leaking dumpsters as soon as possible.
- Put trash and debris in tied plastic bags before placing into the dumpster.
- Do not hose out dumpsters.

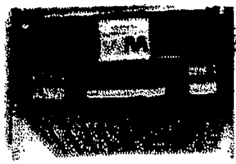
2.3 Control de Materiales



- Ponga etiquetas en todos los materiales peligrosos y guárdelos en un lugar elevado del piso. Si es possible, almacénelos herméticamente cerrados para evitar un posible contacto con la lluvia.
- Mantenga las tapas de los cilindros y contenedores bien cerradas.
- Reporte derrames que no pueden ser detenidos y limpiados antes de entrar al drenaje de la calle, llamando al Programa de Aguas Limpias de la Ciudad 760-435-5800.

- El agua de lavado de maquinaria (esteras, filtros de grasa, etc.) no puede llegar a las calles, aceras, alcantarillas o a drenajes de lluvias, ríos, riachuelos, lagunas y el mar.

2.4 Áreas de Contenedores de Desecho de Basura



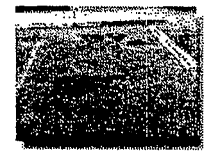
- Mantenga la basura y areas de basura limpias con sus respectivas etiquetas.
- Inspeccione diariamente las áreas de basura.
- Mantenga las tapas de los contenedores de basura bien cerradas cuando no estén en uso.
- Reemplace o arregle de immediato cualquier contenedor de basura que esté goteando.

- Ponga la basura o escombros in bolsas de plástico herméticamente cerradas, antes de ser colocados en los contenedores de basura.
- No limpie los contenedores de basura con manguera.

2.7 Outdoor Areas

- Materials stored on rooftops cannot come into contact with rain water.
- Rooftops and roof drains must be kept clean and regularly inspected.

- Wash water used for powerwashing, equipment cleaning, hosing, etc. is not permitted to enter a storm drain or waterbody. Use dry methods, such as sweeping, or contain wash water and pour it into the sanitary sewer.



- Parking areas must be cleaned and regularly inspected.
- All storm drains on the property must be cleaned regularly and labeled using City provided stencils.
- Never over-apply any chemicals used for landscaping. Carefully follow the directions given on the package.
- Do not over irrigate landscape. Adjust sprinklers so water does not run down the steet and into a storm drain.

- Sweep leaf litter, grass cuttings, and other landscape waste to prevent it from entering the street, sidewalk, gutter, storm drain or a waterbody.

2.7 Áreas de Afuera

- Materiales almacenados en techos no pueden estar en contacto con agua de lluvia.
- Los techos y los drenajes de techos deben ser regularmente limpiados e inspeccionados.

- El agua que proviene de lavados usando maquinaria eléctrica, limpieza de maquinaria, agua de manguera, etc. no esta permitida de llegar al drenaje de la calle o a ríos, riachuelso, lagos, ríos y el mar. Use metodos secos, como por ejemplo barrer, o detenga el agua del lavado y deséchela en el drenaje sanitario dentro del negocio.

- Áreas de estacionamiento de carros deben de ser periódicamente limpiadas e inspeccionadas.
- Todos los drenajes de lluvias en la propiedad deben de ser periódicamente limpiados y marcados usando letras que pueden ser adquiridas en la ciudad.
- Nunca se debe exceder en el uso de productos químicos en la jardinería. Siga cuidadosamente las instrucciones del paquete.
- No se exceda en la irrigación de la jardinería. Ajuste su regadera de agua para que ésta no se desborde hacia la calle y hacia el drenaje de lluvias.

- Barra las hojas, cortes de jardinería, y cualquier otro desecho de plantas para prevenir que éstos lleguen a la calle, acera, surco, drenaje de lluvia o ríos, riachuelos, lagunas y el mar.

2.10 Inspections

- Inspect inside and outside areas of your business (parking areas, outdoor patios, dumpster areas, rooftops, loading and unloading areas, kitchen and back areas).
- Make sure that all indoor pipes are connected to the sewer system.
- Review your current practices and look for areas where you can improve.
- Inspect grease traps or interceptors regularly.
- Good record-keeping is your key to compliance.
- Use the Self-Inspection Checklist in this booklet to keep track of your inspections.

2.11 Employee Training

- Train employees about grease control and urban runoff BMPs at least once annually.
- Employee must understand and perform the BMPs outlined in this booklet.
- The training program for grease control and urban runoff BMPs should at least cover the following:
  - ➔ Materials Management
  - ➔ Dumpster and Trash Areas
  - ➔ Loading and Unloading Areas
  - ➔ Grease Management
  - ➔ Outdoor Areas
  - ➔ Indoor Areas
  - ➔ Spill Prevention and Cleanup
  - ➔ Inspections

2.10 Inspecciones

- Inspeccione las áreas de adentro y de afuera de su negocio (Estacionamiento de vehículos, patios afuera, áreas de contenedores de basura, techos, áreas para uso de carga y de descarga, cocina y áreas de atrás).
- Asegúrese de que toda la tubería esté conectada al sistema de drenaje.
- Revise sus prácticas actuales y busque áreas adonde se puedan aplicar mejores métodos.
- Inspeccione regularmente lugares donde se atrapa la grasa o interceptores.
- La clave para el cumplimiento de las regulaciones es manteniendo un buen sistema de información.
- Use la lista de auto-inspecciones en éste folleto, para mantener documentación de sus inspecciones.

2.11 Entrenamiento de Los Empleados

- Por lo menos una vez al año, provea a sus empleados entrenamiento sobre el control de grasa y derrames urbanos.
- El empleado debe claramente entender y usar las regulaciones catalogadas en página 10.
- El programa de entrenamiento sobre el control de grasa y derrame urbano BMPs deberia por lo menos cubrir los siguientes temas:
  - ➔ Control de materiales
  - ➔ Áreas de contenedores y basura
  - ➔ Áreas de carga y de descarga
  - ➔ Control de grasa
  - ➔ Las áreas de afuera
  - ➔ Las áreas de adentro
  - ➔ Prevención de derrames y limpieza
  - ➔ Inspecciones

Self-Inspection Checklist	Done	Date
Hazardous materials are labeled		
Hazardous materials are stored off the ground		
Lids are kept closed on drums and other containers when not in use		
Wash water from filters, garbage cans, kitchen and floor mats drain only to the sewer		
All wash water and rinse water are drained to the sewer.		
Dumpster and trash areas are clean and labeled		
Dumpster and other waste container lids are kept closed when not in use		
Dumpster and grease bins do not leak and are in good shape		
Trash is tied in plastic bags before being placed into a dumpster		
Loading and unloading areas are cleaned		

Lista de auto-inspecciones	Se efectuó	Fecha
...en etiquetas		
...les peligrosos están almacenados ...áreas fuera del piso		
Las tapas de los cilindros y otros contenedores se mantienen cerradas cuando no están en uso		
El agua de lavado de filtros, de botes de basura, de cocina y de esteras de pisos se desecha solamente en los drenajes dentro del establecimiento		
...oda el agua de lavado y enjuage es drenada ...ntro del establecimiento		
...áreas de contenedores y de basura se ...tienen limpias y están marcadas con ...s		
...pas de contenedores y otros botes de ... se mantienen cerradas cuando no ...n uso		
...enedores de desechos y grasa no		
...es amarrada en...		
Las zonas de carga y descarga estan limpias		

Lista de auto-inspecciones	Se efectuó	Fecha
Atrapadores de grasa e interceptores están … vicio regularmente		
…a con licencia para transportar grasa, proporciona regularmente servicio a los contenedors de grasa		
Las tapas de los contenedores de grasa se mantienen herméticamente cerradas		
El ventilador de aspirador de grasa localizado en el techo es limpiado regularmente		
…ventilador de aspirador de grasa localizado …el techo tiene un plato para atrapar la grasa …tar que esta caiga en el techo		
…latos que atrapan la grasa, son …rmente limpiados antes de ser lavados		
… grasa no son desechados hacia …avatorio, drenaje de lluvia o …or de basura		
…iales que se dejan a la intemperie y …o son tapados adecuadamente		
…e los techos y drenajes no … …combros		
…están protegidas y si agua de lavado se acumula, ésta es recogida antes de llegar al drenaje		

Self-Inspection Checklist	Done	Date
Grease trap/interceptors are installed as required and serviced regularly		
Grease bins are regularly serviced by a licensed grease hauler		
Grease bin lids are kept tightly close		
Rooftop grease exhaust fan is regularly cleaned		
Rooftop grease exhaust fan has a collection pan to prevent grease dripping on the roof		
Plates are scraped thoroughly before washing		
Oil and grease are not poured into a sink, storm drain, or dumpster		
Materials left outside and on the roof are properly covered		
Rooftop areas and drains are free of litter and debris		
Storm drain openings are protected and wash water is collected if water is used outside.		

Nombre del empleado	Fecha

Employee Name	Date

Nombre del empleado	Fecha

Employee Name	Date

STRUCTURAL BMP SUMMARY TABLE			
	VEG. SWALE	INLET FILTER	VEG. STRIP
BASIN #	(L.F.)	(EA.)	(S.F.)
100	2510	9	14400
150	2530	4	0
200	890	14	0
300	1580	1	0
310	1330	0	0
320	0	1	0
500	450	3	0
510	430	2	0
515	470	1	0
520	210	2	0
TOTAL	**10400**	**37**	**14400**

STRUCTURAL BMP SUMMARY TABLE			
	VEG. SWALE	INLET FILTER	VEG. STRIP
BASIN #	(L.F.)	(EA.)	(S.F.)
100	1,880	21	5,850
150	3,030	12	26,000
200	890	15	0
300	1,820	0	0
310	1,340	0	0
320	0	1	0
330	0	2	0
500	400	0	0
505	280	0	0
510	70	3	0
515	70	0	0
520	70	0	0
TOTAL	**9,850**	**54**	**31,850**