WATER-BASED FIRE PROTECTION SYSTEMS DISCHARGE BEST MANAGEMENT PRACTICES MANUAL

California State Fire Marshal

In cooperation with

Division of Water Quality
Storm Water Section

September 2011

Message from the Acting State Fire Marshal

On behalf of CAL FIRE – Office of the State Fire Marshal (OSFM) I am pleased to present the **Water-Based Fire Protection Systems Discharge Best Management Practices Manual**. The extensive discussions, analysis, and expertise resulting in these recommendations and best management practices (BMP) are essential to a balanced and appropriate approach for the proper processing of water discharged from a fire protection system. The testing and flushing of these life safety systems are important to the continued efforts to protect the citizens of California. The Task Force hopes that these BMP will be embraced at both regional and local levels providing a consistent application.

The OSFM would like to extend a sincere gratitude to Co-Chairs: James Parsegian; Deputy State Fire Marshal III, Fire Engineering Division, James Carver, Fire Marshal, El Segundo Fire Department, and Bruce Lecair, West Coast Regional Manager, National Fire Sprinkler Association and to each of the members and organizations for their dedication and commitment to this important project. We appreciate the participants' willingness to share their time, energy, and talent; particularly during these very busy and difficult fiscal times. Through our partnerships we will continue to move fire and panic safety initiatives forward, providing a safer working environment for emergency responders and a safer environment for all those who live in and/or visit the State of California.

Sincerely,

TONYA L. HOOVER
Acting State Fire Marshal

Acknowledgements

This Best Management Practices Manual was developed through the accumulation of research, analysis, and collaborative efforts of the many disciplines involved with the State Fire Marshal Water Discharge for Fire Protection Task Force.

Included in those efforts are (in alphabetical order) the: Allan Automatic Sprinkler Corporation of Southern California, California State Water Resources Control Board, City of Beverly Hills Waste Water Treatment Program, City of El Segundo Fire Department, City of Healdsburg Fire Department, City of Torrance Fire Department, East Bay Municipal Utilities District, National Automatic Sprinkler Industry Promotion, National Fire Sprinkler Association, Northern California Fire Prevention Officers Association, Paraclete Fire Safety Incorporated, Riverside County Fire Department, Sonoma County Permit and Resource Management Department, and Southern California Fire Prevention Officers Association.

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Executive Summary

In response to a request by the National Fire Sprinkler Association, the State Fire Marshal convened a Water Discharge for Fire Protection Task Force under the State Fire Marshal Automatic Extinguishing Systems Advisory Committee to review and develop a guideline for the discharging water from fire protection systems. The task force was established with representatives from various agencies and organizations which included both government and industry. The purpose of the Task Force was to develop a set of Best Management Practices for Contractors State License Board licensed contractors, State Fire Marshal licensed companies and the fire service; to discharge water from a fire protection systems and to provide guidance regarding the practices to control possible contamination of California waters when maintaining fire suppression systems.

Overview

This manual is intended to give persons discharging water (Discharger) from a water-based fire protection system and the municipal separate storm sewer system (MS4) operators a common set of best management practices (BMP) for the proper processing of water discharged from a fire protection system.

The types of discharge covered in this manual are associated with:

- Water-based fire protection system acceptance testing.
- Periodic water-based fire protection system testing and maintenance.
- Fire hydrant testing.
- Water-based fire protection system leaks and emergency repairs.

Purpose and Scope

The purpose of this document is to provide a set of BMP to affected parties in the State of California with a range of procedures for mitigating the discharge of water from a fire protection system to municipal storm sewer systems in a manner consistent with the protection of life property and the environment. It is not to provide a day-to-day field manual for dischargers but rather a set of options (tools) from which dischargers and local agencies may select and customize for their particular needs and settings. Dischargers are encouraged to contact the operator of the receiving MS4 system to discuss any specific discharge requirements.

Part 1: Participants

1. Fire Departments are responsible for protecting life and property from fire. Fire Departments periodically discharge water into the MS4. While emergency fire flows are exempted from permitting, non-emergency discharges may be regulated in some regions.

2. MS4 are built, maintained, and/or operated by a wide range of agencies such as municipalities, counties, flood control districts, and road/transportation departments. They must abide by and enforce the Clean Water Act, the Porter-Cologne Act, and the Storm Water Rule. Most Regional Water Quality Control Boards (RWQCB) and the U.S. Environmental Protection Agency (EPA) issue MS4 permits; most MS4 operators must have an MS4 permit. MS4 permits require agencies to legally ban and prevent all illicit discharges of non-storm water from entering their MS4. Water collected by MS4 is ultimately discharged into the waters of California.

3. The State Water Resources Control Board (SWRCB) and the various RWQCB are charged with the protection of the waters of California and enforcement of the Clean Water Act, the Porter-Cologne Act, and the Storm Water Rule. This is accomplished by the issuance and enforcement of National Pollution Discharge Elimination System (NPDES)/Waste Discharge Requirements (WDR) permits, including MS4 permits for most MS4 operators and in some cases WDR for Community Water Systems (CWS) discharging into MS4.

4. Dischargers include California State Fire Marshal (CSFM) SFM A license Concern, as well as Contractors State Licensing Board (CSLB) Type A, C-16, C-34, and C-36 licensees who perform testing and maintenance of water-based fire protection systems as required by the California Fire Code. Carrying out these activities requires periodic and prescribed discharges into MS4. The activity and concerns/contactors approved for those activities are as follows.

   a. For water-based fire protection acceptance testing:
      - Underground – Type A, C-16, C-34 and C-36 only
      - Above Ground – C-16 only
      - Water Flow – C-10 (limited to water flow only)
   b. For periodic water-based fire protection system testing and maintenance:
      - Underground – C-16 only
      - Above Ground – C-16 only
      - Water Flow – C-10 (limited to water flow only)

- SFM A license Concern (Limited to testing and maintenance)

c. For fire hydrant testing:
   - Underground – Type A, C-16, C-34 and C-36 only
   - Above Ground – C-16 only
   - SFM A license Concern (Limited to testing and maintenance)

d. For water-based fire protection system leaks and emergency repairs:
   - Underground – Type A, C-16, C-34 and C-36 only
   - Above Ground – C-16 only
   - Water Flow – C-10 (limited to water flow only)
   - SFM A license Concern (Limited to testing and maintenance)

Note: Fire Departments may conduct testing of any water based fire protection system.

Part 2: Notification and Record Keeping

This document covers discharges to the municipal storm sewer system, not the sanitary sewer system. If it becomes necessary to discharge to the sanitary sewer system, written permission or a permit is typically required from the local sanitary sewer authority. When using this manual, a discharge is water which comes from a single location and project. If a Discharger releases water from a given location and a given project in a series of related events, these events are considered one discharge.

1. Notification and Recordkeeping

   a. A single discharge of less than 1,500 gallons – Discharger does not need to give prior notification.
   b. A single discharge equal to or greater than 1,500 gallons but less than 10,000 gallons – Discharger does not need to give prior notification for any single discharge, but would need to maintain records of those discharges.
   c. A single discharge equal to or greater than 10,000 gallons – Discharger does need to give prior notification and maintain records of the discharge.

2. Prior Notification
   Dischargers should notify the MS4 agency/operator not less than 24 hours prior to any planned discharge and as soon as possible after any emergency discharge. The method of notification must be by one of the four options listed below:

a. Telephone call
b. A fax transmission
c. An email
d. In person

Note: The large majority of single discharge events from existing building water-based fire protection systems are drain and fill tests which are small in volume falling at or below 1500 gallons based on building and system size. Reporting and recordkeeping (though the latter is often done as a matter of practice by licensed Dischargers) would yield a significant additional administrative and cost burden on all parties.

3. Recordkeeping

Records should be kept utilizing the sample form provided in **Appendix C** of this manual. The sample form should be completed in either black or blue ink. Records of discharges should be retained for a minimum of five years. Records must be made available for review by the MS4 and/or RWQCB and must provide the following information:

a. Information for all discharges greater than 1,500 gallons
b. Name of Discharger
c. Date of notification (if equal to or greater than 10,000 gallons) or emergency
d. Method of notification (if equal to or greater than 10,000 gallons) or emergency
e. Location of discharge
f. Date of the discharge
g. Time of the beginning and end of the discharge
h. Duration of the discharge (minutes)
i. Flow rate (gallons per minute)
j. Total number of gallons discharged
k. Type of dechlorination “chemicals” used
l. Concentration of chlorine measured after dechlorination including time of sampling and description of sampling location
m. Type of sediment controls used

Note: When exact flows, volumes, and length of discharge are not available the discharger needs to estimate the values.

FIRE SPRINKLER
WATER DISCHARGE SUMMARY

Event Total Gallons	Notification MS4	De-Chlorination	Sediment and Debris Control		Chemical Testing	Record Keeping
			Within Piping System	Exterior Surface		
≤ 1,500	Not Required	Not Required	Not Required	**	***	Not Required
> 1,500 ≤ 10,000	Not Required	*	**	**	***	Required
> 10,000	Required	*	**	**	***	Required

* *Required if discharge is to enter storm drain system and water is fresh.*
** *Required if debris exists and together with discharge will enter storm drain system*
*** *Required if it has been determined that chemical additives are within piping system.*

Part 3: Flow and Volume Determination

Dischargers need to determine the flow and volume of the discharge.

1. Flow is determined by one of the following methods:

    a. Attaching a flow meter to the discharge opening and reading the displayed value
    b. Measuring the pressure from a pressure gauge and then using the table or formulas found at the end of **Appendix B**
    c. Where "a" or "b" are not applicable, measure the velocity (V) using a floating object and measure or calculate the cross-sectional area (A) of flowing water. (V x A = flow rate [e.g., V = 2 ft/sec and A = 1.5 ft^2; Flow = 3 ft^3/sec or 1,347 gal/min])

2. Volume is determined by multiplying the flow (e.g., gallons/minute) by the duration of the discharge (minutes).

Part 4: Safety Considerations

Dischargers need to take the following precautions before flow testing a hydrant:

1. Ensure water will flow into nearby drain inlets as intended.

2. Ensure drain inlets are open and free of debris.

3. Ensure flowing water will not cause flooding or damage to adjacent properties.

4. Ensure water flow trajectory will not impact nearby vehicles, equipment, or pedestrian traffic.

5. Ensure water flow does not create slick or unsafe conditions.

Note: Do not conduct the test if any unsafe condition exists or would be created. If in doubt, do not conduct the test and notify the building owner and MS4 operator if prior notification was made.

Part 5: Discharge into Sensitive Areas

Sensitive areas are those that may present a potential problem or hazard to the environment. Use best judgment in analyzing each area. Address the following concerns when evaluating whether to test the hydrant.

1. Ensure road surfaces are free of debris that may flow into the drain inlets or nearby sensitive areas.

2. Ensure curbs or ditches are adequate to handle the flow without creating a buildup of silt which cannot be contained and removed.

3. Ensure water flows will be free of potential contaminants such as oil, contaminated soils, etc.

4. Ensure water does not cause erosion.

Note: Do not test the hydrant if any of the above or any other condition may adversely impact the area. If in doubt, do not test and notify the building owner and MS4 if prior notification was made. If a problem does arise, such as a major erosion or siltation of nearby creeks, discontinue testing and notify the MS4 immediately.

Part 6: Water Discharge Mitigation

1. Conduct flows for the shortest duration possible. MS4 may limit maximum flow rate to storm sewer.

2. Remove all debris from the curb and gutter before initiating flushing.

3. If chlorine residual is a concern, use dechlorination. Many, if not most, testing and maintenance discharges will not have chlorine residual due to the age of the water in the system. If CWS water is introduced during testing and then discharged, it will require dechlorination.

4. Whenever possible and when safe to do so without causing damage or erosion, contain flows onsite by directing the water to landscaped or green areas.

5. When practicable and with the permission of the local sewer agency, divert sprinkler system discharge to the sewer. The local sewer agency may have additional conditions.

6. Assess the following prior to any partial or full discharge of water from a vault, substructure or building fire system into the street or storm drain system.

    a. Ensure the water is not cloudy, discolored and/or has no unusual odor.
    b. Ensure the Fire Protection System water does not have chemical additives. If it has been determined that chemicals have been added to the fire protection system the following actions must be taken:

    Note: The following conditions may require testing by an accredited laboratory for cloudiness, discoloration and odors (sewage, chemicals, solvents, gasoline, etc.). Turbid water due to rust and musty stagnation would be subject to BMP for containment and sediment control.

        i. The water should be tested by an approved testing facility to determine the chemical and the proper treatment.
        ii. Upon completion of the chemical report of the water test, the results should be submitted to the MS4 regulator to determine the approved discharge method and location of the water discharge. Examples of the discharge location may be storm drains, sewage system or to an approved treatment facility or plant.
        iii. If chemicals are to be reintroduced into a system, proper signage should be provided for guidance.

7. Dechlorination – The MS4 General NPDES Permit requires all waters discharged must be dechlorinated before entering a storm drain. Failure to follow this procedure could result in death of aquatic animals and legal liability. Methods of dechlorinization include using aeration

and/or other appropriate means such as infiltration to the ground, bags, diffusers, and at sediment traps in drop inlets where controllable.

Dechlorination Equipment

a. Bags – Consisting of a mesh bag into which large tablets of dry chemical are placed to react with residual chlorine to remove it from the water
b. Flow Meter (optional)
c. Pressure Gauge
d. Pitot Tube
e. Dechlorination chemicals
    i. Sodium Sulfite
    ii. Sodium Bisulfate
    iii. Sodium Thiosulfate
    iv. Ascorbic Acid
f. Diffusers – Mechanical devices which are placed on the end of the discharge point which automatically mixes the discharged water with either dry or wet dechlorination chemicals. A wide variety of diffusers are available.
g. Chlorine Residual Test Kits
    i. Test Strips – Are dipped into the water; the color of the strip changes depending on the concentration of the chlorine. A comparator on the package allows for the determination of the chlorine concentration.
    ii. Color Wheels – A square clear plastic container that holds about 10 milliliters of water. Chemicals are added to produce a pink color. A wheel attached to the plastic container has different shades of pink which correspond to different concentrations of chlorine. The wheel can be turned so that the shade of pink of the water sample can be matched to the corresponding chlorine concentration.
    iii. Electronic Colorimeters – Devices consisting of a glass or plastic cell and a hand-held electronic colorimeter. A sample of water is placed in the cell and chemicals are added which produce a pink color. A second cell has a water sample with no chemicals added. The cell with no chemicals is placed into the colorimeter and the device measures the intensity of color. This is then assigned a value of zero. The cell that had chemicals added is then placed in the colorimeter and the device measures the intensity of the color and then converts that intensity into a concentration of chlorine or chloramines on a display.

Note: Chlorine Residual Test Kits–In order to determine if the dechlorination process removes the disinfectant, it is necessary to test the water.

8. Sediment Control – The MS4 General NPDES Permit requires all Dischargers to minimize sediments and other debris entering a storm drain. Failure to follow this procedure could result in adverse impacts to aquatic animals, obstruction of flood control facilities, flooding, and legal liability.

   a. There are a wide variety of equipment that may be used for sediment control and clean-up depending upon the requirements of the specific site where discharges might occur **(see Appendix D for pictures of examples)**.
      i. Wattles
      ii. Sand Bags
      iii. Gravel bags
      iv. Mats
      v. Booms
      vi. Barricades
      vii. Silt Fencing
      viii. Hay Bales
      ix. Hoses
      x. Filters
      xi. Debris Storage
      xii. Brooms
      xiii. Shovels
      xiv. Rakes
      xv. Vacuum Truck or Wet/Dry Vacuum

   b. Procedure – As an example place gravel or sand filled bags to form dams across (perpendicular to) the flow path and curb with the end of the dam (furthest from curb) curving slightly upstream. Dam height, length, the number of bags used and the interval between dams will vary depending upon site conditions and the resources available. It is recognized that there will be some circumstances where steep topography and/or high flow rates will preclude effective sediment removal using any of the current technologies. The following criteria should be used to determine bag placement:
      i. Dam Height – The height of each dam should be slightly less than the height of the curb or other retaining structure that is acting to channel the flow. If it is equal to or higher than the curb, flow will be diverted onto the sidewalk and cause flooding.

ii. Dam Length – The longer the dam, the greater the ponding area and the better the retention, which allows the sediment to drop out. However, dam length is limited by the number of bags available, traffic flow considerations and potential for flooding of property, bags and ponded water should not extend outside of coned areas into traffic lanes or onto private property.

iii. Number of Dams and Distance between Dams – In general, the greater the number of dam locations between the discharge source and entry into storm drains or receiving waters, the greater the retention of sediment. A minimum of two dams should be used in all cases. The interval between dams must shorten as the ground surface gradient (slope) increases to maintain equivalent sediment removal rates.

iv. When the discharge is complete, allow any water that is ponded behind the dams to be drained. Be sure storm drain inlet is protected. Shovel up as much sediment as possible. Move one of the dams to a location immediately upstream of the storm drain or to the point where the flow enters receiving waters to provide sediment control for discharge cleanup. If possible, clean the flow path and upstream dams to remove residual sediment from the street. Retrieve all dam materials and store in appropriate location.

9. Determine Flow Path

Determine the flow path of the discharge from the point of release to the inlet of a storm drain.

a. Procedures: Evaluate and determine the appropriate BMP to use.
   i. Isolate the riser or control valve prior to draining
   ii. Evaluate the release volume and character. Compare with the release point and conveyance
b. Inspect the flow path to ensure the flow path is clear and unobstructed allowing water to flow to the storm drain. Consider the following:
   i. The maximum flow rate that will not cause erosion or scouring of any exposed ground in the flow path
   ii. The flow path must offer adequate capacity to allow the flow to move quickly to the storm drain without undesirable flooding or pooling. There must be nothing in the path that would interfere with the dechlorination process or hinder the analysis of the chlorine level. Whether the flow path is paved or unpaved, permeable or

impermeable, the flow must not inappropriately scour the surface. The discharge must not damage either pavement or neighboring property or impact vehicle or pedestrian traffic

iii. Permeable and natural surfaces are much more subject to scouring and erosion and thus cannot support higher velocities and require more robust sediment control equipment.

If there are large areas of permeable or natural surfaces where scouring and mobilization of sediments are possible, hoses may be used to move the discharge point away from these areas to an area better able to support the anticipated flow or temporary mats or channels may be installed to protect the area

c. Alignment of the discharge point can have important implications. Whether the discharge point is a diffuser or a hose or a pipe, it must be placed in such a way that it does not undercut pavement or erode soils. The force with which the water is hitting the surface should be minimized by adjusting the flow.
   i. Record the time of the beginning of the discharge.
   ii. Begin the flow slowly, increasing flow gradually so as not to damage any equipment or property.
   iii. Inspect the discharge path as the flow increases. Make sure that no scouring, erosion, or undercutting of pavement is occurring. If concerns arise immediately take corrective action which could include:
      1. Reduce the flow rate of the discharge.
      2. Adjust the angle of the discharge.
      3. Stop discharge altogether.

d. Prepare the flow path for discharge. Remove materials that may obstruct or divert discharge flow from the discharge point to the entrance. Also remove any materials that may interfere with the dechlorination process or clog the sediment control equipment.
   i. Place the dechlorination and sediment control equipment between the point of release and the entry to the storm drain. Impermeable and engineered surfaces can generally support higher velocities and require less robust sediment control equipment or angle of the discharge.
   ii. Add the dechlorination chemical to the equipment.
   iii. Measure the chlorine concentration at a point prior to the inlet to the storm drain. If chlorine residual is present, take steps to reduce this concentration, including but not limited to:
      1. Make adjustments to the dechlorination equipment

to increase the amount of chemical being added.
2. Reduce the flow of the discharge.
3. Add more chemical to the storage vessel.
4. Reduce flow slowly and remove equipment.
5. When the discharge is complete, record the time and determine the volume discharged.
6. Clean up all debris and sediments in the flow path and trapped by the control equipment.

10. Drain Inlet Protection – Drain Inlet Filter Bag
Before the drain event, check to be sure the fire protection system discharge does not interfere with or delay repairs or corrective actions undertaken by the MS4 agency.

a. Procedure: Evaluate and determine appropriate BMP to use. Place bags to either completely or partially surround drain inlet. The number of bags used will vary depending upon site conditions and the resources available. Protection should be installed around all affected drain inlets within reason. Several bags may need to be stacked on top of each other to produce the desired protection. Remove grate from drain inlet and ensure that it is clear and clean of debris. Place filter bag insert so that edges are secured when grate is replaced. Periodically inspect and adjust bags. Because filter bags clog quickly, pay particular attention to water backing up around the drain inlet. Either replace the bags frequently or adjust upstream sediment dams to provide more sediment removal prior to drain inlet.
b. When the discharge is complete, allow any water that is ponded behind the dams to drain. Clean the flow path and upstream dams to remove residual sediment from the street. Retrieve all control equipment and remove temporary drain inlet bag.

Part 7: Water Discharge Awareness Course

The CFSM developed a sample course outline for this BMP manual. This part presents an overview of a joint effort to inform the water-based fire protection system contractors, business concerns and the fire service of these guidelines and provisions. The outline is intended to assist dischargers in developing a training plan for their employees to ensure compliance with local, state and federal law dealing with the waters of California.

1. The BMP outlined in this document are essential elements for a contractor and/or business concern to be aware of and to utilize in the day-to-day business company operations when discharging fire protection system waters. The Awareness Level Training Course will help ensure that the procedures outlined in this set of BMP are utilized

(see Appendix E).

2. The Water Discharge for Fire Protection Systems Awareness Level Course will provide the student with:

   a. An awareness of the Water-Based Discharge for Fire Protection Systems BMP document and to become familiar with the water discharge requirements as they relate to water-based fire protection systems during the flowing of water for testing, draining, and maintenance of these systems.
   b. An awareness of the necessary records, forms, and notification procedures deemed necessary to be in compliance with the various federal, state, regional, and local laws, regulations, and procedures relevant to the discharge of water.
   c. An awareness of safety considerations, testing procedures, control equipment, clean-up equipment, and drain inlet protection.
   d. An awareness and understanding of the need to identify the volume/quantity of water to be discharged during periodic flow testing and maintenance procedures and to recognize the thresholds which reflect the different levels of notifications and/or protocol.
   e. An awareness of the federal, state, regional, and local law, regulations, and procedures relevant to the discharge of water into the lands, streets, storm drains, sewers, streams, creeks, rivers, lakes, bays, and oceans.
   f. An awareness of the various federal, state, regional, and local agencies which are assigned the roles of enforcing these laws, regulations, and procedures and to understand the various acronyms associated with these agencies.

Appendix A

Regional Water Quality Control Board Contact List

The boundary information and general contact information for the nine Regional Water Quality Control Boards may be found at the following website:

http://www.waterboards.ca.gov/waterboards_map.shtml

Storm Water Contacts

Region 1 (Santa Rosa)
John Short
(707) 576-2065

Region 2 (San Francisco Bay)
Shin-Roei Lee
(510) 622-2376

Region 3 (San Luis Obispo)
Phil Hammer
(805) 549-3882

Region 4 (Los Angeles)
Ivar Ridgeway
(213) 620-2150

Region 5 (Fresno)
Dale Harvey
(559) 445-6190

Region 5 (Sacramento)
Diana Messina
(916) 464-4828

Region 5 (Redding)
George Day
(530) 224-4859

Region 6 (South Lake Tahoe & Victorville)
Lauri Kemper
(530) 542-5436

Region 7 (Palm Desert)
John Carmona
(760) 340-4521

Region 8 (Santa Ana)
Michael Adackapara
(951) 782-3238

Region 9 (San Diego)
David Barker
(858) 467-2989

Appendix B

Typical Discharge Types and Volume Ranges for Example Buildings

TABLE A

DISCHARGE TABLE FOR CIRCULAR OUTLETS
(Outlet pressure measured by pitot gauge)

Outlet/Pitot Pressure (psi)	Outlet Diameter in Inches							
	2-1/4"	2-3/16"	2-3/8"	2-7/16"	2-1/2"	2-9/16"	2-5/8"	2-11/16"
	(gpm)							
1	136	144	151	160	168	176	185	194
2	192	203	214	226	237	249	262	274
3	235	249	262	276	291	305	320	336
4	272	287	303	319	336	353	370	388
5	304	321	339	357	375	394	414	434
6	333	352	371	391	411	432	453	475
7	360	380	401	422	444	466	489	513
8	384	406	428	451	475	499	523	548
9	408	431	454	479	503	529	555	582
10	430	454	479	504	531	557	585	613
11	451	476	502	529	557	585	614	643
12	471	497	525	553	581	611	641	672
13	490	518	546	575	605	636	667	699
14	509	537	567	597	628	660	692	726
15	526	556	587	618	650	683	716	751
16	544	574	606	638	671	705	740	776
17	560	592	624	658	692	727	763	799
18	577	609	642	677	712	748	785	823
19	592	626	660	695	731	768	806	845
20	608	642	677	713	750	788	827	867
21	623	658	694	731	769	808	848	889
22	637	673	710	748	787	827	868	910
23	652	689	726	765	805	845	887	930
24	666	703	742	781	822	864	906	950
25	680	718	757	798	839	881	925	970
26	693	732	772	813	856	899	943	989
27	706	746	787	829	872	916	961	1008
28	719	760	801	844	888	933	979	1026
29	732	773	815	859	904	949	996	1044
30	744	786	829	874	919	966	1013	1062
31	757	799	843	888	934	982	1030	1080
32	769	812	857	902	949	997	1046	1097
33	781	825	870	916	964	1013	1063	1114
34	793	837	883	930	978	1028	1079	1131
35	804	849	896	944	993	1043	1094	1147
36	815	861	909	957	1007	1058	1110	1163
37	827	873	921	970	1021	1072	1125	1179
38	838	885	934	983	1034	1087	1140	1195
39	849	897	946	996	1048	1101	1155	1211
40	860	908	958	1009	1061	1115	1170	1226

Outlet Nozzle Coefficient = 0.90

Table reprinted with permission of East Bay Municipal Utility District

TABLE A

DISCHARGE TABLE FOR CIRCULAR OUTLETS (Outlet pressure measured by pitot gauge)								
Outlet/Pitot Pressure (psi)	Outlet Diameter in Inches							
	2-1/4"	2-3/16"	2-3/8"	2-7/16"	2-1/2"	2-9/16"	2-5/8"	2-11/16"
	(gpm)							
41	870	919	970	1021	1074	1129	1185	1242
42	881	930	981	1034	1087	1142	1199	1257
43	891	941	993	1046	1100	1156	1213	1272
44	902	952	1004	1058	1113	1169	1227	1286
45	912	963	1016	1070	1126	1183	1241	1301
46	922	974	1027	1082	1138	1196	1255	1315
47	932	984	1038	1094	1150	1209	1268	1329
48	942	995	1049	1105	1163	1221	1282	1343
49	951	1005	1060	1117	1175	1234	1295	1357
50	961	1015	1071	1128	1186	1247	1308	1371
51	971	1025	1081	1139	1198	1259	1321	1385
52	980	1035	1092	1150	1210	1271	1334	1398
53	989	1045	1102	1161	1222	1283	1347	1412
54	999	1055	1113	1172	1233	1295	1359	1425
55	1008	1065	1123	1183	1244	1307	1372	1438
56	1017	1074	1133	1194	1256	1319	1384	1451
57	1026	1084	1143	1204	1267	1331	1397	1464
58	1035	1093	1153	1215	1278	1343	1409	1477
59	1044	1103	1163	1225	1289	1354	1421	1489
60	1053	1112	1173	1236	1300	1366	1433	1502
61	1062	1121	1183	1246	1311	1377	1445	1514
62	1070	1130	1192	1256	1321	1388	1457	1527
63	1079	1140	1202	1266	1332	1399	1468	1539
64	1087	1149	1211	1276	1342	1410	1480	1551
65	1096	1157	1221	1286	1353	1421	1491	1563
66	1104	1166	1230	1296	1363	1432	1503	1575
67	1112	1175	1240	1306	1373	1443	1514	1587
68	1121	1184	1249	1315	1384	1454	1525	1599
69	1129	1193	1258	1325	1394	1464	1537	1611
70	1137	1201	1267	1335	1404	1475	1548	1622
71	1145	1210	1276	1344	1414	1485	1559	1634
72	1153	1218	1285	1353	1424	1496	1570	1645
73	1161	1227	1294	1363	1434	1506	1581	1657
74	1169	1235	1303	1372	1443	1516	1591	1668
75	1177	1243	1311	1381	1453	1527	1602	1679
76	1185	1252	1320	1391	1463	1537	1613	1690
77	1193	1260	1329	1400	1472	1547	1623	1702
78	1200	1268	1337	1409	1482	1557	1634	1713
79	1208	1276	1346	1418	1491	1567	1644	1723
80	1216	1284	1354	1427	1501	1577	1655	1734

Outlet Nozzle Coefficient = 0.90

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TABLE A

DISCHARGE TABLE FOR CIRCULAR OUTLETS (Outlet pressure measured by pitot gauge)								
Outlet/Pitot Pressure (psi)	Outlet Diameter in Inches							
	2-1/4"	2-3/16"	2-3/8"	2-7/16"	2-1/2"	2-9/16"	2-5/8"	2-11/16"
	(gpm)							
81	1223	1292	1363	1436	1510	1587	1665	1745
82	1231	1300	1371	1444	1519	1596	1675	1756
83	1238	1308	1380	1453	1529	1606	1685	1767
84	1246	1316	1388	1462	1538	1616	1695	1777
85	1253	1324	1396	1471	1547	1625	1706	1788
86	1260	1331	1404	1479	1556	1635	1716	1798
87	1268	1339	1412	1488	1565	1644	1725	1809
88	1275	1347	1421	1496	1574	1654	1735	1819
89	1282	1354	1429	1505	1583	1663	1745	1829
90	1289	1362	1437	1513	1592	1672	1755	1840
91	1297	1370	1445	1522	1601	1682	1765	1850
92	1304	1377	1453	1530	1609	1691	1774	1860
93	1311	1385	1460	1538	1618	1700	1784	1870
94	1318	1392	1468	1546	1627	1709	1794	1880
95	1325	1399	1476	1555	1635	1718	1803	1890
96	1332	1407	1484	1563	1644	1727	1813	1900
97	1339	1414	1491	1571	1653	1736	1822	1910
98	1345	1421	1499	1579	1661	1745	1831	1920
99	1352	1428	1507	1587	1670	1754	1841	1929
100	1359	1436	1514	1595	1678	1763	1850	1939
101	1366	1443	1522	1603	1686	1772	1859	1949
102	1373	1450	1529	1611	1695	1780	1868	1958
103	1379	1457	1537	1619	1703	1789	1877	1968
104	1386	1464	1544	1627	1711	1798	1887	1977
105	1393	1471	1552	1634	1719	1806	1896	1987
106	1399	1478	1559	1642	1728	1815	1905	1996
107	1406	1485	1566	1650	1736	1824	1914	2006
108	1412	1492	1574	1658	1744	1832	1922	2015
109	1419	1499	1581	1665	1752	1841	1931	2024
110	1425	1506	1588	1673	1760	1849	1940	2034
111	1432	1513	1595	1681	1768	1857	1949	2043
112	1438	1519	1603	1688	1776	1866	1958	2052
113	1445	1526	1610	1696	1784	1874	1966	2061
114	1451	1533	1617	1703	1792	1882	1975	2070
115	1458	1540	1624	1711	1799	1890	1984	2079
116	1464	1546	1631	1718	1807	1899	1992	2088
117	1470	1553	1638	1725	1815	1907	2001	2097
118	1476	1560	1645	1733	1823	1915	2010	2106
119	1483	1566	1652	1740	1830	1923	2018	2115
120	1489	1573	1659	1747	1838	1931	2026	2124

Outlet Nozzle Coefficient = 0.90

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TABLE A

DISCHARGE TABLE FOR CIRCULAR OUTLETS (Outlet pressure measured by pitot gauge)								
Outlet/Pitot Pressure (psi)	Outlet Diameter in Inches							
	2-1/4"	2-3/16"	2-3/8"	2-7/16"	2-1/2"	2-9/16"	2-5/8"	2-11/16"
	(gpm)							
121	1495	1579	1666	1755	1846	1939	2035	2133
122	1501	1586	1673	1762	1853	1947	2043	2142
123	1507	1592	1679	1769	1861	1955	2052	2151
124	1513	1599	1686	1776	1868	1963	2060	2159
125	1520	1605	1693	1783	1876	1971	2068	2168
126	1526	1612	1700	1790	1883	1979	2077	2177
127	1532	1618	1707	1798	1891	1987	2085	2185
128	1538	1624	1713	1805	1898	1994	2093	2194
129	1544	1631	1720	1812	1906	2002	2101	2202
130	1550	1637	1727	1819	1913	2010	2109	2211
131	1556	1643	1733	1826	1920	2018	2117	2219
132	1562	1649	1740	1833	1928	2025	2125	2228
133	1567	1656	1746	1840	1935	2033	2133	2236
134	1573	1662	1753	1846	1942	2041	2141	2245
135	1579	1668	1760	1853	1950	2048	2149	2253
136	1585	1674	1766	1860	1957	2056	2157	2261
137	1591	1680	1772	1867	1964	2063	2165	2270
138	1597	1687	1779	1874	1971	2071	2173	2278
139	1602	1693	1785	1881	1978	2078	2181	2286
140	1608	1699	1792	1887	1985	2086	2189	2294
141	1614	1705	1798	1894	1992	2093	2197	2303
142	1620	1711	1805	1901	1999	2101	2204	2311
143	1625	1717	1811	1907	2007	2108	2212	2319
144	1631	1723	1817	1914	2014	2115	2220	2327
145	1637	1729	1824	1921	2021	2123	2228	2335
146	1642	1735	1830	1927	2027	2130	2235	2343
147	1648	1741	1836	1934	2034	2137	2243	2351
148	1653	1747	1842	1941	2041	2145	2251	2359
149	1659	1752	1848	1947	2048	2152	2258	2367
150	1665	1758	1855	1954	2055	2159	2266	2375
151	1670	1764	1861	1960	2062	2166	2273	2383
152	1676	1770	1867	1967	2069	2173	2281	2391
153	1681	1776	1873	1973	2075	2181	2288	2398
154	1687	1782	1879	1979	2082	2188	2296	2406
155	1692	1787	1885	1986	2089	2195	2303	2414
156	1698	1793	1891	1992	2096	2202	2311	2422
157	1703	1799	1897	1999	2102	2209	2318	2430
158	1708	1805	1903	2005	2109	2216	2325	2437
159	1714	1810	1910	2011	2116	2223	2333	2445
160	1719	1816	1916	2018	2122	2230	2340	2453

Outlet Nozzle Coefficient = 0.90

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FORMULAS

Use the following formula to calculate the "observed" or measured flow rate based on the pitot measurement:

$$\mathbf{Q_f = 29.83\ d^2 C \sqrt{P_o}} \qquad (1)$$

Where:

Q_f = measured flow rate (gpm)

d = inside diameter of flow outlet or stream diameter (inches)

P_o = pitot measurement (psi)

C = coefficient of discharge*

* Use the typical value of 0.90 for the coefficient of discharge.

Sample calculation:

P_o	=	Pitot measured in the field	=	35 psi
C	=	coefficient of discharge	=	0.90
d	=	inside diameter of flow	=	2.5 inches

$$Q_f = 29.83 \times 2.5^2 \times 0.90 \times \sqrt{P_o}$$

$$= 167.8 \times \sqrt{35}$$

$$= 167.8 \times 5.9$$

$$= 992.7 \quad \text{or} \quad 993 \text{ gpm (see Table A for comparison)}$$

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TABLE B
Typical Discharge Types for Buildings that Require Testing by the California State Fire Marshal

Table 5.1 Summary of Sprinkler System Inspection, Testing, and Maintenance

Item	Activity	Frequency	Reference
Gauges (dry, preaction, and deluge systems)	Inspection	~~Weekly/monthly~~ Quarterly	5.2.4.2, 5.2.4.3
Control valves	Inspection	~~Weekly/monthly~~ Quarterly	Table 12.1
Alarm devices	Inspection	Quarterly	5.2.6
Gauges (wet pipe systems)	Inspection	~~Monthly~~ Quarterly	5.2.4.1
Hydraulic nameplate	Inspection	Quarterly	5.2.7
Buildings	Inspection	Annually (prior to freezing weather)	5.2.5
Hanger/seismic bracing	Inspection	Annually	5.2.3
Hanger/seismic bracing in accessible concealed spaces	Inspection	5 Years	5.2.3.3
Pipe and fittings	Inspection	Annually	5.2.2
Pipe and fittings in accessible concealed spaces	Inspection	5 Years	5.2.2.3
Sprinklers	Inspection	~~Annually~~ Quarterly	5.2.1
Sprinklers in accessible concealed spaces	Inspection	5 Years	5.2.1.1.4
Spare sprinklers	Inspection	~~Annually~~ Quarterly	5.2.1.3
Fire department connections	Inspection	Quarterly	Table 12.1
Valves (all types)	Inspection		Table 12.1
Alarm devices	Test	~~Quarterly/semiannually~~ Annually	5.3.3
Main drain	Test	Annually	Table 12.1
Antifreeze solution	Test	Annually	5.3.4
Gauges	Test	5 years	5.3.2
Sprinklers — extra-high temperature	Test	5 years	5.3.1.1.1.3
Sprinklers — fast response	Test	At 20 years and every 10 years thereafter	5.3.1.1.1.2
Sprinklers	Test	At 50 years and every 10 years thereafter	5.3.1.1.1
Valves (all types)	Maintenance	Annually or as needed	Table 12.1
Obstruction investigation	Maintenance	5 years or as needed	13.2.1, 13.2.2
Low point drains (dry pipe system)	Maintenance	Annually prior to freezing and as needed	12.4.4.3.3

Table 6.1 Summary of Standpipe and Hose Systems Inspection, Testing, and Maintenance

Item	Activity	Frequency	Reference
Control valves	Inspection	~~Weekly/monthly~~ Quarterly	Table 12.1
Pressure regulating devices	Inspection	Quarterly	Table 12.1
Piping	Inspection	~~Quarterly~~ Semi-Annually	6.2.1
Hose connections	Inspection	~~Quarterly~~ Semi-Annually	Table 12.1
Cabinet	Inspection	~~Annually~~ Semi-Annually	NFPA 1962
Hose	Inspection	~~Annually~~ Semi-Annually	NFPA 1962
Hose storage device	Inspection	~~Annually~~ Semi-Annually	NFPA 1962
Alarm device	Test	~~Quarterly~~ Annually	Table 12.1
Hose nozzle	Test	Annually	NFPA 1962
Hose storage device	Test	~~Annually~~ 5 years	NFPA 1962
Hose	Test	5 years/3 years	NFPA 1962
Pressure control valve	Test	5 years	Table 12.1
Pressure reducing valve	Test	5 years	Table 12.1
Hydrostatic test	Test	5 years	6.3.2
Flow test	Test	5 years	6.3.1
Main drain test	Test	Annually	Table 12.1
Hose connections	Maintenance	Annually	Table 6.2.2
Valves (all types)	Maintenance	Annually/as needed	Table 12.1

NOTE: — Strikeout items are not applicable in California
Shaded (screened) items are California amendments

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Table 7.1 Summary of Private Fire Service Main Inspection, Testing, and Maintenance

Item	Activity	Frequency	Reference
Hose houses	Inspection	Quarterly	7.2.2.7
Hydrants (dry barrel and wall)	Inspection	Annually and after each operation	7.2.2.4
Monitor nozzles	Inspection	Semiannually	7.2.2.6
Hydrants (wet barrel)	Inspection	Annually and after each operation	7.2.2.5
Mainline strainers	Inspection	Annually and after each significant flow	7.2.2.3
Piping (exposed)	Inspection	Annually	7.2.2.1
Piping (underground)	Inspection	See 7.2.2.2	7.2.2.2
Monitor nozzles	Test	Flow annually (range and operation)	7.3.3
Hydrants	Test	Flow annually	7.3.2
Piping (exposed and underground)	Flow test	5 years	7.3.1
Mainline strainers	Maintenance	Annually and after each operation	7.4.2
Hose houses	Maintenance	Annually	7.4.5
Hydrants	Maintenance	Annually	7.4.3
Monitor nozzles	Maintenance	Annually	7.4.4

Table 8.1 Summary of Fire Pump Inspection, Testing, and Maintenance

Item	Activity	Frequency	Reference
Pump house, heating ventilating louvers	Inspection	Weekly	8.2.2(1)
Fire pump system	Inspection	Weekly	8.2.2(2)
Pump operation			
No-flow condition	Test	Weekly	8.3.1
Flow condition	Test	Annually	8.3.3.1
Hydraulic	Maintenance	Annually	8.5
Mechanical transmission	Maintenance	Annually	8.5
Electrical system	Maintenance	Varies	8.5
Controller, various components	Maintenance	Varies	8.5
Motor	Maintenance	Annually	8.5
Diesel engine system, various components	Maintenance	Varies	8.5

Table 9.1 Summary of Water Storage Tank Inspection, Testing, and Maintenance

Item	Activity	Frequency	Reference
Condition of water in tank	Inspection	Monthly/quarterly*	9.2.1
Water temperature	Inspection	Daily/weekly*	9.2.4
Heating system	Inspection	Daily/weekly*	9.2.6.6
Control valves	Inspection	~~Weekly/monthly~~ Quarterly	Table 12.1
Water — level	Inspection	Monthly/quarterly	9.2.1
Air pressure	Inspection	Monthly/quarterly	9.2.2
Tank — exterior	Inspection	Quarterly	9.2.5.1
Support structure	Inspection	Quarterly	9.2.5.1
Catwalks and ladders	Inspection	Quarterly	9.2.5.1
Surrounding area	Inspection	Quarterly	9.2.5.2
Hoops and grillage	Inspection	Annually	9.2.5.4
Painted/coated surfaces	Inspection	Annually	9.2.5.5
Expansion joints	Inspection	Annually	9.2.5.3
Interior	Inspection	5 years/3 years	9.2.6
Check valves	Inspection	5 years	Table 12.1
Temperature alarms	Test	Monthly*	9.2.4.2, 9.2.4.3
High temperature limit switches	Test	Monthly*	9.3.4
Water level alarms	Test	Semiannually	9.3.5
Level indicators	Test	5 years	9.3.1
Pressure gauges	Test	5 years	9.3.6
Automatic Filling Device	Test	5 years	9.3.7
Water level	Maintenance	—	9.4.1
Drain silt	Maintenance	Semiannually	9.4.5
Control valves	Maintenance	Annually	Table 12.1
Embankment-supported coated fabric (ESCF)	Maintenance	—	9.4.6
Check valves	Maintenance	—	12.4.2.2

*Cold weather/heating season only.

NOTE: — Strikeout items are not applicable in California
Shaded (screened) items are California amendments

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Table 11.1 Summary of Foam-Water Sprinkler System Inspection, Testing, and Maintenance			
Item	**Activity**	**Frequency**	**Reference**
Manual actuation device(s)	Test	Annually	11.3.5
Water supply flow test	Test	See Chapter	4 11.2.6
Discharge device obstruction	Test	Annually	11.3.3.6

Table 12.1 Summary of Valves, Valve Components, and Trim Inspection, Testing, and Maintenance			
Item	**Activity**	**Frequency**	**Reference**
Main Drains	Test	Annually	12.2.6, 12.2.6.1, 12.3.3.4
Water-Flow Alarms	Test	Quarterly / Annually	12.2.7
Full flow	Test	Annually	12.4.3.2.2
Pressure Reducing and Relief Valves			
Sprinkler systems	Test	5 years	12.5.1.2
Circulation relief	Test	Annually	12.5.6.1.2
Pressure relief valves	Test	Annually	12.5.6.2.2
Backflow Prevention Assemblies	Test	Annually	12.6.2
Fire Department Connection	Test	5 years	12.7.4

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Appendix C

Record & Notification Form for Water-Based Fire Protection Systems Discharges

Record & Notification Sample Form for Water-Based Fire Protection Systems Discharges

Total gallons discharged:
>10,000 gallons – Please fill out form completely.
Between >1,500 and 10,000 gallons – Please fill out Part A only.

PART A

Name of Discharger:_____

Location of Discharge:_____

Date of Discharge:_____

Time Frame of Discharge: (Begin)_____(End)_____

Duration of Discharge (Minutes)_____

Discharge Flow Rate (gpm)_____

Total Gallons Discharged_____

Dechlorination Chemicals Used:_____

Chlorine Residual Concentration (After Dechlorination, in mg/l)_____

Location of Monitoring_____

Time of Monitoring_____

Description of Sediment Controls Used:_____

_____

_____

_____

PART B

Date of Notification

_____

Method of Notification

_____

Who was Notified

_____

SAMPLE FORM

Note: Information is required when notifying MS4

Appendix D
Pictures of Sediment Control Equipment

Examples of Sediment Control Equipment

Wattle and Municipal Sewer Protection

Typical Dechlorinator with De-Chlorination Tablet

Typical Sandbag

Gravel Bag

Mats and Wattle Erosion Protection

Synthetic and Straw Booms

These photos were obtained from various public websites

Examples of Sediment Control Equipment

Silt Fence

Barricade Utilizing Silt Fence and Hay Bales

Utilization of Hose to Apply Groundwork Protection

Filter Bag

Filter Bag with Sandbags Protecting Municipal Sewer

These photos were obtained from various public websites

Appendix E
Awareness Course Outline

Water Discharge for Fire Protection Systems
Awareness Level Training Course Outline

Course Objectives: To provide the student with an awareness of:

a. The Water-Based Fire Protection Systems Discharge Best Management Practices during testing, draining, and maintenance of these systems.
b. The records, forms, and notification procedures necessary for compliance with federal, state, regional, and local, water discharge laws and, regulations.
c. Safety considerations, testing procedures, control equipment, and drain inlet protection.
d. An understanding of the need to identify the volume/quantity of water discharged during testing and maintenance procedures.
e. The reporting thresholds which reflect the different levels of notifications and/or protocols.
f. The various federal, state, regional, and local agencies assigned the role of enforcement.

Course Content (2-1/2-hours to 3-hours)

1-1 **Orientation and Administration**

1-1.1 – Introduction of Instructor(s)
1-1.2 – Overview of Student Manual/Handouts
1-1.2 – Self Introductions

1-2 **Water Discharge for Fire Protection Task Force**

1-2.1 – Brief History
1-2.1.1 – Scope Goals and Objectives
1-2.1.2 - Timeline
1-2.1.3 – Development of the BMP
1-2.1.4 – Guidelines
1-2.1.5 – Awareness Training

2-1 **Overview of Best Management Practices**

2-1.1 – Typical Activities Associated with Water-based Fire Protection Systems
2-1.1.1 – Pre-construction Flow Testing
2-1.1.2 – Construction Testing and Draining
2-1.1.3 – Additions, Alterations and Modifications to Existing Systems

2-1.1.4 – Periodic Inspection, Testing, and Maintenance
2.1.1.4.1 – Title 19 California Code of Regulations (CCR) and NFPA 25 2006 (CA Edition)
2-1.2 – Emergency Repairs on Water-based Fire Protection Systems
2.1.2.1 – Repairs following a fire/explosion
2-1.2.2 – Repairs following an earthquake
2-1.2.3 – Repairs following a structural failure
2-1.3 – Discharges Associated with Water-based Fire Protection Systems
2-1.3.1 – General Engineering Contractor – A (CSLB)
2-1.3.1.1 – *Underground Piping only*
2-1.3.2 – Fire Protection Contractor – C-16 (CSLB)
2-1.3.2.1 – *Overhead and Underground Piping*
2-1.3.3 – Pipeline Contractor – C-34 (CSLB)
2-1.3.3.1 – *Underground Piping only*
2-1.3.4 – Plumbing Contractor – C-36 (CSLB)
2-1.3.4.1 – *Underground Piping only*
2-1.3.5 – Electrical Contractor – C-10 (CSLB)
2-1.3.5.1 – *Water-flow Fire Alarm only*
2-1.3.6 – SFM A-Licensed Concern/Company (CSFM)
2-1.3.6.1 – *Inspection, Testing and Maintenance only*

3-1 Participants vs. Regulations

3-1.1 Fire Protection Contractors (Discharges)
3-1.1.1 – Routine Discharge vs. Emergency Discharge
3-1.2 Fire Departments/Agencies
3-1.2.1 – Emergency Discharge vs. Non-emergency Discharge
3-1.3 Water Purveyors
3-1.3.1 – Routine Discharge vs. Emergency Discharge
3-1.4 Water Pollution Control Facilities
3-1.4.1 – Reclamation Procedures
3-1.5 MS4
3-1.5.1 – Municipal Separate Storm Sewer Systems
3-1.6 Regional Water Quality Control Boards
3-1.6.1 – Nine (9) Regional Areas/Boards
3-1.6.1.1 – Independent/Autonomous
3-1.7 State Water Resources Control Board
3-1.7.1 – Water Discharge Requirements (WDR)
3-1.7.1.1 – Title 23 CCR
3-1.8 U.S. Environmental Protection Agency (EPA)
3-1.8.1 – National Pollution Discharge Elimination System (NPDES)

4-1 Notification Requirements/Procedures

4-1.1 When to notify
4-1.2 Discharges < 1,500 gallons vs. > 1,500 gallons
4-1.3 Discharges > 10,000 gallons
4-1.4 Notification Method
- 4-1.4.1 – Telephone
- 4-1.4.2 – Fax Transmission
- 4-1.4.3 – E-mail
- 4-1.4.4 – In Person

5-1 Information Provided by Discharger for Notification

5-1.1 Recordkeeping
- 5-1.1 – Use of approved MS4 Forms (where available)

5-1.2 Method of Maintaining Records
- 5-1.2.1 – Bound Notebook
- 5-1.2.2 – Portable Electronic Device

5-1.3 Entries Recorded on Paper
- 5-1.3.1 – Black or Blue Ink

5-2 Discharger Records (information) for Discharges > 1,500 gallons

5-2.1 Name of Discharger
5-2.2 Date of notification (if greater than or equal to 10,000 gallons)
5-2.3 Method of notification (if greater than or equal to 10,000 gallons)
5-2.4 Location of discharge
5-2.5 The date of the discharge
5-2.6 The time of the beginning and end of the discharge
5-2.7 Duration of the discharge (minutes)
5-2.8 The flow rate (gallons per minute)
5-2.9 Total number of gallons discharged
5-2.10 Type of Dechlorination “chemicals” used
5-2.11 Concentration of chlorine measured after Dechlorination
5-2.12 Type of sediment controls used

5-3 Record Maintenance

5-3.1 Dischargers must maintain all records, including emergency discharges, for a minimum of five years and must have the records available for review by the MS4 upon request.

6-1 Volume Control during Emergency Repairs

6-1.1 During emergency discharges, the Dischargers will attempt to cease the release of water at the earliest opportunity while attempting to implement BMP to the extent feasible.

6-1.2 Exact flows, volumes, and length of discharge may not be available. In this situation, estimated values should be established and recorded.

6-2 Volume Determination

6-2.1 Water Discharge for Typical Fire Protection System Chart

6-2.1.1 - Flow and Volume Determination – Dischargers must determine the flow and volume discharge.

6-2.1.2 - By attaching a flow meter to the discharge opening and simply reading the displayed value.

6-2.1.3 - By measuring the pressure from a pressure gauge and then using the table or formulas found in **Appendix B**.

7-1 Safety Considerations

7-1.1 Sensitive Discharge Areas

7-1.2 Are road surface areas free of debris that may flow into the drain inlets or nearby creeks or ponds?

7-1.3 Are curbs or ditches adequate to handle the flow without creating a buildup of silt that cannot be contained and removed?

7-1.4 Will the water flow be free of contaminants such as oil, contaminated soils, etc.?

7-1.5 Will water movement during the flow test create erosion in any unpaved areas?

7-1.6 Flow for the shortest duration possible (e.g., MS4 may limit maximum flow rate to storm sewer where discharge flows could be very large)

7-1.7 Remove all debris from the curb and gutter before initiating flushing

7-1.8 Use Dechlorination when chlorine residual is a concern

7-1.8.1 – Many, if not most, inspection, testing and maintenance discharges will not have chlorine residual due to water age in the sprinkler system and thus will not need dechlorination. If CWS water is introduced during testing and is then discharged, it will require dechlorination.

7-1.9 Contain flow onsite whenever possible and/or direct the water flow to landscaped or green areas without causing damage or erosion.

7-1.10 When practicable, divert sprinkler system test flow to the sewer with the permission of the local sewer agency.

7-1.10.1 – The local sewer agency will likely set conditions so plan ahead.

7-1.11 A sensory checklist method (SCM) is completed for any partial or full discharge of vault, substructure or building fire system water to the street or storm drain system.

8-1 Dechlorination

8-1.1 The MS4 General NPDES Permit requires all waters discharged by Dischargers to be dechlorinated before entering a storm drain

8-2 Dechlorination Equipment

8-2.1 Mesh Bags

8-2.1.1 – These consist of a mesh bag into which large tablets of dry chemical are placed to react with residual chlorine to remove it

8-2.2 Flow Meter (optional)

8-2.3 Pressure Gauge

8-2.4 Pitot Tube

8-2.5 Dechlorination chemicals

8-2.6 Diffusers – These are mechanical devices which are placed on the end of the discharge point and which automatically mixes the discharged water with either dry or wet dechlorination chemicals. There are a wide variety of diffusers available.

8-2.7 Chlorine Residual Test Kits

8-3 Dechlorination Chemicals

8-3.1 Sodium Sulfite

8-3.2 Sodium Bisulfate

8-3.3 Sodium Thiosulfate

8-3.4 Ascorbic Acid

8-4 Chlorine Residual Test Kits

8-4.1 Test Strips

8-4.2 Color wheels

8-4.3 Electric Colorimeters

8-4.4 Sediment Control

8-4.5 Advantages and Limitation

9-1 Control Equipment

9-1.1 Wattles

9-1.2 Sand Bags
9-1.3 Gravel bags
9-1.4 Mats
9-1.5 Booms
9-1.6 Barricades
9-1.7 Silt Fencing
9-1.8 Hay Bales
9-1.9 Hoses
9-1.10 Filters

9-2 **Clean-up Equipment**

9-2.1 Debris Storage
9-2.2 Brooms
9-2.3 Shovels
9-2.4 Rakes
9-2.5 Vacuum truck or vacuum
9-2.6 Procedure
9-2.7 Sand or Gravel Bags
9-2.8 Dams
9-2.9 Number, Length and Height

9-3 **Drain Inlet Protection**

9-3.1 Determining Flow of Path
9-3.2 Alignment of Discharge Point
9-3.3 Preparing Flow Path for Discharge
9-3.4 Chlorination and Sediment Control
9-3.5 Adding Chlorination Concentration
9-3.6 Measuring Chlorination Concentration

10-1 **Historical Overview of Various Laws, Regulations, and Procedures**

10-1.1 Federal (Clean Water Act)
- 10-1.1.1 – Federal Water Pollution Control Act (1972)
  - 10-1.1.1.1 – National Pollutant Discharge Elimination System (NPDES)
  - 10-1.1.1.2 – Municipal and Industrial Storm Water Discharge (1987)

10-1.2 EPA Published Regulations (1990)
- 10-1.2.1 – Construction Projects encompassing five (5) or more acres
- 10-1.2.2 – EPA Regulation (Phase II Rule) lowered storm water discharge from five (5) to one (1) acre (1999)

10-1.3 State (Title 23 CCR – Waters)

10-1.3.1 – General Construction Storm Water Permits (1999)

10-1.3.1.1 – Water Quality Order 99-08-DWQ

10-1.3.2 – SWRCB amended Order 99-08-DWQ to apply to sites as small as one (1) acre.

10-1.3.3 – Water Quality Order 2009 – 0009 - DWQ

10-1.4 – Porter-Cologne Water Quality Control Act

11-1 **Appendix Information**

12-1 **Conclusions**

12-1.1 Complete Class Evaluation Forms

13-1 **Questions and Answers**

Glossary of Terms

GLOSSARY OF TERMS

American Water Works Association (AWWA): An international non-profit professional organization dedicated to the improvement of water quality and supply. Founded in 1881, it has a membership of over 57,000 members worldwide as of 2010 and is the largest organization of water professionals in the world, representing more than 100 countries. AWWA members represent the full spectrum of the water community: water utilities, treatment plant operators and managers, scientists, environmentalists, manufacturers, academics, regulators, and others with an interest in water supply and public health. These members provide about 85 percent of the North American population with safe drinking water.

Best Management Practices (BMP): A compilation or an industry standard method to prevent or reduce the adverse effects of an action or process to the environment. Refers to those practices that have produced outstanding results in another situation and that could be adapted for our situation.

Clean Water Act (CWA): This is the primary federal law in the United States governing water pollution. Commonly abbreviated as the CWA, the act established the goals of eliminating releases of high amounts of toxic substances into water, eliminating additional water pollution by 1985, and ensuring that surface waters would meet standards necessary for human sports and recreation by 1983. The principal body of law currently in effect is based on the Federal Water Pollution Control Amendments of 1972, which significantly expanded and strengthened earlier legislation. Major amendments were enacted in the Clean Water Act of 1977 and the Water Quality Act of 1987.

Community Water Systems (CWS): A central system, owned, operated and maintained by a private corporation or a non-profit property owners association or city, county or water agency or district.

Dechlorination: A procedure that addresses chlorine residual in the discharged water. It is accomplished by adding an environmentally safe dechlorination chemical to the discharge flow to neutralize the chlorine residual. Using dechlorination in combination with the natural demand for chlorine, discharges entering the storm drain inlet should have negligible or non-detectable chlorine residual. Dechlorination can also be achieved by aeration of the discharged water through the use of a diffuser and by flowing along the ground a minimum distance to remove the chlorine.

Discharger: The person or company that caused non-storm water discharges water into the storm drain system.

A-Licensed Concern (company, firm, or individual): A license issued by the CSFM which is engaged in the business of servicing automatic fire extinguishing systems. This license is divided into four separate categories:

a. Type 1 – Fire Sprinkler Systems
b. Type 2 – Engineered and Pre-engineered Fixed Extinguishing Systems
c. Type 3 – Standpipe Systems
d. Type L – Limited to public or private entities that are not engaged in the business of performing testing and maintenance of wet fire extinguishing systems and which only perform annual testing and maintenance of wet pipe sprinkler systems, standpipe systems, private fire service mains, and weekly fire pump tests in structures or property owned or leased by that public or private

A-Classification Contractor – General Engineering Contractor: A license issued by the CSLB. The "A-General Engineering Contractor" is a contractor whose principal contracting business is in connection with fixed works requiring specialized engineering knowledge and skill, including the following divisions or subjects: irrigation, drainage, water power, water supply, flood control, inland waterways, harbors, docks, and wharves, shipyards and ports, dams and hydroelectric projects, levees, river control and reclamation work, railroads, highways, streets and roads, tunnels, airports, and airways, sewers and sewage disposal plants and systems, waste reduction plants, bridges, overpasses, underpasses, and other similar works, pipelines and other systems for the transmission of petroleum and other liquids or gaseous substances, parks, playgrounds and other recreational works, refineries, chemical plants and similar industrial plants requiring specialized engineering knowledge and skill, powerhouses, power plants and other utility plants and installations, mines and metallurgical plants, land leveling and earthmoving projects, excavating, grading, trenching, paving and surfacing work and cement and concrete work in conjunction with the above mentioned fixed works (California Business and Professions [B&P] Code, Section 7056).

C-10 License – Electrical Contractor: A specialty contractor classification license issued by the CSLB that performs their trade using the art, experience, science and skill necessary to satisfactorily organize, administer, construct and complete projects under their

classification in accordance with the standards of their trade. An electrical contractor places, installs, erects or connects any electrical wiring, fixtures, appliances, apparatus, raceways, conduits, solar photovoltaic cells or any part thereof, which generates, transmits, transform or utilize electrical energy in any form.

C-16 License – Fire Protection Contractor: A specialty contractor classification license issued by the CSLB that performs their trade using the art, experience, science and skill necessary to satisfactorily organize, administer, construct and complete projects under their classification in accordance with the standards of their trade. A fire protection contractor (C-16) lays out, fabricates and installs all types of fire protection systems including all the equipment associated with these systems, excluding electric alarm systems (B&P Code, Sections 7055(c) and 832.16).

C-34 License – Pipeline Contractor: A specialty contractor classification license issued by the CSLB that performs their trade using the art, experience, science and skill necessary to satisfactorily organize, administer, construct and complete projects under their classification in accordance with the standards of their trade.

A pipeline contractor fabricates and installs pipelines for the conveyance of fluids, such as water, gas, or petroleum, or for the containment or protection of any other material, including the application of protective coatings or systems and the trenching, boring, shoring, backfilling, compacting, paving and surfacing necessary to complete the installation of such pipelines (B&P Code, Sections 7055(c) and 832.34).

C-36 License – Plumbing Contractor: A specialty contractor classification license issued by the CSLB that performs their trade using the art, experience, science and skill necessary to satisfactorily organize, administer, construct and complete projects under their classification in accordance with the standards of their trade. A plumbing contractor provides a means for a supply or safe water, ample in volume and of suitable temperature for the purpose intended and the proper disposal of fluid waste from the premises in all structures and fixed works. This classification includes but is not limited to:

a. Complete removal of waste from the premises or the construction and connection of onsite waste disposal systems;
b. Piping, storage tanks and venting for a safe and adequate supply of gases and liquids for any purpose, including

vacuum, compressed air and gases for medical, dental, commercial and industrial uses;

c. All gas appliances, flues and gas connections for all systems including suspended space heating units. This does not include forced warm air units;
d. Water and gas piping from the property owner's side of the utility meter to the structure or fixed works;
e. Installation of any type of equipment to heat water, or fluids, to a temperature suitable for the purposes listed in this section, including the installation of solar equipment for these purposes; and
f. The maintenance and replacement of all items described above and all health and safety devices such as, but not limited to, gas earthquake valves, gas control valves, backflow preventers, water conditioning equipment and regulating valves (B&P Code, Sections 7055(c) and 832.36).

Emergency Discharges: Non-routine activities where discharges are the result of unintended releases due to accidents or disasters not under the control of the Discharger. These activities may occur at anytime. Examples of emergency discharges include sheared private onsite fire hydrants, broken sprinklers and/or piping.

Environmentally Sensitive Area (ESA): Areas in which plant or animal life or their habitats are either rare or especially valuable because of their special nature or role in an ecosystem and which would easily be disturbed or degraded by human activities and developments (California Public Resources Code, Section 30107.5). ESAs subject to urban runoff requirements include but are not limited to all CWA section 303(d) impaired water bodies, areas designated as "State Water Quality Protection Areas," inclusive of "Areas of Special Biological Significance" by the SWRCB (Ocean Plan), water bodies designated with the RARE beneficial use by the RWQCBs (Basin Plans), and any other equivalent environmentally sensitive areas which the permittees have identified.

Municipal Separate Storm Sewer System Operator (MS4): The operators of storm drainage systems and are usually municipalities. Under Phase I of the NPDES Storm Water program, MS4 with a service population greater than 100,000 are required to have an NPDES MS4 permit for their storm water discharges. Phase II of the NPDES Storm Water program was promulgated on February 7, 2000, and addresses MS4 with populations under 100,000.

National Fire Protection Association (NFPA): The National Fire Protection Association (NFPA) is an international non-profit organization established in 1896. The company's mission is to reduce the worldwide burden of fire and other hazards on the quality of life by providing and advocating consensus codes and standards, research, training, and education. NFPA is responsible for 300 codes and standards that are designed to minimize the risk and effects of fire by establishing criteria for building, processing, design, service, and installation in the United States, as well as many other countries. Its more than 200 technical code- and standard- development committees are comprised of over 6,000 volunteer seats. Volunteers vote on proposals and revisions in a process that is accredited by the American National Standards Institute (ANSI).

a. NFPA-13 – Standard for the Installation of Sprinkler Systems, 2010 Edition.
b. NFPA-13R – Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height, 2010 Edition.
c. NFPA-13D – Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes, 2010 Edition.
d. NFPA-14 – Standard for the Installation of Standpipe and Hose Systems, 2007 Edition.
e. NFPA-15 – Standard for Water Spray Fixed Systems for Fire Protection, 2007 Edition.
f. NFPA-16 – Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems, 2007 Edition.
g. NFPA-20 – Standard for the Installation of Stationary Pumps for Fire Protection, 2007 Edition.
h. NFPA-22 – Standard for Water Tanks for Private Fire Protection, 2003 Edition.
i. NFPA-24 – Standard for the Installation of Private Fire Service Mains and Their Appurtenances, 2010 Edition.
j. NFPA-25 – Standard for the Installation of Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems. *Special Note:* The CSFM has adopted and amended the 2002 Edition of NFPA-25 and published the "NFPA-25 2006 California Edition."

National Pollution Discharge Elimination System (NPDES): As authorized by the Clean Water Act, the NPDES permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States. Point sources are discrete conveyances such as pipes or human-made ditches. Individual homes that are connected to a municipal system, use a septic system, or do not have a surface discharge do not need an NPDES permit; however, industrial, municipal and other facilities must obtain permits if their discharges go directly to surface waters.

Permeable Surface: A surface that will allow water to seep into it.

Porter-Cologne Water Quality Control Act: In 1969, the California Legislature enacted the Porter-Cologne Water Quality Control Act to preserve, enhance and restore the quality of the State's water resources. The Act established the State Water Resources Control Board and nine Regional Water Quality Control Boards as the principal state agencies with the responsibility for controlling water quality in California. Under the Act, water quality policy is established, water quality standards are enforced for both surface and ground water, and the discharges of pollutants from point and non-point sources are regulated. The Act authorizes the State Water Resources Control Board to establish water quality principles and guidelines for long range resource planning including ground water and surface water management programs and control and use of recycled water.

Potable Water: Water that is distributed through a community water system. Water from a fire sprinkler system is not considered potable water.

Receiving Body: A storm sewer system or storm drain system.

Regional Water Quality Control Boards (RWQCB): There are nine Regional Water Quality Control Boards (RWQCBs) statewide (Region 1-North Coast, 2-San Francisco Bay Area, 3-Central Coast, 4-Los Angeles, 5-Central Valley, 6-Lahontan, 7-Colorado River Basin, 8-Santa Ana, and 9-San Diego). The nine RWQCB are comprised of nine part-time Board members appointed by the Governor and confirmed by the senate. Regional boundaries are based on watersheds and water quality requirements on the unique differences in climate, topography, geology, and hydrology for each watershed. Each RWQCB makes critical decisions for its region, including setting standards, issuing waste discharge requirements, determining compliance with those requirements, and taking appropriate enforcement action. **See Appendix C** for the RWQCB contact list.

Sediment: Solid particulate matter, both mineral and/or organic, that is in suspension, is being transported, or has been moved from its site of origin by air, water, gravity, or ice and has come to rest on the earth's surface either above or below sea level.

Sedimentation: Process of deposition of sediment carried by water, wastewater, or other liquids, by gravity. It is usually accomplished by reducing the velocity of the liquid below the point at which it can transport the suspended material.

Sediment Control BMP: Describe practices that trap sediment after they have been eroded by rain, flowing water, or wind. They include those practices that intercept and slow or detain the flow of storm water to allow sediment to settle and be trapped (e.g., silt fence, sediment basin, fiber rolls, etc.).

Sensitive Discharge Areas: Areas where water discharges may present a potential problem or hazard to the natural environment (such as creeks).

Sensory Checklist Method: A BMP checklist of activities to be completed for any partial or full discharge of vault, substructure or building fire system water to the street or storm drain system. Primary sensory methods include visual observation and odor.

State Water Resources Control Board (SWRCB): Created by the State Legislature in 1967, the five-member Board protects water quality by setting statewide policy, coordinating and supporting the RWQCB efforts, and reviewing petitions that contest RWQCB actions. The SWRCB is also solely responsible for allocating surface water rights.

Storm Sewer System or Storm Drain System: The drainage system used to divert storm water runoff from its source to the final receiving water. Systems include but are not limited to: culverts, street gutters, swales, brooks, creeks, rivers, ponds, lakes, aqueducts and the ocean.

Water Discharge Mitigation: The management of erosion, debris, and sediment during the discharge of water through the use of BMP.

Waters of the State (California): Any surface water or groundwater, including saline waters, that is within the boundaries of the state" (California Water Code, Section 13050(e)); broadly construed to include all waters within the state's boundaries, whether private or public, including waters in both natural and artificial channels.