Recertification Notice of Intent (NOI)

Regulated Small Municipal Separate Storm Sewer Systems (MS4's) General Permit ARR040000

You must **complete, certify, and sign this Recertification Notice of Intent (NOI) form** and return it along with the **updated Stormwater Management Program (SWMP)** to the Department in order to continue permit coverage under the General Permit ARR040000. You must submit this form **no later than July 1, 2019.** Please keep a copy of this form for your records once completed and signed.

Permittee Name	Permit Tracking Number	AFIN
City of Fort Smith	ARR040011	88-00838

If any changes or additions need to be made to the information shown below, please update the new information in the corrections section below and/or attach documentation.

	Current Information in ADEQ's database	Corrections/Additions, If Needed
Small MS4 Physical Address	623 Garrison Avenue #409	—
County	Sebastian	—
Urbanized/Core Areas	Fort Smith	—
Receiving Stream	Massard Creek, Little Massard Creek, Spivey Creek, Sunnymede Creek, No Name Creek, Oak Park Tributary, May Branch, Mill Creek, Little Vache Grasse Creek, Poteau River	—
Ultimate Receiving Stream	Arkansas River	—
Contact Person & Title	Matt Meeker, PE, Project Engineer	Billy Butler, PE, Project Engineer
Telephone Number	(479) 784-2225	—
Cognizant Official & Title	Carl E. Geffken, City Administrator	—
Responsible Official & Title	Carl E. Geffken, City Administrator	—

Are the mailing and invoice addresses the same?

Yes or No* *If "No," please provide invoice address: _____

Additional Comments: _____

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

I certify that I have read and will comply with all the requirements of the Regulated Small Municipal Separate Storm Sewer Systems (MS4's) General Permit ARR040000.

Responsible Official Name: CARL E. GEFFKEN
Responsible Official Title: CITY ADMINISTRATION
Responsible Official Signature: Carl E. Geffken
Date: 6/25/19

Return the NOI form to the address below or send it electronically to: water.permit.application@adeq.state.ar.us **or via ePortal at the following web address:** https://eportal.adeq.state.ar.us/

NPDES Permits Section, Office of Water Quality
Arkansas Department of Environmental Quality
5301 Northshore Drive
North Little Rock, AR 72118-5317

The City of Fort Smith ARKANSAS

STORMWATER MANAGEMENT PROGRAM

June 25, 2019

Prepared by the City of Fort Smith
Engineering Department
P.O. Box 1908 Fort Smith, Arkansas 72902
(479)784-2225

TABLE OF CONTENTS

CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Carl E. Geffken

Carl Geffken - City Administrator

THE CITY OF FORT SMITH
STORMWATER MANAGEMENT PROGRAM
June 25, 2019

1. REQUIREMENTS

1.1 In accordance with NPDES Permit No. ARR040000, the City of Fort Smith has developed a stormwater management program (SWMP) designed to reduce the discharge of pollutants from the small MS4 to the maximum extent practicable (MEP), to protect water quality, and to satisfy water quality requirements and the Clean Water Act. The City of Fort Smith shall also implement and enforce the SWMP to meet the aforementioned criteria. The SWMP includes management practices; control techniques and system, design, and engineering methods; and shall be modified to include provisions as ADEQ determines appropriate after its review of the program for the control of such pollutants. The SWMP contains the following information for each of the six minimum control measures described in Section 2:

1.1.1 The best management practices (BMP's) that the City of Fort Smith will or already does implement for each of the stormwater minimum control measures;

1.1.2 The measurable goals for each of the BMP's, the ones the City of Fort Smith believes to have the authority to implement, including, as appropriate, the months and years in which the City will undertake required actions, including interim milestones and the frequency of the action.

1.1.3 The position title and contact information for those responsible for implementing or coordinating the BMP's for the SWMP. A Table of Organization is attached in Appendix "A." The Table of Organization includes a primary point of contact and identifies how implementation across multiple positions, agencies and departments will occur.

1.1.4 A rationale for how and why each of the BMP's and measurable goals were selected for the SWMP. The City of Fort Smith initially had coverage under a previous version of NPDES Permit No. ARR040000, therefore, the City shall revise its program and its implementation to satisfy the general permit's performance standards within two years of August 1, 2019, the effective date of the new general permit.

1.1.5 The City of Fort Smith discharges to a segment of the Poteau River which appears on the 2016 Impaired Water bodies List (303(d) List) for dissolved oxygen. This particular segment of the river is a Category 5 water body, and a total maximum daily load (TMDL) has not been prepared. The source of impairment for this segment of the Poteau River is unknown. Since the City has not been determined to be a contributor to the impairment,

the BMP's have not been reevaluated for or specifically addressed the impairment within the SWMP.

1.1.6 The City of Fort Smith discharges to a segment of the Poteau River which appears on the 2016 Impaired Water bodies List (303(d) List) for turbidity. This particular segment of the river is a Category 4a water body and has an approved TMDL. However, the City has not been assigned a wasteload allocation (WLA) within the TMDL *(5)*. Therefore, the City has not reevaluated its BMP's for the impairment and enhanced BMP's have not specifically addressed the impairment.

2. MINIMUM CONTROL MEASURES

2.1 Public Education and Outreach on Stormwater Impacts

2.1.1 The City of Fort Smith has implemented a public education program to distribute educational materials to the community and has conducted equivalent outreach activities about the impacts of stormwater discharges on water bodies.

2.1.2 *Decision Process*. The City of Fort Smith has documented the decision process in the section below for the development of the stormwater public education and outreach program. The rationale statement addresses the overall public education program, the BMP's, the measurable goals, and the persons responsible for the program. The rationale statement includes the following:

2.1.2.1 The City of Fort Smith plans to inform individuals and households about the steps they can take to reduce stormwater pollution through print media, social media, and television advertisements.

2.1.2.2 The City of Fort Smith plans to inform individuals and groups on how to become involved in the stormwater program through the same mechanisms listed in 2.1.2.1 (print media, social media, and television advertisements).

2.1.2.3 The target audiences selected for the education program are those that are likely to have significant impacts on stormwater. The selected audiences include: residential, commercial, industrial, and land development.

Common individual behaviors such as littering, disposing of trash and recyclables, applying lawn chemicals, washing cars, changing motor-oil on impervious driveways, and certain household behaviors like disposing of leftover paint and chemicals have the potential to generate stormwater pollution *(13)*. Therefore, the City selected the residential community as a target audience.

Many commercial activities contribute to stormwater pollution. These activities can include vehicle washing, landscape fertilization, improper disposal of automotive fluids, improper disposal of restaurant wastes, as well as many others *(19)*. The City, therefore, selected the commercial community as a target audience.

Like the commercial community, pollution from industrial activities can come from many different sources. Due to the City's numerous industries, it was decided that the industrial community should also be a target audience.

Uncontrolled stormwater runoff from construction sites can significantly impact rivers, lakes and other water bodies *(10)*. New developments and subdivisions are always under construction within the City. The City itself constructs several substantial capital improvement projects each year. For these reasons, and the fact that Part 3.2.1.3 of the new MS4 Permit (NPDES Permit No. ARR040000) requires it, the land development community has also been selected as a target audience.

2.1.2.4 The public education program is designed to address the following target pollutant sources:

- Soil Erosion from Construction Activities
- Fertilizers
- Herbicides/Insecticides
- Household Hazardous Chemicals
- Hazardous Chemicals Used in Commercial & Industrial Processes
- Automotive Fluids
- Restaurant/Grocery Wastes
- Litter/Cigarette Butts

2.1.2.5 The outreach strategy for the City of Fort Smith includes print, televised, and web-based media. Over the permit term, the City expects to reach over 50% of the population. The City's outreach strategy includes four different mechanisms, or Best Management Practices (BMP's). The individual BMP's, and their associated measureable goals, are described in more detail in Section 2.1.2.7.

2.1.2.6 The Engineering Department is responsible for the overall management and implementation of this stormwater program. However, other departments, as listed in Section 2.1.2.7, are responsible for implementation of specific BMP's or portions thereof.

2.1.2.7 The success of the public education and outreach minimum control measure will be evaluated according to the number of measurable goals that are successfully met each reporting year for their associated BMP's.

Measurable goals have been selected for the BMP's that are cost effective and easily achievable, but still allow the City to effectively reach high percentages of the population with the stormwater message. No schedule for deployment for the BMP's is listed because all four BMP's are already being implemented by the City and will continue to be implemented under the new permit. The individual BMP's and their associated measurable goals are listed below:

2.1.2.7.1 **BMP 1: Publish stormwater related articles and information for the residential, commercial, industrial, and land development communities on Facebook.**

Goal: Under the new permit, stormwater information and/or articles will continue to be posted at least 12 times annually on the City of Fort Smith Stormwater Management page on Facebook.

According to the Pew Research Internet Project, 73% of online adults use social networking sights *(6)*. Posting stormwater related information and articles on a social networking site such as Facebook allows the City to reach a large segment of the population in an economical way.

After the Facebook page was developed, it was decided that the measureable goal for this BMP should be a minimum of 12 posts annually. This number was selected because it is easily achievable, allows for a diverse range of topics to be covered, and is small enough in number that recipients won't ignore posts due to too many items being posted.

This BMP will continue to be implemented under the new permit. The Engineering Department is responsible for developing the posts and maintaining the Facebook page.

2.1.2.7.2 **BMP 2: Post stormwater related information and contacts on the City's website.**

Goal: Stormwater related information and contacts will be updated as necessary under the new permit.

More and more people are turning to the internet as their primary source for information. Posting storm water information and contacts on the internet allows the City to reach those who may not be reached by more traditional means. Information is posted on the Engineering Department's website at http://www.fortsmithar.gov/index.php/departments/engineering. The information available on the website includes contact information for the Engineering Department, the telephone number for the Stormwater Hotline, and the City's

Storm Drainage Standards. Since the contact information and Storm Drainage Standards rarely change, it was determined that the measureable goal for this BMP should only be to update the website as necessary.

This BMP will continue to be implemented under the new permit. The Engineering Department is responsible for ensuring that all information on the website is current.

2.1.2.7.3 **BMP 3: Broadcast stormwater related public service announcements on city's public access television channel.**

Goal: Under the new permit, public service announcements will continue to be aired at least twice annually.

Television ads on the City's existing public access channel are yet another economical way of reaching as many people as possible with the storm water message. Citizens tune in to the public access channel to find out local information and to look for upcoming events and activities.

It was decided that the measureable goal for this BMP should be a minimum of two public service announcements (PSA's) annually. This allows plenty of time for development and scheduling of PSA's on the City's public access channel.

This BMP was implemented during the first year of the original MS4 permit. It will continue to be implemented under the new permit. The Engineering Department is responsible for developing the PSA's and providing them to the City Clerk's Office. The City Clerk's Office is responsible for broadcasting the PSA's on the City's public access channel.

2.1.2.7.4 **BMP 4: Distribute stormwater related brochures to land development community.**

Goal: Under the new permit, brochures dealing with soil erosion and construction site erosion control will continue to be distributed to all members of the land development community who are issued Fill & Grading Permits or Building Permits for New Construction.

Stormwater runoff from construction sites not only carries sediment, but it can also carry pesticides, cleaning solvents, concrete wash, asphalt, fuel, and motor oil. When land is cleared for development activities, loose sediment and other materials washed from construction sites can pollute our waterways *(7)*. The land development community must be educated about these pollutants and on how to prevent their discharge to our surface waters.

In order to spread the word about construction site erosion control to as many in the land development community as possible, it was decided that the measureable goal for this BMP should be to provide everyone who purchases a Fill and Grading Permit or a Building Permit for New Construction with a brochure on the topic. This allows for the information to be distributed to the larger developers as well as those only involved in residential and commercial construction.

This BMP will continue to be implemented under the new permit. The Engineering Department is responsible for keeping the brochure up-to-date and for distributing the brochure to all Fill and Grading Permit applicants. The Building Safety Division is responsible for distributing the brochure to all applicants for Building Permits for New Construction.

2.1.3 *Performance Standards.* The stormwater public education and outreach program for the City of Fort Smith includes four mechanisms or BMP's which have been discussed in the previous sections and targets five different stormwater themes. The stormwater themes, along with the target audiences, are as follows:

- Fertilize Sparingly and Caringly.
  - Target Audience: Single & Multi-Family Residences, Commercial Businesses, Industrial Businesses, Land Development Community
- Oil and Water Really Don't Mix.
  - Target Audience: Commercial Auto Shops, Single & Multi-Family Residences
- Only Rain Down the Drain.
  - Target Audience: Single & Multi-Family Residences, Commercial Businesses, Industrial Businesses
- Be the Solution to Stormwater Pollution.
  - Target Audience: Land Development Community
- Keep Our Streets Clean – Grass, Leaves, and Litter Pollute Our Rivers and Streams.
  - Target Audience: Single & Multi-Family Residences

The stormwater public education and outreach program is projected to reach at least 50 percent of the population over the permit term.

2.1.4 *Annual Reporting.* The annual report shall identify each mechanism or BMP used, including each stormwater theme, audience targeted and estimate of how many people were reached by each mechanism.

2.2 Public Involvement/Participation

2.2.1 The City of Fort Smith has complied and will continue to comply with State and local notice requirements when implementing the public involvement/participation program.

2.2.2 *Decision Process.* The City of Fort Smith has documented the decision process in the section below for the development of the stormwater public involvement/participation program. The rationale statement addresses both the overall public involvement/participation program and the individual BMP's, measurable goals and responsible persons for the program. The rationale statement includes the following:

2.2.2.1 The City of Fort Smith will receive public input on the NOI and SWMP. The NOI and SWMP will be posted on the City's website for a 30-day public review period beginning on July 1, 2019. The City will accept comments from the public during this review period. A hard copy will also be available in the Engineering Department office. See BMP 5 in Section 2.2.2.6 for more information.

2.2.2.2 The City of Fort Smith plans to involve the public in the development and implementation of the program by providing citizens with a variety of activities where they can contribute. The two main considerations of the public involvement/participation program are to give citizens the opportunity to provide the necessary feedback to improve the overall SWMP and to give citizens with a desire to serve the community the chance to take an active role in the program.

2.2.2.3 The target audiences for the public involvement/participation program include the following:

- Single & Multi-Family Residences
- Commercial Businesses
- Industrial Businesses
- Land Development Community
- Civic Clubs/Organizations
- Student Clubs/Organizations
- Religious Organizations

There are several different ethnic groups that will be engaged among the target audiences within the City. According to the latest data from the U.S. Census Bureau, the population of the City of Fort Smith is 70.4% White, 9.5% Black or African American, 1.0% American Indian and Alaska Native, 5.9% Asian, 0.0% Native Hawaiian and Other Pacific Islander, 5.0% Two or More Races, and 8.1% Some Other Race. Of these, 18.8% are Hispanic or Latino, which can be of any race *(9)*. The economic groups that will be engaged include all ranges, from those areas where incomes are at or above the area median income, to those located within low and moderate income areas.

2.2.2.4 The types of public involvement activities or BMP's in the City's SWMP include a public review and comment period, involvement of alternative sentencing personnel in

clean-up activities, marking of new manholes by contractors (land development community), volunteer marking of manholes, volunteer clean-up activities, and operating a stormwater hotline to receive stormwater complaints from citizens. The individual BMP's, and their associated measureable goals, are described in more detail in Section 2.2.2.6.

2.2.2.5 The Engineering Department is responsible for the overall management and implementation of this stormwater program. However, other departments, as listed in Section 2.2.2.6, are responsible for implementation of specific BMP's or portions thereof.

2.2.2.6 The success of the public involvement/participation minimum control measure will be evaluated according to the number of measurable goals that are successfully met each reporting year for their associated BMP's.

Measurable goals have been selected for the BMP's that are cost effective and easily achievable, but still allow the City to effectively involve and engage the public in the stormwater program. A schedule for deployment is listed for BMP 5 only. No schedule is necessary for the other five BMP's, as they are already being implemented by the City and will continue to be implemented under the new permit. The individual BMP's and their associated measurable goals are listed below:

2.2.2.6.1 **BMP 5: The City will hold a public review and comment period for the NOI and SWMP.**

Goal: Before the NOI and SWMP are approved by ADEQ, the City will hold a 30-day public review period to receive comments and input from the public.

In order to give the public opportunity to provide input in the development of the NOI and SWMP, the City will hold a review period beginning on July 1, 2019 in order to receive questions and comments from the public. This review period will be advertised in the *Southwest Times Record* on June 30, 2019, and July 7, 2019. The proposed SWMP will be available online on the City's website, and a hard copy was available for review in the Engineering Department office. The Engineering Department was responsible for implementing this BMP.

2.2.2.6.2 **BMP 6: Utilize alternative sentencing personnel to clean curbs and gutters and pick up trash accumulated along city streets.**

Goal: Alternative sentencing personnel will continue to meet on a monthly basis under the new permit.

Since the first year of the original permit, alternative sentencing personnel, also known as the "A" Team, have been utilized for minor maintenance work on the

City's stormwater drainage system. Using the "A" Team for such work allows those involved to perform their public service, and it provides them with first-hand knowledge of the pollutants in our waterways and the efforts necessary to remove them. Maintenance activities performed by the "A" Team include: clearing litter from city right-of-ways, cleaning city drainage easements, checking and clearing obstructions from drainage inlets and easements, cleaning dirt and grass from curbs and gutters, cleaning concrete swales, and cleaning leaves from roadside ditches. The "A" Team will continue to meet at least once a month under the new permit. The Operations Department is responsible for overseeing the activities of the "A" Team.

2.2.2.6.3 **BMP 7: New storm sewer manhole covers will be marked with the warning: "Storm Sewer – No Dumping – Drains to River."**

Goal: Marking of new manhole covers will continue under the new permit.

Since the first year of the original permit, the City has required that all new manhole covers located in City right-of-way, on both municipal projects and private developments, be marked with the following warning: "Storm Sewer – No Dumping – Drains to River." Placing these covers on new manholes educates both the general public and those installing the covers (the Land Development Community) on the environmental consequences of illegal dumping in storm drains. Installing these manholes also allows the Land Development Community to have an active role in preventing stormwater pollution within the community.

Placement of the marked manhole covers on all new construction will continue under the new permit. The Engineering Department is responsible for ensuring that all new storm sewer manholes have the marked covers.

2.2.2.6.4 **BMP 8: Existing storm sewer manholes will be marked with the warning: "No Dumping – Drains to River."**

Goal: Decals shall be placed on at least 20 manholes per year by citizen volunteers and/or by members of the City's "A" Team.

Under the previous permit, the City began a storm drain marker program where members of the public place decals with the warning, "No Dumping – Drains to River," on existing storm sewer manholes. Citizens involved with this work include both volunteers from the general public and members of the City's "A" Team. Placing these decals on existing manholes educates the public on the environmental consequences of illegal dumping in storm drains. It also allows citizens to become involved in preventing stormwater pollution within the community.

In order to prevent the program from becoming overly burdensome to those involved, it was decided that the minimum marking requirement should be no more than 20 manholes per year. The program for the marking of existing manholes will continue under the new permit. The Engineering Department is responsible for administering the manhole marking program.

2.2.2.6.5 **BMP 9: Operate a community hotline for reporting stormwater problems and complaints.**

Goal: Hotline will continue accepting calls under the new permit.

The Storm Water Hotline supplements the City's efforts to stop illicit discharges and determine where storm water problems currently exist. Advertising the hotline also further facilitates public involvement in the Storm Water Management Plan *(11)*. The Storm Water Hotline number is 479-784-2225 (Engineering Department phone number). It has been maintained by the Engineering Department and advertised on the Engineering Department website. The hotline will continue to be advertised on the website, and it will continue to be maintained under the new permit.

2.2.2.6.6 **BMP 10: Maintain a volunteer Adopt-A-Spot or Adopt-A-Street program to clear trash, yard wastes, and other debris from streets, right-of-way, parking lots, and parks.**

Goal: A volunteer Adopt-A-Spot or Adopt-A-Street program will continue to be operational under the new permit.

Adopt-A-Spot and Adopt-A-Street programs create a unique partnership between the City of Fort Smith and its business community, civic organizations, and residents. The programs allow groups or individuals to become directly responsible for the litter abatement and the appearance and upkeep of public rights-of-way, parking lots, parks, planters and green areas. To show its appreciation, the City of Fort Smith recognizes each of these civic contributions by installing a special "Adopt-A-Spot" sign to commemorate the participating organization.

Both the Adopt-A-Spot and Adopt-A-Street programs were fully implemented and operational prior to the original MS4 permit. The City will continue to maintain these programs under the new permit. The Mayor's office is responsible for maintaining the list of Adopt-A-Spot and Adopt-A-Street groups. The Operations Department is responsible for installing the roadway signs.

2.2.3 *Performance Standards.* The City of Fort Smith stormwater public involvement/participation program shall include at least five public involvement activities over the permit term.

2.2.4 *Annual Reporting.* The City of Fort Smith shall utilize the standard annual report form developed by ADEQ. The annual report shall identify each public involvement/participation activity conducted, including a brief description of the activity and an estimate of how many people participated.

2.3 Illicit Discharge Detection and Elimination

2.3.1 The City of Fort Smith has developed, implemented and is enforcing a program to detect and eliminate illicit discharges. "Illicit Discharge" shall be defined as any discharge to a municipal separate storm sewer that is not composed entirely of stormwater except discharges pursuant to a NPDES permit (other than the NPDES permit for discharges from the municipal separate storm sewer) and discharges resulting from emergency fire fighting activities.

2.3.2 Under the previous permit, the City of Fort Smith completed a storm sewer system map for the entire MS4 system. The map includes the following: outfalls, surface waters of the State receiving discharges from those outfalls, catch basins, pipes, ditches, and public and private stormwater facilities.

Under the new permit, the storm sewer system map will be updated periodically to include any newly constructed stormwater facilities.

2.3.3 Prior to the original permit, the City of Fort Smith effectively prohibited through ordinance illicit discharges into the storm sewer system. The City has also implemented appropriate enforcement procedures and actions.

2.3.4 Under the previous permit, the City of Fort Smith developed and implemented a plan to detect and eliminate non-stormwater discharges to the system, including illegal dumping. See 2.3.6 and 2.3.7 for exceptions to this requirement.

2.3.5 Under the new permit, the City of Fort Smith shall continue to inform public employees, businesses, and the general public of hazards associated with illegal discharges and improper disposal of waste.

2.3.6 The categories of non-stormwater discharges or flows (i.e. illicit discharges) listed in 2.3.7 have not been identified as significant contributors of pollutants to the City of Fort Smith, therefore, they have not been addressed in the SWMP.

2.3.7 The following incidental non-stormwater discharges will not be addressed as illicit discharges:

- Waterline flushing
- Landscape irrigation
- Diverted stream flows
- Rising ground waters
- Uncontaminated ground water infiltration (as defined at 40 CFR 35.2005(20))
- Uncontaminated pumped ground water
- Discharges from potable water sources
- Foundation drains
- Air conditioning condensation
- Irrigation water
- Springs
- Water from crawl space pumps
- Footing drains
- Lawn watering
- Individual residential car washing
- Non-commercial or charity car washes
- Flows from riparian habitats and wetlands
- Dechlorinated swimming pool discharges
- Backwashing discharges from swimming pools
- Street wash water
- Discharges or flows from emergency fire fighting activities

Any individual non-stormwater discharge that is determined to be contributing significant amounts of pollutants to the MS4 shall be prohibited.

Landscape irrigation, discharges from potable water sources, irrigation water, lawn watering, individual residential car washing, non-commercial or charity car washes, and street wash water are all regulated by the Fort Smith Water Conservation Program. This program consists of year-round water conservation measures which are intended to prevent the wasteful use of water and a Two-Phase water conservation plan in the event the water supply lake levels drop due to lack of rainfall. Phase I of the plan will go into effect when lake levels drop from 91,100 acre-feet (100%) to a capacity of 55,000 acre-feet (60%) and will continue until lake levels remain above 56,000 acre-feet (61%) for 15 consecutive days. Phase II will go into effect when the total usable water storage decreases to 36,000 acre-feet (39%). The restrictions and prohibitions of Phase II will be removed when the lake levels remain above 41,000 acre-feet (45%) for 15 consecutive days *(4)*.

Whenever an emergency exists as determined by the City Administrator, or his designated agent, by reason of a shortage of water, limited distribution facilities or any other circumstances which make it necessary to immediately conserve water, the City

Administrator, or his designated agent, have the authority to implement the conservation measures of Phase I and/or Phase II of the Fort Smith Water Conservation Program and other conservation measures which are necessary to maintain potable water for essential public health and safety functions. Once implemented, these emergency measures remain in effect until the next regularly scheduled meeting or special meeting of the Board of Directors at which time the Board decides whether it is necessary to continue the said measures *(4)*.

Listed below are the things that you cannot do under the year-round water conservation program. During time periods when water conservation measures are not in effect, the following limitations or prohibited uses of water are in effect:

(1) No person shall use water for the irrigation or watering of lawns, turf, shrubs, plants, trees or gardens to such an extent as to allow water to escape from user's premises onto public property, such as alleys or streets, nor onto another person's property.

(2) No person shall irrigate or water lawns, turf, shrubs, plants, trees or gardens between the hours of 11:00 a.m. and 6:00 p.m. (not applicable to greens and tee boxes on golf courses).

(3) No person during the course of cleaning or washing motor vehicles, aircraft, building exteriors, sidewalks, walkways, driveways, patios, decks, fences, parking lots, tennis courts, or other similar types of hard surfaces, with a hose or other equipment, will allow the flow of water to be used or uncontrolled at the point of use, or to continue if unattended, such that water is wasted.

(4) No person shall use potable water for any construction activity that can be performed using non- potable water unless approved by the Director of Utilities, or his designated representative, and, if required by same, shall be conducted under the direct supervision of an employee of the City of Fort Smith Utility Department.

(5) No person shall use water from a fire hydrant unless approved by the Director of Utilities, or his designated representative, and, if required by same, shall be conducted under the direct supervision of an employee of the City of Fort Smith Utility Department. Any such use shall be registered through a City owned meter issued under a permit for a specific use, time period, location and, if further specified, for a maximum volume of use *(4)*.

An initial conservation phase (Phase I) will go into effect when lake levels drop from 91,100 acre-feet (100%) to a capacity of 55,000 acre-feet (60%) and will continue until lake levels remain above 56,000 acre-feet (61%) for 15 consecutive days. Phase I conservation measures consist of the following restrictions and prohibitions on the use of City water:

(1) The following uses of water are permitted at locations with even-numbered addresses on even-numbered days of the month only and at locations with odd numbers addresses on odd-numbered days of the month only: Lawn watering; watering of shrubs, plants, trees and gardens; the washing of motor vehicles, trailers, airplanes or boats (not applicable to commercial car washes); filling swimming pools or fountains; and washing of building exteriors.

(2) No person shall use water as provided for in (1) to such an extent as to allow water to escape from his premises onto public property, such as alleys or streets, nor onto another person's property.

(3) Golf course watering and other commercial irrigation from City sources shall be done only to the extent necessary to preserve turf and other plant life and at such times during the day as to minimize water loss due to evaporation.

(4) The use of water from fire hydrants at any time for construction purposes, fire drills, or routine hydrant testing is prohibited. Only non-potable water may be used for dirt compaction, earth moving operations, or street base course construction.

(5) The washing of sidewalks, walkways, driveways, patios, parking lots, concrete tennis courts, and other hard-surfaced areas by hosing or by use of water directly from faucets or other City sources is prohibited. Food processing and food service establishments may engage in such use of water only to the extent necessary to maintain and preserve the public health, and in compliance with any state or federal regulations. Restaurants and other food service establishments may hose or wash only walkways immediately adjacent to entrances and not beyond ten (10) feet of entrances and not beyond ten (10) feet of garbage facilities, food delivery or food serving areas.

(6) No person shall irrigate or water lawns, turf, shrubs, plants, trees or gardens between the hours of 10:00 a.m. and 7:00 p.m. (not applicable to greens and tee boxes on golf courses).

(7) The City shall have the authority to install flow restriction devices on those lines to contract water users which exceed their contractual allocation. Installation of flow, restriction devices shall require specific approval of the Board of Directors of the City of Fort Smith before installation *(4)*.

An advanced conservation phase (Phase II) shall go into effect when the following conditions occur when the total usable water storage decreases to a 36,000 acre-feet (39%). The restrictions and prohibitions of Phase II shall be removed when the lake levels remain above 41,000 acre-feet (45%) for 15 consecutive days. Phase II conservation measures consist of all Phase I measures PLUS the following restrictions and prohibitions on the use of City water:

(1) The watering of shrubs, plants, trees and gardens is permitted only by hand held hose and should be limited to the minimum amounts necessary to sustain plant life.

Such watering is permitted at locations with even numbered addresses on even numbered days of the month only and at locations with odd numbered addresses on odd numbered days of the month only. All lawn and turf watering from City sources is prohibited.

(2) Golf course watering and other commercial irrigation from City sources shall be done only to the extent necessary to preserve turf and other plant life. Golf courses are permitted to water only greens and tee boxes from City sources. Golf course fairway and rough watering and school football and baseball field watering from City sources is specifically prohibited.

(3) All washing of motor vehicles, trailers, airplanes, boats or building exteriors is prohibited, except at commercial car washes and licensed commercial vehicle dealerships. Licensed commercial dealerships shall limit washing to Tuesday and Friday only. The filling of swimming pools or outdoor fountains and outdoor fountain operation is prohibited *(4)*.

2.3.8 *Decision Process.* The City of Fort Smith has documented the decision process for the development of the stormwater illicit discharge detection and elimination program. The rationale statement addresses the overall illicit discharge detection and elimination program and the individual BMP's, measurable goals, and responsible persons for the program. The rationale statement includes the following:

2.3.8.1 The City of Fort Smith will continue to update and maintain the storm sewer system map. The development process, as well as the process for updating the map, are described in more detail under BMP 11 in Section 2.3.8.7.

2.3.8.2 The City of Fort Smith will continue to prohibit illicit discharges to the storm sewer system by ordinance. This ordinance is described in more detail under BMP 12 in Section 2.3.8.7. A copy of the relevant sections of the ordinance is also contained in Appendix "B."

2.3.8.3 The City of Fort Smith will continue to ensure that the ordinance prohibiting illicit discharges is implemented through the use of appropriate enforcement procedures and actions. The plan for accomplishing this is described in more detail under BMP 12 in Section 2.3.8.7.

2.3.8.4 The City of Fort Smith will continue to detect and address illicit discharges to the MS4 system, including discharges from illegal dumping and spills. The plan for accomplishing this is described in more detail under BMP's 12, 13, and 14 in Section 2.3.8.7. The plan includes: procedures for locating priority areas, procedures for tracing the source of an illicit discharge, procedures for removing the source of the illicit discharge, and procedures for program evaluation and assessment.

2.3.8.5 The City of Fort Smith plans to inform businesses and the general public of the hazards associated with illegal discharges and improper disposal of wastes through the BMP's described in the public education and outreach minimum control measure. These BMP's include posting stormwater related articles and information on Facebook and through PSA's on the City's public access television channel.

The City plans to inform public employees about the same hazards through the employee training BMP described in the pollution prevention/good housekeeping minimum control measure in sections 2.6.3.2 and 2.6.3.3.2.

2.3.8.6 The City of Fort Smith Engineering Department is responsible for overall management and implementation of the stormwater illicit discharge detection and elimination program. However, other departments, as listed in Section 2.3.8.7, are responsible for the implementation of specific BMP's or portions thereof.

2.3.8.7 The success of the illicit discharge detection and elimination minimum control measure will be evaluated according to the number of measurable goals that are successfully met each reporting year for their associated BMP's.

Measurable goals have been selected for the BMP's that will allow the City to detect and eliminate illicit discharges without creating the need for additional personnel. No schedule for deployment for the BMP's is listed because all four BMP's are already being implemented by the City and will continue to be implemented under the new permit. The individual BMP's and their associated measurable goals are listed below:

2.3.8.7.1 **BMP 11: Update and maintain storm sewer system map.**

Goal: Under the new permit, the storm sewer system map shall be updated at least once annually to include all newly constructed public and private storm sewers and drainage ditches.

The storm sewer map aids the City in targeting outfalls with dry weather flows and other suspicious discharges for more in-depth inspection. It also aids in coordinating management activities to remove illicit connections and track storm drain system maintenance *(11)*. In 2004, the City began working with a local high school EAST (Environmental and Spatial Technology) lab to develop a map of the storm sewer system. However, this arrangement did not work well due to student time constraints, and City staff took over the storm sewer mapping. In 2005, City staff completed the first phase of the mapping process which included locating all of the City's storm sewer and drainage ditch outfalls. Outfalls were located with aerial maps and by physical inspection. This initial work was used to begin outfall inspections on the storm sewer system in the fall of 2005.

Early in 2009, City staff began compiling information from various sources into one map of the entire storm sewer system. The records included subdivision plans, record drawings for Capital Improvements Projects, City sewer atlases, and aerial photography. Mapping of the storm sewer system was complete by the spring of 2011.

Due to employee time constraints, it was decided that the map should be updated no more than once annually, unless work schedules permit additional updates. The City has been updating the map since 2011 and will continue to update it at least once annually under the new permit. The Engineering Department is responsible for maintaining and updating the storm sewer system map.

2.3.8.7.2 **BMP 12: Prohibit illicit discharges by ordinance.**

Goal: Enforcement of the ordinance shall continue under the new permit.

An ordinance that prohibits illicit discharges to the storm sewer system within the City of Fort Smith went into effect in 1997. Specifically, the regulations are found in Section 25-183 (a) and (b) and in Section 25-186 (a) of the municipal code. Under the new permit, the City will continue to ensure that these regulations are being implemented through the use of appropriate enforcement measures. The enforcement measures and penalties are outlined in Sections 1-9 and 25-192 of the municipal code.

Copies of Sections 1-9, 25-183 (a) and (b), 25-186 (a), and 25-192 have been included in Appendix "B" for further reference. Both the Engineering Department and the Utility Department are responsible for ensuring the ordinance is enforced and illicit discharges are abated.

2.3.8.7.3 **BMP 13: Prohibit illegal dumping by ordinance.**

Goal: Enforcement of the ordinance will continue under the new permit.

Illegal dumps degrade surface water quality, give off offensive odors, and present direct health hazards from vectors among many other things *(1)*. Ordinances have been developed addressing these issues. Chapters 16 and 25 of the municipal code prohibit illegal dumping. These ordinances are enforced by the City's Neighborhood Services Division. The City will continue to enforce these ordinances prohibiting illegal dumping under the new permit.

2.3.8.7.4 **BMP 14: Dry weather inspection of storm sewer system.**

Goal: A dry weather survey of 20% of the storm drain system outfalls per year will be conducted to identify non-storm water flows. After each year's survey is

complete, areas found to have suspicious discharges will be inspected further to detect suspected direct connections to the wastewater system and identify areas where wastewater might be leaking into adjacent storm drain pipes. Inspections will continue under the new permit.

Inspections of outfalls began in the fall of 2005. Targeted inspection of areas where high nutrient levels, suds and oily discharges, or dry weather flows are found allows the City to efficiently and effectively identify locations where illicit connections to the storm drain system exist. Outfalls with suspicious discharges will be further tested in the field by single parameter analysis. The indicator chemical used will be ammonia.

Under the new permit, the City will only prioritize those areas where dry weather discharges are observed. Once a suspicious discharge has been identified, two different methodologies will be employed to trace the source of the possible illicit discharge—storm drain network investigation and on-site investigation. Both of these methodologies are more fully described in chapter 13 of Illicit Discharge Detection and Elimination, *A Guidance Manual for Program Development and Technical Assessments (3)*.

With storm drain network investigation, field crews from the Operations Department and Engineering Department will strategically inspect manholes within the storm sewer system to measure physical indicators or perform single parameter analysis (ammonia) in order to isolate discharges to a specific segment of the network. Field crews shall inspect the manholes and the storm sewer system by one of the following three options:

- Field crews can work progressively up the trunk from the outfall and test manholes along the way (Small diameter outfall, < 36"; Simple drainage network).
- Field crews can split the trunk into equal segments and test manholes at strategic junctions in the storm sewer system (Large diameter outfall, > 36"; Complex drainage; Logistical or traffic issues).
- Field crews can work progressively down from the upper parts of the storm sewer network toward the problem outfall (Very large drainage area, > one square mile) *(3)*.

Once field crews have identified the pipe segment, on-site investigations will be used to find the specific discharge or improper connection. The three basic approaches that will be utilized for on-site investigations are dye, video, and smoke testing *(3)*.

In order to eliminate the source, the following questions must be answered by City staff about each individual illicit discharge to determine how to proceed:

- Who is responsible?
- What methods will be used to fix the problem?
- How long will it take?
- How will removal be confirmed *(3)*?

The answers to these questions will depend upon the source of the discharge. Illicit discharges will generally originate from one of the following sources:

- An internal plumbing connection
- A service lateral cross-connection
- An infrastructure failure within the sanitary sewer
- An indirect or transitory discharge resulting from leaks, spills, or overflows *(3)*

The financial responsibility for removal of the source will typically fall on property owners, the City, or some combination of the two *(3)*.

Dry weather inspections of the storm drain system will continue under the new permit. Initial inspections will be the responsibility of the Operations Department. Follow-up inspections on outfalls or segments found to have suspicious discharges will be the responsibility of the Engineering Department. The illicit discharge detection and elimination program will be evaluated at least once annually to assess if the goals of the program are being achieved.

2.3.9 *Performance Standards.* The stormwater illicit discharge detection and elimination program includes dry-weather screening of all stormwater outfalls located in the City's urbanized area. Outfalls draining undeveloped watersheds will not be screened for illicit discharges. The storm sewer system map shall be updated annually as needed for changes occurring in the urbanized area boundaries.

2.3.10 *Annual Reporting.* The City of Fort Smith shall utilize the standard annual report form developed by ADEQ. The annual report will document the following:

- Number of outfalls dry-weather screened
- Number of dry-weather flows identified
- Number of illicit discharges identified
- Number of illicit discharges eliminated
- Schedules for elimination of illicit connections that have been identified but have yet to be eliminated
- Summary of any storm sewer mapping updates

2.4 Construction Site Stormwater Runoff Control

2.4.1 The City of Fort Smith has developed, implemented, and is enforcing a program to reduce pollutants in stormwater runoff from construction activities that result in a land disturbance of greater than or equal to one acre. Reduction of pollutants in stormwater discharges from construction activity disturbing less than one acre has also been included in the program if that construction activity is part of a larger common plan of development or sale that would disturb one acre or more. This program included the development and implementation of:

2.4.1.1 An ordinance to require erosion and sediment controls, as well as sanctions to ensure compliance, to the extent allowable under State and local law. The ordinance is at least as stringent and not conflicting with the criteria set forth in the current, at time of issuance of the new MS4 permit, ADEQ NPDES General Stormwater Permit for Construction Activities.

2.4.1.2 Requirements for construction site operators to implement appropriate erosion and sediment control BMP's.

2.4.1.3 Requirements for construction site operators to control waste such as discarded building materials, concrete truck washout, chemicals, litter, and sanitary waste at the construction site that may cause adverse impacts on water quality.

2.4.1.4 Procedures for site plan review which incorporate consideration of potential water quality impacts.

2.4.1.5 Procedures for receipt and consideration of information submitted by the public.

2.4.1.6 Procedures for site inspection and enforcement of control measures.

2.4.2 *Decision Process.* The City of Fort Smith has documented the decision process for the development of the construction site stormwater control program. The rationale statement addresses the overall construction site stormwater control program and the individual BMP's, measureable goals, and responsible persons for the program. The rationale statement includes the following information:

2.4.2.1 The City of Fort Smith will continue to require erosion and sediment controls at construction sites. Erosion and sediment controls are required by the City's Fill and Grading Ordinance. This ordinance is described in more detail under BMP 15 in Section 2.4.2.8. A copy of the relevant sections of the ordinance is also contained in Appendix "C."

2.4.2.2 The City of Fort Smith will continue to ensure compliance with the Fill and Grading Ordinance through the use of sanctions and other enforcement mechanisms. The sanctions, enforcement mechanisms, and enforcement procedures are described in

more detail under BMP 15 in Section 2.4.2.8 and in the relevant sections of the ordinance which are included in Appendix "C."

2.4.2.3 The City of Fort Smith will continue to require construction site operators to implement appropriate erosion and sediment control BMPs and control waste at construction sites that may cause adverse impacts to water quality. Such waste includes discarded building materials, concrete truck washouts, chemicals, litter, and sanitary waste. The control of these wastes at construction sites is discussed in more detail under BMP 15 in Section 2.4.2.8.

2.4.2.4 The City of Fort Smith will continue to review pre-construction site plans for all sites disturbing one or more acres for potential water quality impacts. Procedures for the site plan review process are discussed in more detail under BMP 17 in Section 2.4.2.8.

2.4.2.5 The City of Fort Smith will continue to receive and consider information submitted by the public. Procedures for receipt and consideration of this information are discussed in more detail under BMP's 18 and 19 in Section 2.4.2.8.

2.4.2.6 The City of Fort Smith will continue to perform monthly inspections on all sites disturbing one or more acres. Sites will be inspected to ensure compliance with the City's Fill and Grading Ordinance. Procedures for inspections are discussed in more detail under BMP 20 in Section 2.4.2.8.

2.4.2.7 The City of Fort Smith Engineering Department is responsible for the overall management and implementation of the stormwater control program. However, other departments, as listed in Section 2.4.2.8, will be responsible for the implementation of specific BMP's or portions thereof.

2.4.2.8 The success of the construction site stormwater runoff control minimum control measure will be evaluated according to the number of measurable goals that are successfully met each reporting year for their associated BMP's.

Measurable goals have been selected for the BMP's that will allow the City to reduce pollutants from construction sites without creating the need for additional personnel. The individual BMP's and their associated measurable goals are listed below:

2.4.2.8.1 **BMP 15: Require erosion and sediment controls at construction sites by ordinance.**

Goal: Enforcement of the ordinance shall continue under the new permit.

In March of 2006, the City adopted a Fill and Grading Ordinance that requires fill and grading activities disturbing one or more acres to be permitted by the City. In

2011, parts of the ordinance were updated to reflect revised inspection procedures and ADEQ permit requirements.

According to this ordinance, construction site operators are required to implement appropriate erosion and sediment control BMP's. Natural vegetation must be retained wherever practicable in order to minimize the potential for soil loss. Erosion control devices must be in place prior to the start of grading. Soil stabilization shall be complete within two weeks of clearing or inactivity in construction. If seeding or another vegetative erosion control method is used, the vegetation shall become established within three weeks or the City may require that the site be reseeded and/or mulched to stabilize the site. The entire disturbed area must be stabilized by seeding and mulching when site grading is complete. The City may require seeding and mulching on any part of the site that will remain inactive for longer than two weeks or when an erosion problem is identified.

If a wet watercourse will be crossed regularly during construction a temporary stream crossing will be required. The watercourse channel must be stabilized after any in-channel work. Stabilization adequate to prevent erosion shall be located at the outlets of all pipes and paved channels.

A temporary access road is required at all sites. Other measures may be required by the City to ensure that sediment is not washed into the storm drains and construction vehicles do not track sediment onto public streets.

Structural controls must be installed and maintained to reduce sediment from stormwater runoff. They must be installed after the clearing necessary for the installation of the controls, but before the clearing for the remaining portions of the site. Techniques that divert upland runoff past disturbed slopes shall also be employed.

Dust abatement measures must be provided as often as necessary to prevent the operations from producing dust in amounts damaging to property, cultivated vegetation, domestic animals, or causing a nuisance to persons living or occupying buildings in the vicinity of the work area.

Clearing and grading of natural resources, such as wetlands, shall not be permitted, except when in compliance with the ordinance and with applicable state and federal laws. Clearing, except that necessary to establish sediment control devices, shall not begin until all sediment control measures have been installed.

Measures must be installed that will prevent the discharge of solid materials, including building materials, to waters of the State. The measures utilized must ensure and demonstrate compliance with State and City waste disposal as well as temporary and permanent sanitary sewer or septic system regulations. If concrete washout will occur on site, measures must be provided to prevent the discharge of concrete washout waters to waters of the State. Measures must also be provided to

prevent discharges from fuel storage areas, hazardous waste storage, and truck wash areas to waters of the State.

Permitting under the City's Fill and Grading Ordinance requires submittal of a permit application, an erosion and sediment control plan (stormwater pollution prevention plan), and a grading plan (site plan with erosion controls) for review and approval. The erosion and sediment control plan and the grading plan must meet the requirements of the latest version of the ADEQ NPDES General Stormwater Permit for Construction Activities. Sites disturbing less than an acre are not required to obtain a permit, however, all sites regardless of size must meet the minimum erosion control requirements outlined in the ordinance or be subject to enforcement actions.

An initial permit is valid for only six months. All permits are subject to review and re-approval and all re-approvals are subject to any reasonable additional requirements as may be deemed necessary by the City Engineer. At any time the City Administrator or his/her designated agents become aware of a potential violation of the requirements, a notice to that affect is issued to the person(s) engaged in the activity. The notice specifies the alleged violation and requires the person(s) engaged in the activity to provide engineering documentation certifying the reasonableness of their actions with reference to the permit requirements. In absence of submitted documentation or after review of same, the City may proceed with enforcement. In the event that any person(s) fails to meet the minimum standards of this ordinance, the City may suspend the activities through a stop-work order or may revoke the permit. Any person(s) judicially determined to be in violation of the ordinance shall be deemed guilty of a misdemeanor and shall be subject to the penalties set forth in section 1-9 of the municipal code. In addition, the Board of Directors may, in lieu of or in addition to those penalties previously mentioned, cause to be initiated an action in the Circuit Court for the Fort Smith District of Sebastian County, Arkansas, for the purpose of restraining or abating any violation of the ordinance.

The City will continue to enforce the Fill & Grading Ordinance under the new permit. The Engineering Department is responsible for enforcing the Fill and Grading Ordinance, except on Utility Department projects. The Utility Department is responsible for ensuring that their projects comply with the City's Fill and Grading Ordinance. A copy of the Fill & Grading Ordinance is attached in Appendix "C."

2.4.2.8.2 **BMP 16: Require all construction activities disturbing greater than one acre be covered under ADEQ Storm Water Construction General Permit.**

Goal: Under the new permit, the City will continue to require the following to be submitted prior to approval of a Fill and Grading Permit: (a.) a copy of the NOI for coverage under ADEQ's Storm Water Construction General Permit for all construction projects disturbing five or more acres; (b.) for sites disturbing one or

more acres, but less than five acres, a copy of the Automatic Coverage Construction Site Notice for coverage under ADEQ's Storm Water Construction General Permit.

Construction sites can be a significant source of sediment for City storm drains. To prevent sediment from entering storm drains it is important to plan for erosion and sediment control practices and procedures in advance of starting construction *(11)*. Requiring developers to submit a copy of an NOI or Automatic Coverage Construction Site Notice has provided some additional assurance that careful preliminary planning for erosion and sediment control has been accomplished.

Submittal of the NOI or Automatic Coverage Construction Site Notice will continue as a requirement of the Fill and Grading Ordinance under the new permit. With the exception of Utility Department projects, the Engineering Department is responsible for ensuring that copies of the proper notices have been submitted. The Utility Department is responsible for maintaining records of notices on Utility Department projects.

2.4.2.8.3 **BMP 17: For all developments that will disturb one or more acres, review site plans to evaluate potential water quality impacts.**

Goal: Procedure for reviewing site plans is currently in place and shall be continued under the new permit.

No person shall conduct any grading that would alter an area one acre or more in size, or would occur over or within 15 feet of an existing utility line, without first obtaining a Fill & Grading Permit from the City. Each application for a permit must include a grading plan (site plan with erosion controls) and an erosion and sediment control plan (stormwater pollution prevention plan). No permit is required for the following activities:

- Excavations below finished grade – including basements, footings, swimming pools, hot tubs, septic systems, retaining walls, and like structures authorized by a valid building permit;
- Cemetery graves;
- Refuse disposal – if controlled by other federal, state, or local regulations;
- Construction of one single-family or duplex residence;
- Building additions – less than 2,000 square feet authorized by a valid building permit;
- Emergency work or repairs immediately necessary to protect life, property or natural resources;
- Nursery and agricultural operations.

Public and private utility organizations may obtain a one-time approval for all routine underground electric, water, sewer, natural gas, telephone, or cable

facilities. The approval will include a utility organization and its contractors, agents, or assigns and will be permanent in nature as long as the original approval procedures are followed.

Applications submitted to the Building Department for a Site Development Permit shall be reviewed by the Engineering Department to determine their conformance with the provisions of the Fill & Grading Ordinance. Grading plans shall be evaluated for conformance with minimum erosion control requirements. Within seven working days after receiving a properly completed application, the City shall, in writing:

- Approve the permit application; or
- Approve the permit application subject to such reasonable conditions as may be necessary to secure substantially the objectives of the ordinance; or
- Disapprove the permit application, informing the applicant of the reason(s) therefore, and of the procedure for submitting a revised application and/or submission.

The requirements of the ordinance may be varied by the Engineering Department upon written application by the person engaged in the grading. Variances may be granted upon determination that the literal application of the provisions of the ordinance would result in an unreasonable hardship. The denial of a variance is subject to review by the City Administrator. The review by the City Administrator shall be conducted on the written record and the applicant shall have the right to submit written support materials. The decision of the City Administrator shall constitute the final administrative action of the City.

The Engineering Department is responsible for reviewing site plans for potential water quality impacts.

2.4.2.8.4 **BMP 18: The City will address all construction stormwater complaints that fall within the jurisdiction of the City's Fill and Grading Ordinance. In the event that a substantiated complaint cannot be addressed by the Fill and Grading Ordinance, the City will forward that complaint to ADEQ.**

Goal: The City will continue to address all construction storm water complaints that fall within the jurisdiction of the City's Fill and Grading Ordinance under the new permit. Any substantiated complaint that cannot be addressed by the Fill and Grading Ordinance will be forwarded to ADEQ.

Under the new permit, the City will continue to address all construction stormwater complaints that fall within the jurisdiction of the City's Fill and Grading Ordinance. In the unlikely event that a substantiated complaint arises that cannot be dealt with by the Fill and Grading Ordinance, City Staff will forward that complaint to ADEQ.

In order to gain public input about possible violations, the City will coordinate this effort with the public education program through BMP 19. The Engineering Department is responsible for responding to construction stormwater complaints.

2.4.2.8.5 **BMP 19: Publicize the stormwater hotline on the City's public access television channel or on Facebook.**

Goal: Under the new permit, the stormwater hotline will be publicized at least once per year, either through a public service announcement on the City's public access television channel or in a post on the City of Fort Smith Stormwater Management Facebook page.

City staff can't be on every construction site every day, therefore, staff will also have to rely on citizen input and complaints to determine problem areas. In order to achieve this, the City will coordinate the construction site stormwater control program with the public education program. This will be accomplished by publicizing the stormwater hotline and its purpose, either through PSA's on the City's public access television channel or through Facebook posts on the City's Stormwater Management page. The Engineering Department will be responsible for developing PSA's and Facebook posts. The City Clerk's office will be responsible for airing any PSA's on the City's public access channel.

2.4.2.8.6 **BMP 20: Construction sites disturbing one or more acres shall be inspected monthly.**

Goal: Under the new permit, the City shall continue monthly inspections of construction sites that disturb one or more acres.

Under the new permit, monthly inspections of construction sites disturbing one or more acres shall continue. Engineering Department staff shall make the inspections and shall either approve that portion of the work completed or shall notify the property owner wherein the work fails to comply with the approved stormwater pollution prevention plan. During construction, the property owner shall keep approved plans for grading, stripping, excavating, and filling work on site. In order to obtain inspections, the property owner shall notify the Engineering Department at least two working days before the start of construction. At least one inspection per month will be conducted until the project is completed. The property owner shall notify the Engineering Department at least two working days before final stabilization occurs.

The property owner is also required to make regular inspections of all control measures in accordance with the inspection schedule outlined on the approved stormwater pollution prevention plan. The purpose of such inspections will be to determine the overall effectiveness of the control plan, and the need for additional

control measures. All inspections must be documented in written form. Engineering Department staff are also authorized to enter the property as deemed necessary to make regular inspections to ensure the validity of the reports filed by the property owner.

All sites disturbing one or more acres will be inspected monthly, therefore, no prioritization will be required. If deficiencies are found during the inspection, property owners will be given three days to correct the deficiencies. If the deficiencies are not corrected within three days, a stop-work order will be issued, and their Fill and Grading Permit may be revoked. If deficiencies continue, or if a property owner refuses to comply, the case may be turned over to the prosecuting attorney's office.

2.4.3 *Performance Standards.* The City of Fort Smith construction site stormwater control program shall include pre-construction site plan reviews (reviews of construction site Stormwater Pollution Prevention Plans) of 100 percent of projects from construction activities that result in a land disturbance of greater than or equal to one acre. These applicable sites shall be inspected at least on a monthly basis to ensure compliance.

2.4.4 *Annual Reporting.* The City of Fort Smith shall utilize the standard annual report form developed by ADEQ. The annual report shall document the following:

- Number of applicable sites in the jurisdiction of the City of Fort Smith
- Number of pre-construction site plan reviews performed
- Number and frequency of site inspections
- Number of violation letters issued
- Number of enforcement actions taken
- Number of complaints received and number followed up on

2.5 Post-Construction Stormwater Management in New Development and Redevelopment

2.5.1 The City of Fort Smith has developed, implemented, and is enforcing a program to address stormwater runoff from new development and redevelopment projects that disturb greater than or equal to one acre, including projects less than one acre that are part of a larger common plan of development or sale, that discharge within the City. The program ensures that controls are in place that will prevent or minimize water quality impacts.

2.5.2 The City of Fort Smith has developed and implemented strategies which include a combination of structural and/or non-structural BMP's appropriate for the community.

2.5.3 The City of Fort Smith Storm Drainage Standards, which were adopted by ordinance in October of 2011, address post-construction runoff from new development and redevelopment projects to the extent allowable under State and local law. The Storm Drainage Standards are at least as stringent as the criteria set forth in the current, at the time of issuance of the new MS4 permit, ADEQ NPDES General Stormwater Permit for Construction Activities. The Storm Drainage Standards also require a goal of at least 80% removal of total suspended solids from flows which exceed predevelopment levels when designing and installing stormwater management controls (where practicable).

2.5.4 The City of Fort Smith post-construction SWMP also ensures adequate long-term operation and maintenance of BMP's. The Storm Drainage Standards specify that public BMP's will be maintained by the City and private BMP's will be maintained by the property owner. For private BMP's, the property owner is required to have a signed maintenance agreement with the City.

2.5.5 *Decision Process.* The City of Fort Smith has documented the decision process for the development of the post-construction SWMP. The rationale statement addresses both the overall post-construction SWMP and the individual BMP's, measureable goals, and responsible persons for the program. The rationale statement includes the following information:

2.5.5.1 The post-construction SWMP for the City of Fort Smith addresses both new development and redevelopment projects. If hydrologic and hydraulic studies reveal that the post-development runoff for a proposed development or redevelopment project one acre or more in size will exceed the pre-development runoff, and the existing drainage system is not adequate to carry the post-development runoff, then the proposed development or redevelopment project is not permitted unless one or more of the following mitigation measures are used: onsite detention, off site or regional detention, or improvements to the existing drainage system.

Development and redevelopment projects one or more acres in size (or less than an acre if part of a larger common plan of development) that will increase the impervious area onsite, are not permitted without employing BMP's to address the water quality of the surface waters being discharged from the site. All BMP's or systems of BMP's utilized to address water quality are required to capture and treat the Water Quality Volume (WQ_v).

Areas where the land use or activities on site generate highly contaminated runoff with concentrations of pollutants in excess of those typically found in stormwater are known as Stormwater Hot Spots. When developing or redeveloping a hot spot site, a greater level of stormwater treatment is needed to prevent pollutant washoff after construction. This typically involves preparing and implementing a SWPPP that involves a series of

operational practices at the site that reduces the generation of pollutants by preventing contact with rainfall. For the purposes of the City's Drainage Standards, Stormwater Hot Spots are classified as industrial facilities that:

- Have Standard Industrial Classification (SIC) codes listed in "40 CFR 122.26(b)(14) Subpart (i) – (xi)"
- And, are required to submit applications for a stormwater permit to ADEQ.

2.5.5.2 The post-construction SWMP has been tailored to the City of Fort Smith by allowing the use of various detention practices to maintain pre-development runoff conditions and allowing the use of both acceptable and sub-standard BMP's to minimize water quality impacts. Allowable publicly owned detention practices include stormwater ponds and wetlands. Other detention methods such as infiltration trenches, infiltration basins, etc., may be used with proper documentation for privately owned detention, however, the practice will be discouraged. Acceptable BMP's for water quality are those that are designed to capture and treat the WQ_v with a goal of at least 80% removal of total suspended solids (TSS) from post-construction discharges. BMP's that meet this requirement can be divided into the following five basic groups:

- Stormwater Ponds
- Wetlands
- Infiltration Systems
- Filtering Systems
- Open Channel Systems *(8)*

Sub-standard BMP's are those which do not qualify as "stand alone" practices for full WQ_v treatment. By themselves, these BMP's are unable to remove 80% TSS from post-construction discharges. However, sub-standard BMP's can be used appropriately for pretreatment, or in combination with other BMP's as part of an overall "treatment train," or may be applied in redevelopment situations on a case by case basis where other practices are not feasible *(8)*.

2.5.5.3 The City of Fort Smith post-construction SWMP includes non-structural BMP's in the form of Stormwater Credits. The purpose of the stormwater credit system is to provide incentive to developers, engineers, and builders to implement better site design and locate new development in a manner that causes less impact to aquatic resources. By taking advantage of the credit system, developers and builders are able to reduce the stormwater quality requirements. The credit system directly translates into cost savings to the developer by reducing the water quality volume that has to be captured and treated *(8)*.

Two broad types of credits are included in the system: Site Design Credits and Watershed Credits. Site Design Credits act as incentives to encourage better site design techniques by reducing required water quality volumes on site. Watershed Credits are reductions or exemptions from stormwater management requirements to support watershed goals such as redevelopment or watershed zoning *(8)*.

Site Design Credits allow developers to reduce or eliminate requirements for water quality in exchange for implementation of certain non-structural site design elements. The credits are calculated as volumes that are based on the fraction of the total site area or site impervious area affected by the credit. The following Site Design Credits are included in this program:

- Conservation of Natural Areas
- Reforestation
- Rooftop Disconnection
- Non-Rooftop Disconnection
- Green Rooftops

Watershed Credits focus on the location of the development, rather than on the design of the site. They reward developers who locate in areas that result in less impact to water resources by encouraging development in already urbanized or highly degraded areas. Three Watershed Credits are included in this program:

- Watershed Zoning
- Infill
- Redevelopment *(8)*

2.5.5.4 Structural BMP's in the City of Fort Smith post-construction SWMP include both acceptable and sub-standard BMP's. Acceptable BMP's can be divided into five basic groups. The basic groups and individual BMP's are listed below:

Group 1: Stormwater Ponds

- Micropool Extended Detention Pond
- Wet Pond
- Wet Extended Detention Pond
- Multiple Pond System
- "Pocket" Pond

Group 2: Wetlands

- Shallow Wetland
- ED Shallow Wetland

- Pond/Wetland System
- "Pocket" Wetland

Group 3: Infiltration Systems

- Infiltration Trench
- Infiltration Basin

Group 4: Filtering Systems

- Surface Sand Filter
- Underground Sand Filter
- Perimeter Sand Filter
- Organic Filter
- Bioretention

Group 5: Open Channel Systems

- Dry Swale
- Wet Swale
- Grass Channels *(8)*

Sub-standard BMP's include, but are not limited to, the following practices:

- Dry Extended Detention Ponds
- Catch Basin Inserts
- Water Quality Inlets and Oil/Grit Separators
- Hydro-Dynamic Structures
- Filter Strips
- Deep Sump Catch Basins
- Dry Wells
- On-Line Storage in the Storm Drain Network *(8)*

2.5.5.5 The mechanism the City of Fort Smith uses to address post-construction runoff from new developments and redevelopments is the City's Storm Drainage Standards. Under the previous permit, new Storm Drainage Standards were developed and were adopted by ordinance in October of 2011. The new Standards contain a chapter on post-construction stormwater management.

2.5.5.6 For BMP's where ownership is vested in the City of Fort Smith, long-term operation and maintenance is the responsibility of the City. When ownership of a BMP is not vested in the City, the operation and maintenance responsibility is vested with a responsible party by means of a legally binding and enforceable maintenance

agreement that is executed as a condition of plan approval or the permitting process (also, see BMP 23 in Section 2.5.5.8.3).

2.5.5.7 The Engineering Department is responsible for the overall management and implementation of the post-construction SWMP, however, the Operations Department is responsible for maintenance of publicly owned BMP's.

2.5.5.8 The success of the post-construction stormwater management minimum control measure will be evaluated according to the number of site plans reviewed for compliance with the City's post-construction stormwater management requirements and the number of post-construction stormwater BMP's correctly installed.

Measurable goals have been selected for the BMP's that will ensure developments are constructed with improvements that will reduce pollutant levels in post-construction stormwater without creating the need for additional City personnel to review and inspect the improvements. The individual BMP's and their associated measurable goals are listed below:

2.5.5.8.1 **BMP 21: Review site plans for compliance with the post-construction stormwater management requirements.**

Goal: All development and redevelopment projects disturbing one or more acres shall be reviewed for compliance with the post-construction stormwater management requirements contained in the City's Storm Drainage Standards.

In October of 2011, the City Board of Directors passed an ordinance adopting new Storm Drainage Standards that address post-construction stormwater management in development and redevelopment projects disturbing one or more acres. The post-construction stormwater requirements are found in Chapter 5 of the new Storm Drainage Standards. Chapter 5 has been included in Appendix "D" for further reference.

In order to comply with the City's MS4 Permit, all pre-construction site plans for sites disturbing one or more acres are being reviewed for compliance with the new Standards. The Engineering Department is responsible for reviewing site plans for conformance to these requirements.

2.5.5.8.2 **BMP 22: Inspect post-construction stormwater BMP's for correct installation.**

Goal: All post-construction stormwater BMP's for sites disturbing one or more acres, or less than one acre if part of a larger common plan of development, shall be inspected to ensure they were constructed in accordance with the approved plans.

In order to comply with the City's MS4 Permit, all post-construction stormwater BMP's for sites disturbing one or more acres are being inspected to ensure they are constructed in accordance with the approved plans. The Engineering Department is responsible for performing these inspections.

2.5.5.8.3 **BMP 23: Require long-term operation and maintenance (O&M) plans for privately maintained post-construction stormwater BMP's.**

Goal: A legally binding and enforceable maintenance agreement shall be executed for all privately owned post-construction stormwater BMP's. The maintenance agreement shall be required as part of plan approval or the permitting process.

As was stated above in Section 2.5.5.6, when BMP ownership is vested in the City of Fort Smith, long-term operation and maintenance shall be the responsibility of the City. However, when ownership is not vested in the City, the long-term operation and maintenance responsibility is vested with a responsible party by means of a legally binding and enforceable maintenance agreement that is executed as a condition of plan approval or the permitting process. The Engineering Department is responsible for ensuring that long-term maintenance agreements for privately owned BMP's have been signed.

2.5.6 *Performance Standards.* The City of Fort Smith SWMP shall include pre-construction site plan review (for compliance with local requirements for post-construction management of stormwater) of 100 percent of projects from construction activities that result in a land disturbance of greater than or equal to one acre to ensure that required controls are designed per requirements. These applicable sites shall be inspected to ensure that controls are installed per requirements. The program shall also ensure that long-term operation and maintenance (O&M) plans are developed and agreements in place for all applicable sites.

2.5.7 *Annual Reporting.* The City of Fort Smith shall utilize the standard annual report form developed by ADEQ. The annual report shall document the following:

- Number of applicable sites in the jurisdiction requiring post-construction controls
- Number of pre-construction site plan reviews performed
- Number of inspections performed to ensure as built per requirements
- Compliance rates with City of Fort Smith requirements
- Number of long-term O&M plans developed and agreements in place

2.5.8 *Low Impact Development (LID).* No readily identifiable impediments to low impact development (LID) were found in the City Code of Ordinances. LID is encouraged in the City of Fort Smith through Site Design Credits which allow developers to reduce or eliminate requirements for water quality in exchange for implementation of certain non-

structural site design elements. Site Design Credits are discussed in more detail in Section 2.5.5.3.

2.6 Pollution Prevention/Good Housekeeping for Municipal Operations

2.6.1 The City of Fort Smith has developed and implemented an operation and maintenance program that includes a training component and has the ultimate goal of preventing or reducing pollutant runoff from municipal operations.

2.6.2 Using training materials that are available from EPA, ADEQ, other organizations or developed in-house, the City of Fort Smith pollution prevention/good housekeeping program includes employee training to prevent and reduce stormwater pollution from activities such as park and open space maintenance, fleet and building maintenance, new construction and land disturbances, and stormwater system maintenance; and

The City of Fort Smith owns several facilities that discharge to the MS4 and are subject to ADEQ's Industrial Stormwater General Permit or an individual NPDES permit for discharges of stormwater associated with industrial activity. These facilities, and the applicable ADEQ permit numbers, are listed below:

- North "P" Street Wastewater Treatment Plant (AR0033278, ARR000830)
- Massard Wastewater Treatment Plant (Permit No. ARR000449)
- Fort Smith Transit Maintenance Facility (ARR000589)
- Fort Smith Landfill (Permit No. ARG160017, ARR001116)
- Sanitation Department Maintenance Facilities (Located at Fort Smith Landfill, also covered under Permit No. ARG 160017, ARR001116)
- Fort Smith Regional Airport (Permit No. ARR00B844)
- Port of Fort Smith (Leased by Five Rivers Distribution, ARR00B771)

For facilities not requiring industrial stormwater coverage, the City of Fort Smith requires annual inspections if they perform maintenance activities on mechanical equipment, have fueling stations, are involved in waste storage, transfer, or recycling, have material stockpiles, and/or store fertilizers or pesticides. Currently, there are only two municipally owned facilities meeting these requirements. SWPPP's have been developed for both. The facilities are listed below:

- Operations Department/Utility Department Yard and Maintenance Facility
- Parks & Recreation Department Maintenance Facility

2.6.3 *Decision Process.* The City of Fort Smith has documented the decision process for the development of the pollution prevention/good housekeeping program for municipal operations. The rationale statement has addressed the overall pollution prevention/good

housekeeping program and the individual BMP's, measurable goals, and responsible persons for the program. The rationale statement includes the following:

2.6.3.1 The City of Fort Smith has implemented the operation and maintenance program, as described in Section 2.6.3.3 below, to prevent or reduce pollutant runoff from municipal operations. Departments that are impacted by this program include the following:

- Engineering
- Operations
- Parks & Recreation
- Sanitation
- Utility
- Transit

The City operations that are impacted by this program include:

- Vehicle and equipment fueling, cleaning, and repair
- Outdoor storage of raw materials
- Waste handling and disposal
- Building and grounds maintenance
- Parking/storage area maintenance
- Road and street maintenance
- Landscape maintenance
- Drainage system maintenance
- Water and sewer utility maintenance

2.6.3.2 An employee training program designed to reduce and prevent stormwater pollution has been in place since the previous MS4 permit. As part of this program training materials are distributed semi-annually. This program will be continued for all eligible employees and shall cover such topics as park and open space maintenance, new construction and land disturbances, fleet and building maintenance, and stormwater system maintenance. Other areas of concern include educating employees about illegal dumping and recognizing and reporting illicit discharges. The materials that were utilized previously were developed by ADEQ and EPA, as well as a few in house materials. Fact sheets and training materials from ADEQ and EPA will continue to be used under the new permit.

2.6.3.3 The City's employee training program specifically addresses the following areas:

2.6.3.3.1 Maintenance activities, maintenance schedules, and long-term inspection procedures for controls to reduce floatables and other pollutants to the MS4. See BMP's 24, 25, and 26 in Section 2.6.3.5 for more information.

2.6.3.3.2 Controls for reducing or eliminating the discharge of pollutants from streets, roads, highways, municipal parking lots, maintenance and storage yards, waste transfer stations, fleet or maintenance shops with outdoor storage areas, and salt/sand storage locations and snow disposal areas. See BMP's 27, 28, and 29 in Section 2.6.3.5 for more information.

Additionally, all municipally-owned facilities were evaluated under the previous permit to ensure that industrial stormwater permit coverage, if needed, was obtained. Industrial stormwater permits for qualifying sites will be maintained under the new permit.

Facilities that did not require an industrial stormwater permit, but performed maintenance activities on mechanical equipment, had fueling stations, were involved in waste storage, transfer, or recycling, had material stockpiles, or stored fertilizers or pesticides were required under the previous permit to develop a SWPPP and perform annual inspections. Annual inspections of these sites will continue under the new permit.

2.6.3.3.3 Procedures for the proper disposal of waste removed from the MS4 and the municipal operations, including dredge spoil, accumulated sediments, floatables, and other debris. See BMP 30 in Section 2.6.3.5 for more information.

2.6.3.3.4 Procedures to ensure that new flood management projects are assessed for impacts on water quality and existing projects are assessed for incorporation of additional water quality protection devices or practices. See BMP 31 for more information.

2.6.3.4 The Operations Department is responsible for the overall management and implementation of the pollution prevention/good housekeeping program. However, other departments, as listed in Section 2.6.3.5 are responsible for implementation of specific BMP's or portions thereof.

2.6.3.5 The success of the pollution prevention/good housekeeping minimum control measure will be evaluated according to the number of measurable goals that are successfully met each reporting year for their associated BMP's.

Measurable goals have been selected for the BMP's that will allow the City to reduce pollutants caused by municipal operations without creating the need for additional equipment and personnel. The individual BMP's and their associated measurable goals are listed below:

2.6.3.5.1 **BMP 24: Inspection and sweeping of streets.**

Goal: Streets with curb and gutter will continue to be swept an average of 6 times annually under the new permit.

This BMP was part of the previous MS4 permit. Pollutants, such as sediment, debris, trash, road salt, and trace metals, can be reduced by street sweeping. Street sweeping can also control dust, improve the aesthetics of roadways, and decrease the accumulation of pollutants in catch basins *(12)*.

The measureable goal for this BMP has been updated to clarify that only streets with curb and gutter are swept. Streets without curb and gutter are not swept because the brushes pull dirt and debris from the side of the street and can actually increase the amount of pollutants on the roadway. The City maintains approximately 300 miles of streets with curb and gutter. The City will continue to sweep these streets at least 6 times annually under the new permit. The Operations Department is responsible for overseeing the City's street sweeping program.

2.6.3.5.2 **BMP 25: Perform preventative maintenance on storm sewer system.**

Goal: Drain crews shall continue to perform at least 80 hours per month preventative maintenance on the City storm sewer system under the new permit.

As a stormwater best management practice (BMP), preventive maintenance should be used to monitor systems constructed to control storm water. These systems should be inspected to uncover cracks, leaks, and other conditions that could cause failures of storm water mitigation structures and equipment, which, in turn, could result in discharges of pollutants to surface waters either by direct overland flow or through storm drainage systems. A preventive maintenance program can prevent failures through adjustment, repair, or replacement of structures before a major failure occurs *(18)*. City crews currently perform maintenance on the municipal storm sewer system. While some of this work is complaint driven and occurs during heavy rainfall events, the majority of the maintenance is conducted during dry weather and can be classified as preventative. City crews shall continue performing at least 80 hours of preventative maintenance per month under the new permit. The Operations Department is responsible for maintenance on the storm drain system.

2.6.3.5.3 **BMP 26: Schedule patching, resurfacing, and crack sealing for dry weather.**

Goal: City staff shall continue scheduling patching, resurfacing, and crack sealing only during dry weather under the new permit.

Proper planning for road and bridge resurfacing projects is a simple but effective pollution control method. Several techniques can be used to control the side-effects of road maintenance procedures. Scheduling paving operations only during dry weather is one of those techniques *(15)*. City staff will continue to schedule all patching, resurfacing, and crack sealing operations only during dry weather under the new permit. Both the Engineering and Operations Departments are responsible for roadway maintenance and resurfacing.

2.6.3.5.4 **BMP 27: Distribute training materials on stormwater protection to City employees.**

Goal: Under the new permit, materials will continue to be distributed semi-annually to all eligible employees.

This BMP was part of the previous MS4 permit. Pollutants generated by municipal operations accumulate on ground surfaces where they are transported by runoff to receiving waters. Educating municipal employees through a training program about the impacts of their work on storm water quality can help prevent pollution from municipal operations *(11)*. As part of this program, employee training materials will be distributed that have been developed by ADEQ, EPA, and in house. The subject matter of the materials shall be related to reducing or eliminating the discharge of pollutants from streets, municipal parking lots, maintenance and storage yards, waste transfer stations, fertilizers, pesticides, new construction and land disturbances, fleet or maintenance shops with outdoor storage areas, and salt/sand storage locations. Employees shall also receive training on illegal dumping and recognizing and reporting illicit discharges. The City will continue to distribute training materials semi-annually to all eligible employees under the new permit. The Engineering Department is responsible for producing the employee training materials and distributing them to the departments. The individual departments are responsible for disseminating the information to their employees.

2.6.3.5.5 **BMP 28: Designate vehicle washing and maintenance areas for City fleet.**

Goal: Designated vehicle washing and maintenance areas will continue to be used under the new permit.

This BMP was part of the original MS4 permit. Used automobile fluids are toxic, even in small quantities, because of metal contaminants and organic petroleum-based constituents. They must be properly managed to prevent land, air, and water pollution *(2)*. Designating washing and maintenance areas for city vehicles allows for the proper containment of spills and leaks associated with those activities. The

City has had designated vehicle washing and maintenance areas for the City fleet since the first year of the original MS4 permit (2004). The City will continue to maintain these areas under the new permit. The Operations, Parks and Recreation, Sanitation, Transit, and Utility Departments each have designated vehicle maintenance and/or washing areas. The individual departments are responsible for the activities at their own facilities.

2.6.3.5.6 **BMP 29: Deicing salts and salt/sand stockpiles shall be stored outside of the 100-year floodplain and in containment areas that prevent discharge to the MS4.**

Goal: Under the new permit, the City shall continue to store deicing salts and salt/sand stockpiles outside of the floodplain and in containment areas that prevent discharge to the MS4.

The storage of deicing materials can lead to water quality problems for surrounding areas. Properly storing deicing salts prevents the salt from lumping together, which makes it easier to load and apply. In addition, covering salt storage piles reduces salt loss from stormwater runoff and potential contamination to streams, rivers, and other water bodies. Salt storage piles should also be located outside the 100-year floodplain for further protection against surface water pollution *(14)*. The City stores its deicing salts in an enclosed shelter, located outside of the 100-year floodplain, and will continue to do so under the new permit.

The City also has a pre-mixed salt and sand stockpile that is kept ready for use during the winter months. This stockpile is not covered, however, it is stored in a containment area where it is enclosed on three sides by concrete walls. Water that collects at the low end of this containment area drains through weep holes in the back wall and flows into a concrete pit. The concrete pit is pumped out as needed, and the runoff is transported to one of the City's treatment plants. The City will continue to store the mixed salt and sand stockpile in this containment area under the new permit. The Operations Department is responsible for storing and maintaining the City's deicing salts and pre-mixed salt and sand stockpile.

2.6.3.5.7 **BMP 30: Trash, debris, and other solid wastes removed from storm sewers shall be disposed of at sanitary landfill.**

Goal: Under the new permit, all trash, debris, and other solid wastes removed from the storm sewer system shall continue to be disposed of at the sanitary landfill.

Storm sewer systems need to be cleaned regularly. Routine cleaning reduces the amount of pollutants, trash, and debris in both the storm sewer system and the receiving waters. Clogged inlets can cause storm sewers to overflow, leading to

increased erosion. Cleaning increases dissolved oxygen, reduces bacteria levels, and supports in-stream habitat *(16)*. When clogged inlets are encountered, the debris causing the blockage many times will have to be removed by hand. This debris must then be disposed of in a proper manner. The City will continue to dispose of all trash, debris, and other solid wastes removed from the storm sewer system at the sanitary landfill under the permit. The Operations Department is responsible for cleaning out the storm drainage system and disposing of the materials removed.

2.6.3.5.8 **BMP 31: New flood management projects shall be assessed for impacts on water quality.**

Goal: Under the new permit, the City will continue to assess new flood management projects for water quality impacts.

Procedures are currently in place within the Engineering Department for the review of flood management projects. Typically, a consulting engineer will be selected to design the project. Then a scope of services will be agreed upon, an engineering services fee will be negotiated and approved, and an engineering services contract will be executed. Dependent upon the complexity of the project, design will proceed in either two or three phases: preliminary and final design; or conceptual, preliminary, and final design. Submittals are required for each design phase. Engineering staff review the submittals for conformance to City design standards, City specifications, and appropriate engineering practice.

2.6.4 *Performance Standards.* The City of Fort Smith pollution prevention/good housekeeping program includes semi-annual employee training for all eligible employees. An eligible employee is defined as a new or veteran employee whose day-to-day work activities have the potential to impact stormwater quality. Under the previous permit, the City evaluated all current municipally-owned facilities to ensure that industrial general stormwater permit coverage (ARR000000), if needed, was obtained. Annual inspections are required for all City facilities that do not require industrial stormwater permit coverage and that are performing maintenance activities on mechanical equipment, have fueling stations, are involved in waste storage, transfer or recycling, have material stockpiles, and/or are storing fertilizers or pesticides.

2.6.5 *Annual Reporting.* The City of Fort Smith shall utilize the standard annual report form developed by ADEQ. The annual reports shall document the following:

- Summary of employee training program(s) implemented with number of employees that attended
- Summary of activities and procedures implemented for the operation and maintenance program

3. SHARING RESPONSIBILITY

Implementation of one or more of the minimum measures may be shared with another entity, or the entity may fully take over the measure. Currently, the City of Fort Smith does not share responsibility for implementation of any of the control measures with another entity. However, in the future, the City may rely on another entity only if:

3.1 The other entity, in fact, implements all or part of the control measure;

3.2 The particular control measure, or component of that measure, is at least as stringent as the corresponding permit requirement; and

3.3 The other entity agrees to implement the control measure on the City's behalf. There shall be written acceptance of this obligation. This obligation shall be maintained as part of their SWMP. If the other entity agrees to report on the minimum measure, the City shall supply the other entity with the reporting requirements contained in Part 4.3 of NPDES Permit No. ARR040000.

4. REVIEWING AND UPDATING STORMWATER MANAGEMENT PROGRAMS

4.1 *SWMP Review:* The City of Fort Smith shall do an annual review of the SWMP in conjunction with preparation of the annual report required under Part 4.3 of NPDES Permit No. ARR040000.

4.2 *SWMP Update:* The City of Fort Smith shall change the SWMP during the life of the permit in accordance with the following procedures:

4.2.1 Changes adding (but not subtracting or replacing) components, controls, or requirements to the SWMP may be made at any time upon written notification to ADEQ. This includes any changes that affect the signatory authority of the permit. These changes will be considered a minor modification and are not subject to the public notice requirements in Part 2.4 of NPDES Permit No. ARR040000. This does not include changes adding a new BMP based on a newly applicable condition, such as BMPs required by Part 3.4.5 of NPDES Permit No. ARR040000 due to a newly impaired waterbody designation. Such changes will be considered a major modification to the SWMP and are required to undergo the process under Section 4.2.2.

4.2.2 Changes replacing an ineffective or infeasible BMP specifically identified in the SWMP with an alternate BMP may be requested at any time. These changes may be considered a major modification to the SWMP and be subject to the public notice process outlined in Part 2.4 of NPDES Permit No. ARR040000. ADEQ will review and provide a written decision within sixty (60) days of the request. ADEQ may approve with additional specific

requirements. The revised BMPs shall be implemented immediately upon approval or within the timeframe specified by the approval. If the request is denied, ADEQ will send a written response giving the reason for the decision. The modification requests shall include the following:

4.2.2.1 An analysis of why the BMP is ineffective or infeasible (including cost prohibitive),

4.2.2.2 Expectations on the effectiveness of the replacement BMP, and

4.2.2.3 An analysis of why the replacement BMP is expected to achieve the goals of the BMP to be replaced.

4.2.3 Changes applicable to Sections 1.1.3 and 1.1.4 are considered minor modifications and do not require any notification to ADEQ.

4.2.4 Change requests shall be made in writing and signed in accordance with Part 5.7 of NPDES Permit No. ARR040000.

4.3 *SWMP Updates Required by ADEQ:* It is understood that ADEQ may require changes to the SWMP as needed to:

4.3.1 Address impacts on receiving water quality caused, or contributed to, by discharges from the City;

4.3.2 Include more stringent requirements necessary to comply with new Federal statutory or regulatory requirements; or

4.3.3 Include such other conditions deemed necessary by ADEQ to comply with the goals of the Clean Water Act.

4.3.4 It is understood that any changes requested by ADEQ will be made in writing, set forth the time schedule to develop the changes, offer the opportunity to propose alternative program changes to meet the objective of the requested modification, and discuss whether the changes are subject to the public notification requirements in Part 2.4 of NPDES Permit No. ARR040000.

4.4 *Transfer of Ownership, Operational Authority, or Responsibility for SWMP Implementation:* The City of Fort Smith shall implement the SWMP on all new areas added to the City (or areas where the City becomes responsible for implementation of stormwater quality controls) as expeditiously as practicable, but not later than one year from addition of new areas. Implementation may be accomplished in a phased manner to allow additional time for controls that cannot be implemented immediately.

4.4.1 Within 30 days of transfer of ownership, operational authority, or responsibility for SWMP implementation, the City of Fort Smith shall have a plan for implementing a SWMP on all

affected areas. The plan may include schedules for implementation. Information on all new annexed areas and any resulting updates required to the SWMP shall be included in the annual report. ADEQ shall be notified within 30 days of any change of ownership, operational authority or responsibility for SWMP implementation.

4.5 Discharges to Impaired Waters with and without Approved TMDLs, as well as waters that are attaining Water Quality Standards, but have an approved TMDL

4.5.1 Discharges to Waters with an Approved TMDL

The City of Fort Smith discharges to a segment of the Poteau River which appears on the 2016 Impaired Water bodies List (303(d) List) for turbidity. This particular segment of the river is a Category 4a water body and has an approved TMDL. Part 3.4.5.1 of NPDES Permit No. ARR040000 states, "If the permittee discharges to an impaired water body with an approved TMDL, the permittee must comply with the WLA in the final permit in accordance with 40 CFR 122.44(d)(1)(vii)(1)(B) and will have three (3) years to comply with the TMDL in accordance with Reg. 2.104." However, the City cannot comply with this requirement because it was not assigned a WLA in the TMDL. Section 4.8 of the *TMDL for Turbidity for the Poteau River Near Fort Smith, AR* states, "The WLA for the TMDL was set to zero because no point source discharges to Poteau River were identified. This urban land area in the study area is 12.5%, which is small. The stormwater contribution to the point source will not be considered in the calculation of the TMDL *(5)*."

Even though no WLA has been established for the Poteau River, the City will continue to control the discharge of the pollutants of concern through the BMP's the City already implements.

4.5.2 Discharges Directly to Water Quality Impaired Waters or Waters with an approved TMDL (see Part 1.3.4 of NPDES Permit No. ARR04000)

4.5.2.1 The City of Fort Smith does not discharge to a receiving stream that appears on the 2016 303(d) list of impaired waters for a nutrient constituent (e.g., nitrogen or phosphorus), therefore, this section is RESERVED.

4.5.2.2 The City of Fort Smith does not discharge to a receiving stream that appears on the 2016 303(d) list of impaired waters for bacteria, therefore, this section is RESERVED.

4.5.2.3 The City of Fort Smith discharges to a short segment of the Poteau River along the City's western boundary and near the river's confluence with the Arkansas River. This segment of the Poteau River appears on the 2016 Impaired Water Bodies List (303(d) List) for turbidity and is listed as a Category 4a water body with an approved TMDL.

However, no point source discharges were identified by the TMDL and a WLA has not been established. The TMDL lists surface erosion from agricultural activities, unpaved road surfaces, and unstable stream banks as the sources of the turbidity *(5)*. It is the City's understanding that these sources are primarily coming from upstream in Oklahoma. Although the major sources of turbidity appear to be from outside the MS4, the City will perform the following:

4.5.2.3.1 Within one (1) year of the date of permit coverage, identify potential significant sources of turbidity entering the MS4.

4.5.2.3.2 Within two (2) years of the date of permit coverage, develop (or modify the existing program as necessary) and implement a public education program to reduce the discharge of turbidity contributed by construction activities, bare ground, failing stream banks, and other areas;

4.5.2.3.3 Within two (2) years of the date of permit coverage, develop (or modify the existing program as necessary) and implement a program to reduce the discharge of turbidity in municipal stormwater contributed by areas within the MS4 served by on-site wastewater treatment systems;

4.5.2.3.4 Within two (2) years of the date of permit coverage, review results to date from the Illicit Discharge Detection and Elimination program and modify as necessary to prioritize the detection and elimination of discharges contributing turbidity to the MS4;

4.5.2.3.5 Within three (3) years of the date of permit coverage, develop (or modify the existing program as necessary) and implement a program to reduce the discharge of turbidity in municipal stormwater contributed by any other significant source identified in the source identification evaluation; and

4.5.2.3.6 Include the progress on program implementation, reducing the turbidity of impaired waters or waters with an approved TMDL, and updates to measureable goals for turbidity reduction program elements in the annual reports.

4.5.2.4 The City of Fort Smith discharges to a segment of the Poteau River which appears on the 2016 Impaired Water bodies List (303(d) List) for dissolved oxygen. This particular segment of the river is a Category 5 water body, and a TMDL has not been prepared. The most probable significant source of pollutants entering the MS4 that would result in reductions in dissolved oxygen is surface erosion from construction activities. The City will continue to control surface erosion and dissolved oxygen through the BMPs the City already implements. Implementation of the BMPs and updates to measureable goals shall be reported on in the annual reports.

5. MONITORING

The City of Fort Smith discharges to a segment of the Poteau River which appears on the 2016 Impaired Water bodies List (303(d) List) for turbidity. The Poteau River is a Category 4a water body and has an approved total maximum daily load (TMDL). Part 3.5.1 of NPDES Permit No. ARR040000 states, "If the permittee discharges to waters for which a TMDL and implementation plan has been established, then the permittee must monitor to determine if the stormwater controls are adequate to maintain compliance with the MS4's wasteload allocation." However, Section 4.8 of the *TMDL for Turbidity for the Poteau River Near Fort Smith, AR* states, "The WLA for the TMDL was set to zero because no point source discharges to Poteau River were identified. This urban land area in the study area is 12.5%, which is small. The stormwater contribution to the point source will not be considered in the calculation of the TMDL *(5)*." Therefore, since no WLA has been assigned, the City of Fort Smith proposes no sampling plan at this time.

6. REFERENCES

(1) Arkansas State. Arkansas Department of Environmental Quality. *Arkansas is Down on the Dumps.* April 16, 1999.

(2) Arkansas State. Arkansas Department of Environmental Quality. *Universal Waste – Used Oil Environmental Factsheet.* October 1999.

(3) Brown, E., D. Caraco, and R. Pitt. *Illicit Discharge Detection and Elimination: A Guidance Manual for Program Development and Technical Assessments*. Center for Watershed Protection, Ellicott City, MD. 2004.

(4) City of Fort Smith. Utility Department. *Fort Smith's Water Conservation Program.* http://www.fortsmithwater.org/pdfs/fs-water-conservation09.pdf

(5) FTN Associates, Ltd. *TMDL for Turbidity for the Poteau River Near Fort Smith, AR.* December 29, 2005.

(6) Pew Internet Research Project, Social Networking Fact Sheet. http://www.pewinternet.org/fact-sheets/social-networking-fact-sheet/. February 2014.

(7) South Carolina State. South Carolina Department of Health and Environmental Control. *Turning the Tide: A Citizen's Guide to Reducing Runoff Pollution.*

(8) Stormwater Manager's Resource Center (SMRC) Website. www.stormwatercenter.net. Center for Watershed Protection, Inc. Ellicott City, MD. 2000.

(9) Fort Smith, Arkansas Population: Census 2010 and 2000 Interactive Map, Demographics, Statistics, Quick Facts. http://censusviewer.com/city/AR/Fort%20Smith. February 2014.

(10) United States. Environmental Protection Agency. *Construction Site Stormwater Runoff Control.* May 24, 2006. http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=min_measure&min_measure_id=4

(11) United States. Environmental Protection Agency. *Examples of Phase II BMPs and Associated Measurable Goals.* August 15, 2002. http://cfpub1.epa.gov/npdes/stormwater/measurablegoals/part3.cfm

(12) United States. Environmental Protection Agency. *Parking Lot and Street Cleaning.* May 24, 2006. http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=browse&Rbutton=detail&bmp=99&minmeasure=6

(13) United States. Environmental Protection Agency. *Public Education and Outreach on Stormwater Impacts.* September 17, 2008. http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=min_measure&min_measure_id=1

(14) United States. Environmental Protection Agency. *Road Salt Application and Storage.* May 24, 2006. http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=browse&Rbutton=detail&bmp=106&minmeasure=6

(15) United States. Environmental Protection Agency. May 24, 2006. *Roadway and Bridge Maintenance.* May 24, 2006. http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=browse&Rbutton=detail&bmp=100&minmeasure=6

(16) United States. Environmental Protection Agency. *Storm Drain System Cleaning.* February 11, 2009.

(17) United States. Environmental Protection Agency. *Stormwater Discharges From Industrial Facilities.* August 24, 2009. http://cfpub.epa.gov/npdes/stormwater/indust.cfm?program_id=6

(18) United States. Environmental Protection Agency. *Storm Water O&M Fact Sheet: Preventative Maintenance.* September 1999. http://www.epa.gov/owm/mtb/prevmain.pdf

(19) United States. Environmental Protection Agency. *Stormwater Outreach for Commercial Businesses.* May 24, 2006.

http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=browse&Rbutton=detail&bmp=6&minmeasure=1

APPENDIX "A"

TABLE OF ORGANIZATION/CONTACT LIST

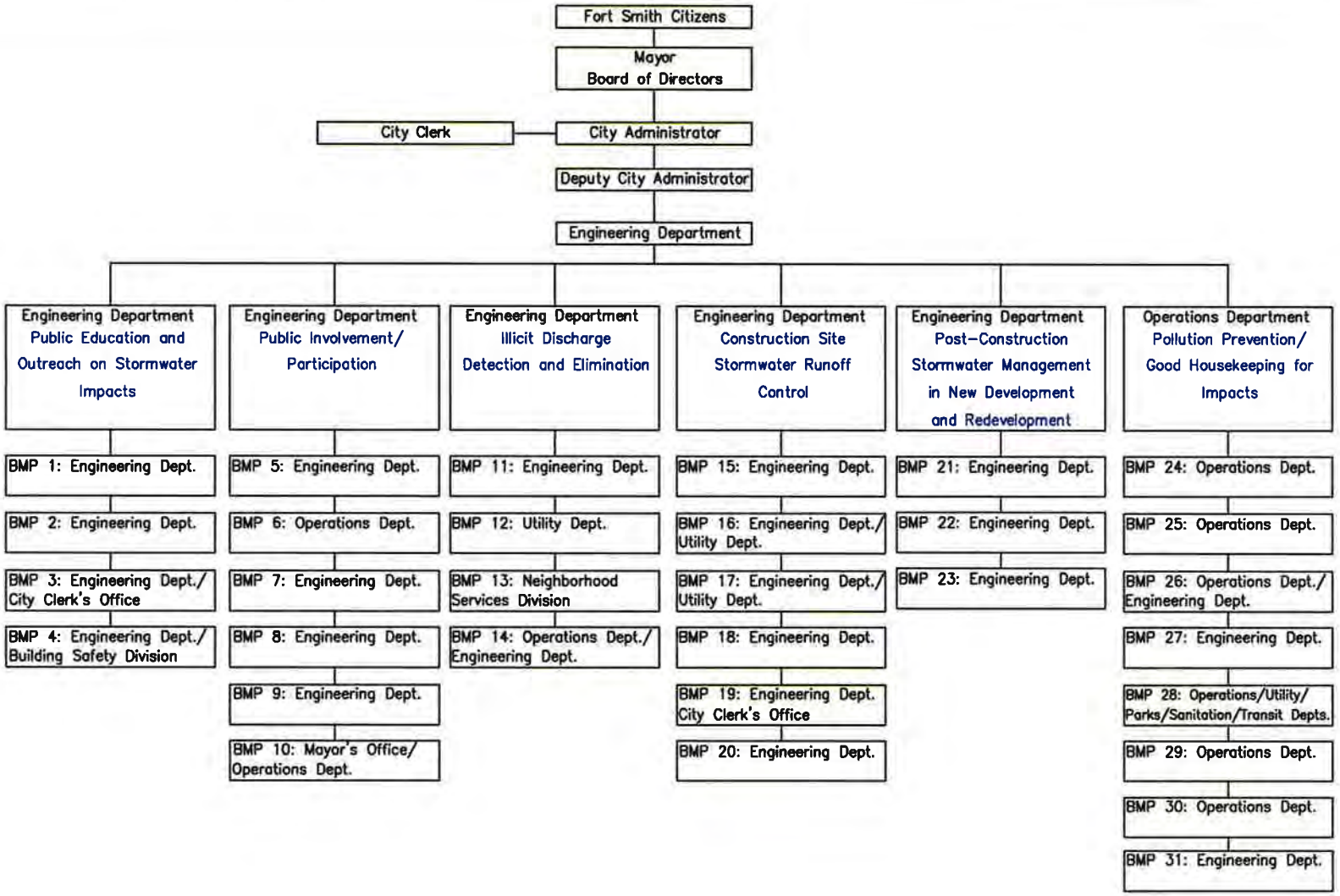

EXHIBIT "A"
2019 SWMP
TABLE OF ORGANIZATION

The City of Fort Smith ARKANSAS

DATE:	6-24-2019
SCALE:	
PROJ. TITLE:	
P.E.:	B. BUTLER
CADD:	MAM
SHEET	49

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APPENDIX "A"
CONTACT LIST

Department	Contact	Position/Title	Phone
Building Safety Division	Jimmie Deer	Building Official	(479) 784-2235
City Clerk's Office	Amber Jones	Access Channel	(479) 784-2205
City Administrator	Carl Geffken	City Administrator	(479) 784-2201
Engineering Department	Billy Butler*	Senior Project Engineer	(479) 784-2243
Mayor's Office	Wendy Beshears	Administrative Secretary	(479) 784-2201
Neighborhood Services Division	Jimmie Deer	Building Official	(479) 784-2235
Street Department	Geroge Allen	Director	(479) 784-2363
Utility Department	Jerry Walters	Director	(479) 494-3908
Parks and Recreation Department	Jim Mackey	Parks Supervisor	(479) 784-2364
Sanitation Department	Alan Spangler	Landfill Manager	(479) 784-2461
Fort Smith Transit	Ken Savage	Director	(479) 784-2320

Notes:
* Primary point of contact.

APPENDIX "B"

MUNICIPAL CODES
REGARDING ILLICIT DISCHARGES

Sec. 25-183. Use of public sewers required.

(a)

It shall be unlawful for any person to place, deposit, or permit to be deposited in any unsanitary manner upon public or private property within the city, or in any area under the jurisdiction of the city, any human or animal excrement, garbage, or other objectionable wastes.

(b)

It shall be unlawful to discharge any sewage or other polluted waters to any natural outlet within the city, or in any area under the jurisdiction of the city, except where suitable treatment has been provided in accordance with a valid, current national pollutant discharge elimination system permit covering such discharges. The control authority may immediately discontinue water service to the user or owner of any property where an unlawful discharge exists until such discharge of any sewage or polluted waters is properly eliminated.

Sec. 25-186. Use of public sewers.

(a)

No user shall introduce or cause to be introduced into the POTW any pollutant or wastewater which causes pass-through or interference. These general prohibitions apply to all users of the POTW whether or not they are subject to categorical pretreatment standards or any other National, State, or local pretreatment standards or requirements. No person shall discharge or cause to be discharged any stormwater, surface water, ground water, roof runoff, subsurface drainage, non-contact cooling water or unpolluted industrial process waters into any sanitary sewer but such waters shall be discharged into such sewers as are specifically designated as storm sewer or into a natural outlet. The discharge into any storm sewer or into natural outlet of any waters, which may have a deleterious effect upon the receiving stream, is prohibited.

Sec. 25-192. Penalties.

(a)

Any person determined to be guilty of a violation of any provision of section 25-183 or section 25-190 of this division shall be deemed guilty of a misdemeanor and shall be subject to the penalties and fines set forth in section 1-8 of this Code.

(b)

Any person found in violation of any of the provisions of this division, except section 25-190, shall be served by the control authority with written notice stating the nature of the violation, describing the penalty applicable to the violation and providing a reasonable time limit for the satisfactory correction thereof. The offender shall, within the period of time stated in such notice, permanently cease all violations. The user may deliver to the control authority, within five (5) days of receipt of such notice, a written request for a hearing before the control authority at which hearing the user shall be given an opportunity to show cause why the notice should be rescinded or modified. Any notice issued pursuant to this subsection may provide one (1) or more of the following penalties:

(1)

An administrative penalty of not more than one thousand dollars ($1,000.00) for each violation of the division, and each day of a continuing violation may be deemed a separate violation; and,

(2)

A compliance directive with time schedule mandating procedures which would bring the user into compliance with this division within the designated time schedule, which compliance directive with schedule shall be expressly stated to be subject to enforcement by withdrawal of the user's discharge permit or termination of POTW service upon noncompliance with the compliance directive with schedule; and,

(3)

A withdrawal of the user's discharge permit and termination of POTW service to the user.

The control authority shall be guided by the city pretreatment program enforcement management plan, which was adopted by the control authority on the effective date of this division, and confirmed hereby, in (1) the initial issuance of penalties set forth in notices issued pursuant to this subsection and (2) in the administrative adjustment or amendment to any such penalty as a result of a hearing requested by the User pursuant to the provisions of this subsection. No action to withdraw a user permit shall be final until the control authority has given notice of and conducted the show cause hearing provided for in the enforcement management plan.

(c)

Any person violating the provisions of this division shall become liable to the city for any expense, loss or damage occasioned the city by reason of such violation.

(d)

In enforcement of the penalty of withdrawing a user's discharge permit or terminating POTW service to a user, the control authority may discontinue water service to the user.

(e)

The city shall have the authority, after notice to the discharger, to immediately and effectively halt or prevent any discharge of pollutants to the sanitary sewer system which reasonably appears to present an imminent danger to the health or welfare of persons, or which threatens to interfere with the operation of the city's treatment facilities.

(f)

The listing of penalties in this section shall not preclude other appropriate judicial remedies available with reference to any violation of this division. In particular, the control authority may petition any court of pertinent jurisdiction to grant injunctive or other legal or equitable relief by reason of a violation. No judicial action against an industrial user to collect a civil penalty for violation of pretreatment standards or requirements shall be commenced without a majority vote of the board of directors.

Sec. 1-9. Penalty for violations.

(a)

In this section "violation of this Code" means:

(1)

Doing an act that is prohibited or made or declared unlawful, an offense or a misdemeanor by ordinance or by rule or regulation authorized by ordinance.

(2)

Failure to perform an act that is required to be performed by ordinance or by rule or regulation authorized by ordinance.

(3)

Failure to perform an act if the failure is declared a misdemeanor or an offense or unlawful by ordinance or by rule or regulation authorized by ordinance.

(b)

In this section "violation of this Code" does not include the failure of a city officer or city employee to perform an official duty unless it is provided that failure to perform the duty is to be punished as provided in this section.

(c)

Except as otherwise provided, a person convicted of a violation of this Code shall be punished by a fine not exceeding five hundred dollars ($500.00), or double such sum for each repetition thereof. If the violation is, in its nature, continuous in respect to time, the penalty for allowing the continuance thereof is a fine not to exceed two hundred fifty dollars ($250.00) for each day that the same is unlawfully continued.

(d)

If a violation of this Code is also a misdemeanor under state law, the penalty for the violation shall be as prescribed by state law for the state offense.

(e)

The imposition of a penalty does not prevent revocation or suspension of a license, permit or franchise.

(f)

Violations of this Code that are continuous with respect to time are a public nuisance and may be abated by injunctive or other equitable relief. The imposition of a "penalty" however does not prevent the simultaneous granting of equitable relief in appropriate cases.

APPENDIX "C"

FILL & GRADING ORDINANCE

Sec. 11-81. Intent; introduction; purpose.

It is the intent of the city to safeguard the health, welfare and safety of the citizens of the city by implementing standards and procedures for the physical alteration of land. The provisions of this article are supplemental to and are not intended to supersede any federal or state regulations.

The purpose of the regulations contained in this article are to control grading, filling, and cutting (or similar activities) which alone or in combination may cause landslides, flooding, degradation of water quality, erosion, sedimentation and potential damage to utility lines. This article is also intended to protect the existing scenic character and quality of the city and its neighborhoods.

(Ord. No. 27-06, § 1, 3-21-06)

Sec. 11-82. Definitions.

ADEQ. The Arkansas Department of Environmental Quality.

Clearing. Any activity that removes the vegetative surface.

Cut. See excavation.

Erosion control. Any measure that prevents erosion.

Erosion and sediment control plan. A set of plans indicating the specific measures and sequencing to be used to control sediment and erosion on a development site during and after construction.

Excavation. The mechanical removal of earth material from water or land.

Fill. The deposit of earth material placed by artificial means.

Grade. The percentage of rise or fall per one hundred (100) feet.

Grading. Any stripping, cutting, filling or stockpiling of earth or land.

Grading permit. A permit issued by the city for the construction or alteration of ground improvements and structures for the control of erosion, runoff and grading.

Grading plan. A plan indicating the specific measures and phasing to be used to grade a development site during construction.

NPDES. National Pollutant Discharge Elimination System.

Phasing. Clearing a parcel of land in distinct phases, with the stabilization of each phase completed before the clearing of the next.

Sediment control. Measures that prevent eroded sediment from leaving the site.

Site. A parcel or lot of land or contiguous combination thereof, where grading is performed or permitted.

Stabilization. The use of practices that prevent exposed soil from eroding.

Utility line. Any public or franchised utility line, including water, sewer, gas, telephone, electric, fiber optic, cable TV or storm water.

Watercourse. Any body of water, including, but not limited to lakes, ponds, rivers, streams, and bodies of water delineated by the city.

Waterway. A channel that directs surface runoff to a watercourse or to the stormwater system.

(Ord. No. 27-06, § 1, 3-21-06; Ord. No. 54-11, § 1, 7-5-11)

Sec. 11-83. General requirements.

(a)

Protection. Persons engaged in grading shall not unreasonably damage public or private properties by such grading.

(b)

Site conditions. Grading shall conform insofar as practicable to the natural contours of the land, natural drainage ways, and other existing site conditions.

(c)

Adjacent properties. All grading shall be performed and maintained so that adjacent properties are not unreasonably burdened with surface waters as a result of such grading. Grading shall not unreasonably impede water runoff from higher properties nor unreasonably channel water onto lower properties.

(d)

Restoration. Land shall be revegetated and restored as close as practicable to its original condition following grading.

(e)

Underground utilities. Grading permit requirements shall also include identified easements for underground utilities and underground utilities identified by Arkansas One Call System prior to any grading. (Arkansas One Call System shall be contacted prior to any filling or excavating.)

(f)

Enforcement of general requirements. The general requirements of this section are applicable to all grading whether or not a permit is required by this article. At any time the city administrator, or his/her designated agents, become aware of a potential violation of these general requirements, a notice to that effect shall be issued to the persons engaged in the grading. The notice shall specify the alleged violation and shall require the persons engaged in the grading to provide engineering documentation certifying the reasonableness of the grading with reference to the general requirements of this section. In the absence of submitted documentation or after review of same, the city may proceed with enforcement pursuant to subsection 11-90(f) of this article. Additionally, a stop work order may be issued pursuant to subsection 11-90(e).

(g)

Other requirements. Other reasonable measures may be required if deemed necessary by the city engineer including but not limited to fencing.

(Ord. No. 27-06, § 1, 3-21-06; Ord. No. 54-11, § 2, 7-5-11)

Sec. 11-84. Grading permits required/exceptions.

(a)

Minimum standards. Although not subject to the permit requirements of this article, all grading on areas less than one (1) acre in size are required to meet the minimum standards set forth in sections 11-83 and 11-85, and subsections 11-86(c), (e), (f), (g) and (h) of this article, and shall be subject to the enforcement procedures of subsection 11-83(f) and subsections 11-90(e) and (f).

(b)

Grading permit required. No person shall conduct any grading that would alter an area one (1) acre or more in size, or which would occur over or within fifteen (15) feet of an existing utility line, without first obtaining a grading permit from the city.

(1)

Each application for a grading permit shall bear the name and address of the owner and/or developer of the site, and the name and contact information of the applicant's authorized representative.

(2)

Each application for a grading permit shall include a grading plan and an erosion and sediment control plan.

(c)

Exceptions. No permit shall be required for the following activities:

(1)

Excavations below finished grade, including basements, footings, swimming pools, hot tubs, septic systems, retaining walls, and like structures authorized by a valid building permit.

(2)

Cemetery graves.

(3)

Refuse disposal, if controlled by other federal, state, or local regulations.

(4)

Construction of one (1) single-family or duplex residence.

(5)

Building additions less than two thousand (2,000) square feet authorized by a valid building permit.

(6)

Emergency work or repairs immediately necessary to protect life, property or natural resources.

(7)

Nursery and agricultural operations.

(8)

City, Sebastian County, State of Arkansas, or federal construction projects.

(d)

One time approvals.

(1)

Utilities. Public and private utility organizations may obtain a one-time approval for all routine underground electric, water, sewer, natural gas, telephone, or cable facilities. The approval will include a utility organization and its contractors, agents, or assigns and will be permanent in nature as long as the original approval procedures are followed.

(Ord. No. 27-06, § 1, 3-21-06; Ord. No. 54-11, §§ 3, 4, 7-5-11)

Sec. 11-85. Minimum erosion control measures.

(a)

Structural controls.

(1)

Structural controls shall be installed and maintained to reduce sediment from stormwater runoff. Structural controls shall include, but not be limited to, silt fences, earthen dikes, drainage swales, check dams, subsurface drains, pipe slope drains, storm drain inlet protection, rock outlet protection, sediment

traps, reinforced soil retaining systems, gabions, and temporary or permanent sediment basins.

(2)

Structural controls must be installed after the clearing necessary for the installation of the controls, but before the clearing for the remaining portions of the site.

(3)

Techniques that divert upland runoff past disturbed slopes shall be employed.

(b)

Stabilization.

(1)

Soil stabilization shall be completed within two (2) weeks of clearing or inactivity in construction. Stabilization methods such as mulching, temporary seeding, permanent seeding, geotextiles, sod stabilization, vegetative buffer strips, protection of trees, and preservation of natural vegetation shall be used. The potential for soil loss shall be minimized by retaining natural vegetation wherever practicable. If seeding or other vegetative erosion control method is used, the vegetation shall become established within three (3) weeks of application or the city may require that the site be reseeded and/or mulched to stabilize the site.

(2)

Material deposits must be graded at two-week, minimum, intervals.

(3)

The entire disturbed area must be stabilized when site grading is complete. The city may require stabilization of any part of the site that will remain inactive for longer than two (2) weeks or when an erosion problem is identified.

(c)

Waterway and watercourse protection requirements.

(1)

A temporary stream crossing will be required if a wet watercourse will be crossed regularly during construction.

(2)

The watercourse channel must be stabilized after any in-channel work.

(3)

Stabilization adequate to prevent erosion shall be located at the outlets of all pipes and paved channels.

(d)

Construction site access requirements. A temporary access road shall be provided at all sites. Other measures may be required by the city to ensure that sediment is not washed into storm drains and construction vehicles do not track sediment onto public streets.

(e)

Dust abatement. Dust abatement measures shall be provided as often as necessary to prevent the operations from producing dust in amounts damaging to property, cultivated vegetation, domestic animals, or causing a nuisance to persons living or occupying buildings in the vicinity of the work area.

(f)

Other controls.

(1)

Measures shall be utilized to prevent the discharge of solid materials, including building materials, to waters of the state. Measures shall ensure and demonstrate compliance with state and city waste disposal, temporary and permanent sanitary sewer or septic system regulations.

(2)

If concrete washout will occur on-site, measures shall be provided which prevent the discharge of concrete washout waters to waters of the state.

(3)

Measures shall be provided to prevent discharges from fuel storage areas, hazardous waste storage and truck wash areas to waters of the state.

(Ord. No. 27-06, § 1, 3-21-06; Ord. No. 54-11, § 5, 7-5-11)

Sec. 11-86. Land alteration requirements.

(a)

Grading plan evaluation. Grading plans shall be evaluated by the city engineer for conformance with minimal erosion control requirements. The plans must identify any current regulatory floodplain and/or floodway impacted by the grading; a floodplain development permit shall also be submitted, if required.

(b)

Requirements varied. The requirements of this article may be varied by the city engineer upon written application by the person engaged in grading. Variances may be granted upon determination that the literal application of the provisions of this article would result in an unreasonable hardship. The denial of a variance is subject to review by the city administrator. The review by the city administrator shall by conducted on the written record and the applicant shall have the right to submit written support materials. The decision by the city administrator shall constitute the final administrative action of the city.

(c)

Clearing and grading. Clearing and grading of natural resources, such as wetlands, shall not be permitted, except when in compliance with this article and with applicable state and federal laws. Clearing, except that necessary to establish sediment control devices, shall not begin until all sediment control measures have been installed.

(d)

Phasing. Phasing shall be required on all sites disturbing greater than thirty (30) acres, unless a phasing plan is submitted to and approved by the city engineer.

(e)

Site drainage. Site shall be graded to provide the following drainage requirements:

(1)

The site must drain away from all buildings and toward the city's street or drainage way.

(2)

The site shall be graded to provide a minimum of six (6) inches of fall in ten (10) feet away from building foundations.

(3)

Grading of the fill material to create positive drainage is required. Standing water is prohibited.

(4)

Drainage shall be directed away from adjacent lots to the maximum extent possible.

(f)

Cut or fill slopes. Cut or fill slopes shall have a finish grade no steeper than fifty (50) percent (two (2) feet horizontal to one (1) foot vertical).

(g)

Maximum vertical cut or fill height. Cuts/fills shall be limited to ten (10) feet in vertical height unless approved the city engineer.

(h)

Fill material. All imported fill shall be free of materials greater than twelve (12) inches in diameter and any detrimental organic material or refuse debris unless approved by the city engineer. Acceptable fill material includes the following:

(1)

Rocks, concrete, brick and asphalt less than twelve (12) inches in diameter.

(2)

Sand.

(3)

Gravel.

(4)

Aggregates.

(5)

Clay/shale.

(6)

Soil.

(Ord. No. 27-06, § 1, 3-21-06)

Sec. 11-87. Grading plan specifications.

The applicant shall prepare and submit a grading plan that shall include:

Site plan. Site plan shall be at a scale no smaller than one (1) inch equals one hundred (100) feet; showing property lines, vicinity map, name and address of the owner, developer and adjacent property owners. The following items shall be shown on the site plan:

(1)

Existing grades. Existing grades and spot elevations.

(2)

Identify land to be disturbed. Land areas to be disturbed, including total acreage.

(3)

Cuts and fills. All cuts and fills, including height and slope.

(4)

Streets and rights-of-way. Location and names of all existing, or platted, streets or rights-of-way within or adjacent to tract; and location of all utilities and easements within or adjacent to the property.

(5)

Lot/building, etc. identification. The proposed location of lots, buildings, streets, parking lots, parks, playgrounds or greenspaces. Any existing or proposed buildings within one hundred (100) feet of the site.

(6)

Streets and drainage ways. Profiles and cross sections for proposed streets and drainage ways.

(7)

Surface water. Provisions for collecting and discharging surface water.

(8)

Underground utilities. Profiles and cross sections of streets, drainage systems, and underground utilities, if they are necessary to clarify the grading plan in terms of potential erosion or runoff, or if the grading on the site has

the potential of disturbing the utility line. Proposed grading plans that pose a risk to existing utility lines due to removal of cover or the placement of excessive loads or result in an undue burden to future maintenance activities will not be approved. Under such conditions applicant may include with the site plan a proposal for relocating any affected utility line. If the relocation is approved by the affected utility company, the applicant shall be responsible for all costs associated with the relocation.

(9)

Erosion/sediment measures. Erosion and sediment measures, including structural and vegetative measures.

(10)

Time schedules. A time schedule indicating the anticipated starting and completion dates of the development sequence and time of grading of each area prior to stabilization measures.

(11)

Temporary access road. Location of temporary access road.

(12)

Concrete washout. Location of areas used for concrete washout.

In addition, the site plan shall meet the requirements for a site map as established by the latest version of the ADEQ NPDES general stormwater permit for construction activities.

(Ord. No. 27-06, § 1, 3-21-06; Ord. No. 54-11, § 6, 7-5-11)

Sec. 11-88. Erosion and sediment control plan.

The applicant shall prepare and submit an erosion and sediment control plan that shall include:

(1)

Sequence of clearing and grading anticipated for construction of the development site. Sequencing shall include the anticipated dates for the start of construction, installation of temporary erosion and sediment control measures, and establishment of permanent vegetation.

(2)

Erosion and sediment control measures necessary to meet the objectives of this article that will remain installed and functioning throughout all phases of construction and after completion of development of the site until soil stabilization with permanent vegetation.

(3)

Proposed seeding mixtures, types of sod, method of seedbed preparation, expected seeding dates, kind and quantity of mulching for both temporary erosion control and permanent vegetative stabilization.

(4)

Provisions for maintenance of control facilities until the site soils are stabilized with permanent vegetation.

(5)

Submission of a copy of notice of intent or automatic coverage posting as required by ADEQ.

(6)

A description of post-construction stormwater management measures that will be installed during the construction process to control pollutants in stormwater discharges that will occur after construction operations have been completed. Post-construction stormwater management measures shall comply with the requirements of the City of Fort Smith Drainage Standards.

In addition, the erosion and sediment control plan shall meet the requirements for a stormwater pollution prevention plan as established by the latest version of the ADEQ NPDES general stormwater permit for construction activities.

(Ord. No. 27-06, § 1, 3-21-06; Ord. No. 54-11, § 7, 7-5-11)

Sec. 11-89. Review and approval.

Applications submitted to the building department for a site development permit shall be reviewed to determine their conformance with the provisions of this article. Within seven (7) working days after receiving an properly completed application, the city shall, in writing:

(1)

Approve the permit application; or

(2)

Approve the permit application subject to such reasonable conditions as may be necessary to secure substantially the objectives of this article; or

(3)

Disapprove the permit application, informing the applicant of the reason(s) therefor, and of the procedure for submitting a revised application and/or submission.

(Ord. No. 27-06, § 1, 3-21-06)

Sec. 11-90. Fees and enforcement.

(a)

Requirements. Each application for a grading permit shall include a grading plan and an erosion and sediment control plan.

(b)

Review fee. There shall be a one hundred dollar ($100.00) fee assessed and collected prior to review of any grading plan and erosion and sediment control plan.

(c)

Time Limit. An initial grading permit shall be valid for a maximum of six (6) months. All grading permits shall be subject to review and re-approval and all re-approvals shall be subject to any reasonable additional requirements as may be deemed necessary by the city engineer. If a grading permit is re-approved with no major revisions, an additional review fee will not be required.

(d)

Inspection.

(1)

The city engineer or his/her designated agent shall make inspections as hereinafter required and shall either approve that portion of the work completed or shall notify the permittee wherein the work fails to comply with the approved stormwater pollution prevention plan. Approved plans for grading, stripping, excavating, and filling work shall be maintained at the site during the progress of the work. In order to obtain inspections, the permittee shall notify the city engineer or his/her designated agent at least two (2) working days before the start of construction. At least one (1) inspection per month will be conducted until the project is completed. The permittee shall notify the city engineer or his/her designated agent at least two (2) working days before final stabilization occurs.

(2)

The permittee or his/her agent shall make regular inspections of all control measures in accordance with the inspection schedule outlined on the approved stormwater pollution prevention plan(s). The purpose of such inspections will be to determine the overall effectiveness of the control plan, and the need for additional control measures. All inspections shall be documented in written form.

(3)

The city engineer or his/her designated agent shall enter the property of the applicant as deemed necessary by the city engineer or his/her designated agent to make regular inspections to ensure the validity of the reports filed under Section (2) above.

(e)

Stop-work order; revocation of permit. In the event that any person conducting grading in the city limits fails to meet the minimum grading standards of this article, or fails to comply with any other applicable ordinance of the city, the city may suspend the grading operation or revoke the grading permit.

(f)

Violation and penalties.

(1)

Any person judicially determined to be in violation of the provisions of this article shall be deemed guilty of a misdemeanor and shall be subject to the penalties set forth in section 1-9 of the City of Fort Smith Municipal Code of Ordinances.

(2)

In addition, the board of directors may, in lieu of or in addition to penalties provided in this section, cause to be initiated an action in the circuit court for the Fort Smith District of Sebastian County, Arkansas, for the purpose of restraining or abating any violation of this article.

(Ord. No. 27-06, § 1, 3-21-06; Ord. No. 54-11, § 8, 7-5-11)

APPENDIX "D"

CHAPTER 5, STORM DRAINAGE STANDARDS

CHAPTER 5 – POST CONSTRUCTION STORMWATER MANAGEMENT

5.1 GENERAL

Land development projects and associated increases in impervious cover alter the hydrologic response of local watersheds and increase storm water runoff rates and volumes, flooding, stream channel erosion, and sediment transport and deposition; This storm water runoff contributes to increased quantities of water-borne pollutants, and; Storm water runoff, soil erosion, and nonpoint source pollution can be controlled and minimized through the regulation of storm water runoff from development sites. For these reasons, the Arkansas Department of Environmental Quality (ADEQ), under regulations administered by the United States Environmental Protection Agency (EPA) requires the City of Fort Smith to meet certain requirements as established in the National Pollutant Discharge Elimination System (NPDES), Phase II, for Small Municipal Separate Storm Sewer Systems (MS4's).

5.1.1 *Detention Required*

If hydrologic and hydraulic studies reveal that the post-development runoff for a proposed development or redevelopment project one acre or more in size will exceed the pre-development runoff, and the existing drainage system is not adequate to carry the post-development runoff, then the proposed development or redevelopment project shall not be permitted unless one or more of the following mitigation measures are used: onsite detention, offsite or regional detention, or improvements to the existing drainage system.

All detention facilities shall be designed to limit the peak storm water discharge rate of the 10-, 25-, 50-, and 100-year storm frequencies after development to pre-development flow rates.

5.1.1.1 Acceptable Detention Practices

Only stormwater ponds and wetlands shall be allowed for publicly owned detention, i.e. within residential subdivisions and developments (see Section 5.9). Other methods of detention such as infiltration trenches, infiltration basin, etc., will not be allowed for publicly owned detention and are discouraged for privately owned detention. If other methods are proposed, proper documentation of soil data, percolation, geological features, etc., will be needed for review and consideration.

5.1.1.2 Parking Lot Detention

Privately owned detention is permitted in parking lots to maximum depths of 6 inches. In no case shall the maximum limits of ponding be designed closer than 10 feet from a structure unless waterproofing of the structure and pedestrian accessibility are properly documented and approved. The minimum freeboard and the maximum ponding elevation to the lowest sill or floor elevation shall be 2 feet.

5.1.2 *Stormwater Treatment Required*

Development and redevelopment projects one or more acres in size (or less than an acre if part of a larger common plan of development), that will increase the impervious area onsite, shall not be permitted without employing Stormwater Treatment Practices (STP's) to address the water quality of the surface waters being discharged from the site. All STP's or systems of STP's utilized to address water quality shall be required to capture and treat the Water Quality Volume (WQ_v). The WQ_v shall be equal to:

$$WQ_v = (P_1)(R_v)(A)/12 \quad (5.1)$$

Where:
WQ_v = Water Quality Volume (acre-ft)
P_1 = The First One Inch (1.0") of Direct Runoff
R_v = Runoff Coefficient
A = Site Area (acres)

$$R_v = 0.05+0.009I \quad (5.2)$$

Where:
I = Site Impervious Cover (%)

The WQ_v shall be based on the impervious cover of the proposed site. Offsite existing impervious areas may be excluded from the calculation of the water quality volume requirements.

5.1.2.1 Acceptable Stormwater Treatment Practices (STPs)

All acceptable STP's shall be designed to capture and treat the WQ_v with a goal of at least 80% removal of total suspended solids (TSS) from post-construction discharges (See Table 5.2 for Pollutant Removal Percentages). STP's that meet these requirements can be divided into five basic groups – Stormwater Ponds, Wetlands, Infiltration Systems, Filtering Systems, and Open Channel Systems. When properly designed, the following STP's shall be considered sufficient to meet the requirements above:

Group 1: Stormwater Ponds

Stormwater ponds are practices that have a combination of a permanent pool, extended detention or shallow marsh equivalent to the entire WQ_v. Design variants include:

- Micropool Extended Detention Pond
- Wet Pond
- Wet Extended Detention Pond
- Multiple Pond System
- "Pocket" Pond

Group 2: Wetlands

Stormwater wetlands are practices that create shallow marsh areas to treat urban stormwater and often incorporate small permanent pools and/or extended detention storage to achieve the full WQ_v. Design variants include:

- Shallow Wetland
- ED Shallow Wetland
- Pond/Wetland System
- "Pocket" Wetland

Group 3: Infiltration Systems

Stormwater infiltration practices capture and temporarily store the WQ_v before allowing it to infiltrate into the soil. Design variants include:

- Infiltration Trench
- Infiltration Basin

Group 4: Filtering Systems

Stormwater filtering system capture and temporarily store the WQ_v and pass it through a filter bed of sand, organic matter, soil or other media. Filtered runoff may be collected and returned to the conveyance system, or allowed to partially exfiltrate into the soil. Design variants include:

- Surface Sand Filter
- Underground Sand Filter
- Perimeter Sand Filter
- Organic Filter
- Bioretention

Group 5: Open Channel Systems

Open channel systems are vegetated open channels that are explicitly designed to capture and treat the full WQ_v within dry or wet cells formed by checkdams or other means. Design variants include:

- Dry Swale
- Wet Swale
- Grass Channels

5.1.2.2 Sub-Standard Storm Water Treatment Practices

Many current and future stormwater management structures may not meet the performance criteria specified in Section 5.1.2.1 above to qualify to be used as "stand-alone" practices for full

WQ_v treatment. Reasons for this include poor longevity, poor performance, inability to decrease TSS by 80%, or inadequate testing. Some of these practices include:

- Dry Extended Detention Ponds
- Catch Basin Inserts
- Water Quality Inlets and Oil/Grit Separators
- Hydro-Dynamic Structures
- Filter Strips
- Deep Sump Catch Basins
- Dry Wells
- On-Line Storage in the Storm Drain Network

In some cases, these practices are appropriately used for pretreatment, as part of an overall STP system, or may be applied in redevelopment situations on a case-by-case basis where other practices are not feasible. New structural BMP designs are continually being developed, including many proprietary designs. All current and future structural practice design variants should fit in one of the five STP groups referenced above if the intent is to use them independently to treat the full WQ_v. Current or new STP design variants cannot be accepted for inclusion on the list until independent pollutant removal performance and monitoring data determine that they can meet the 80% TSS removal target and that the new STPs conform with local and/or State criteria for treatment, maintenance, and environmental impact.

5.1.2.3 Stormwater Hot Spots

Stormwater hot spots are areas where land use or activities generate highly contaminated runoff, with concentrations of pollutants in excess of those typically found in stormwater. A greater level of stormwater treatment is needed at hot spot sites to prevent pollutant washoff after construction. This typically involves preparing and implementing a ***stormwater pollution prevention plan*** (SWPPP) that involves a series of operational practices at the site that reduces the generation of pollutants by preventing contact with rainfall.

For the purposes of this document, stormwater hot spots shall be classified as industrial facilities that:

- have Standard Industrial Classification (SIC) codes listed in "40 CFR 122.26(b)(14) Subpart (i) – (xi)"
- and, are required to submit applications for a storm water permit to the Arkansas Department of Environmental Quality (ADEQ).

A copy of "40 CFR 122.26(b)(14) Subpart (i) – (xi)" can be found in Appendix 5A.

5.1.3 *Variances*

Criteria for differential runoff and detention guidelines are set out in the following in an attempt to decrease the possible effects of development on downstream properties due to increased runoff and pollutants. Variances to the requirements in this chapter may be granted by the Engineering Department if it is determined that detention would be ineffective to prevent flooding or would aggravate the flooding conditions. Variances to the detention requirements do not relieve the developer/owner of any water quality requirements. However, reductions in the required WQ_v are possible with the use of storm water credits (See Section 5.9).

5.1.4 *Verification of Adequacy*

Projects shall provide documented verification of adequacy according to the scope and complexity of design. Documentation must have original signature and be certified as-built by the same Arkansas Registered Professional Engineer, if feasible.

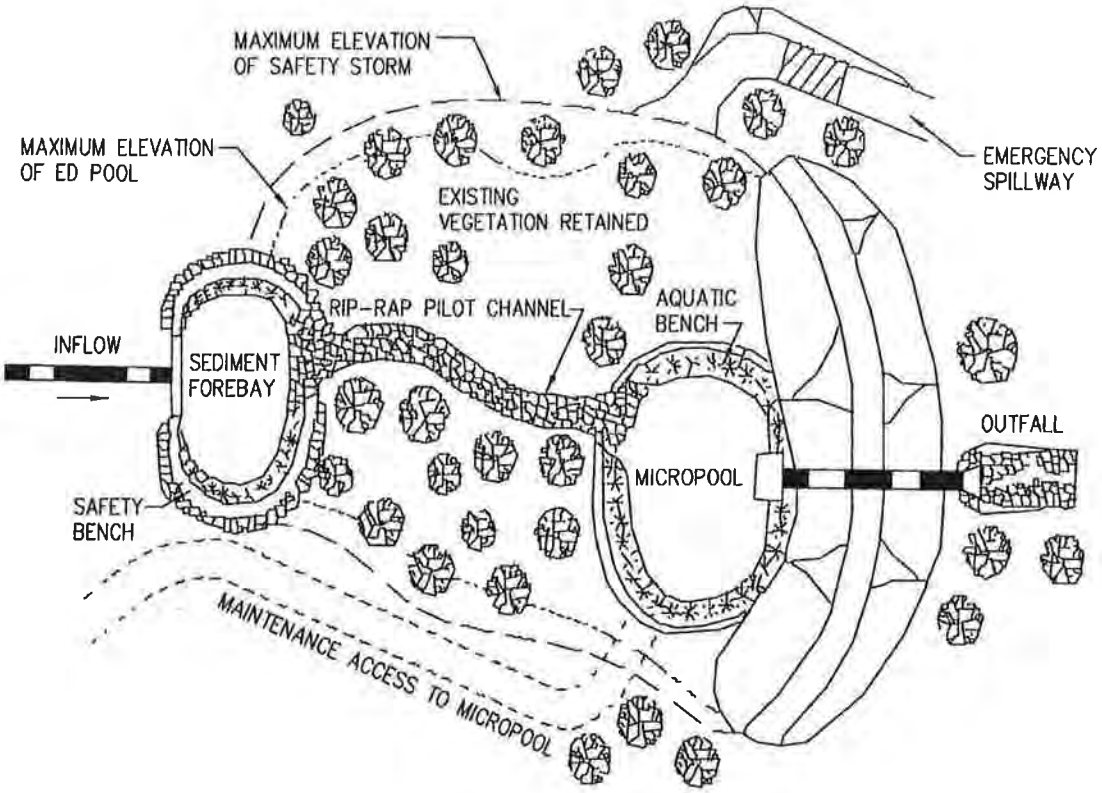
5.2 DESIGN CRITERIA – STORMWATER PONDS

Stormwater ponds are practices that have a combination of a permanent pool, extended detention or shallow marsh equivalent to the entire WQ_v. Design variants include:

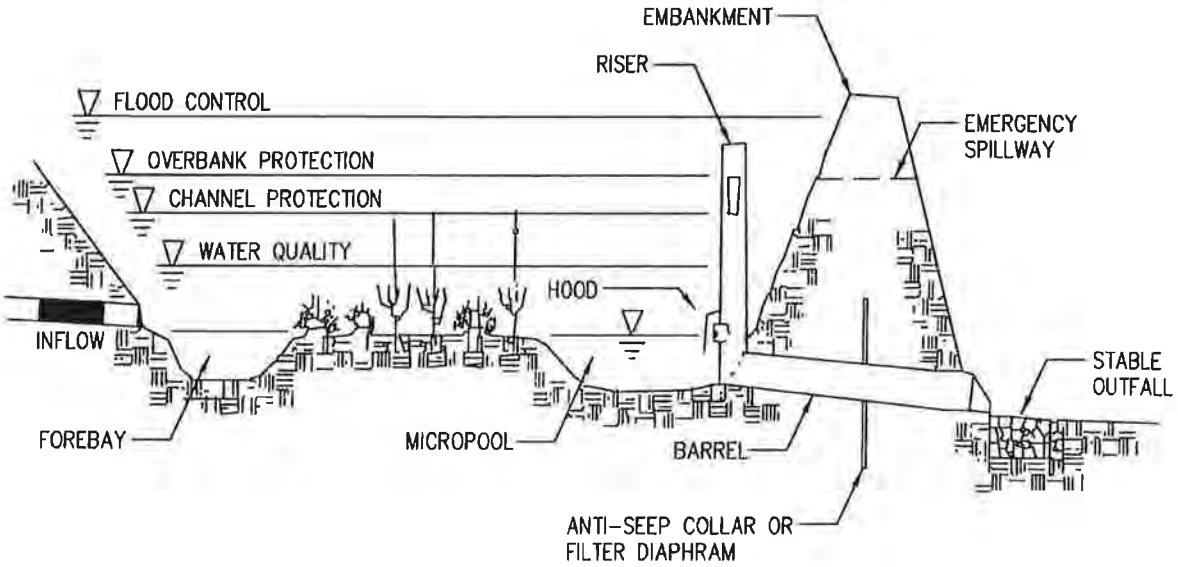
- Micropool Extended Detention Pond (Figure 5-1)
- Wet Pond (Figure 5-2)
- Wet Extended Detention Pond (Figure 5-3)
- Multiple Pond System (Figure 5-4)
- "Pocket" Pond (Figure 5-5)

The term "pocket" refers to a pond or wetland that has such a small contributing drainage area that little or no baseflow is available to sustain water elevations during dry weather. Instead, water elevations are heavily influenced and, in some cases, maintained by a locally high water table.

Stormwater ponds may be used in residential, private, commercial, and industrial subdivisions and developments to meet the detention and WQ_v requirements.

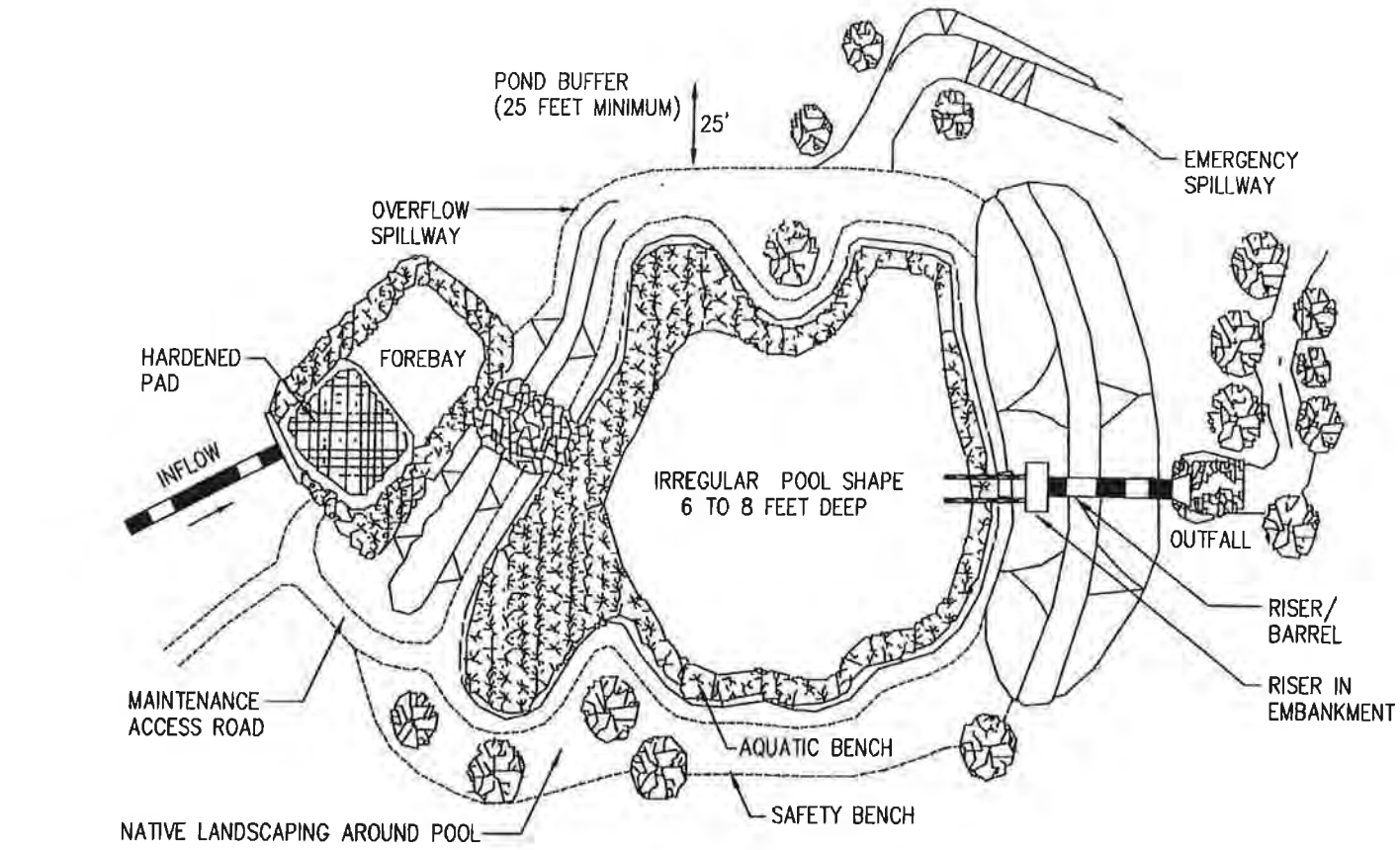


PLAN VIEW



PROFILE

FIGURE 5-1. Micropool Extended Detention Pond



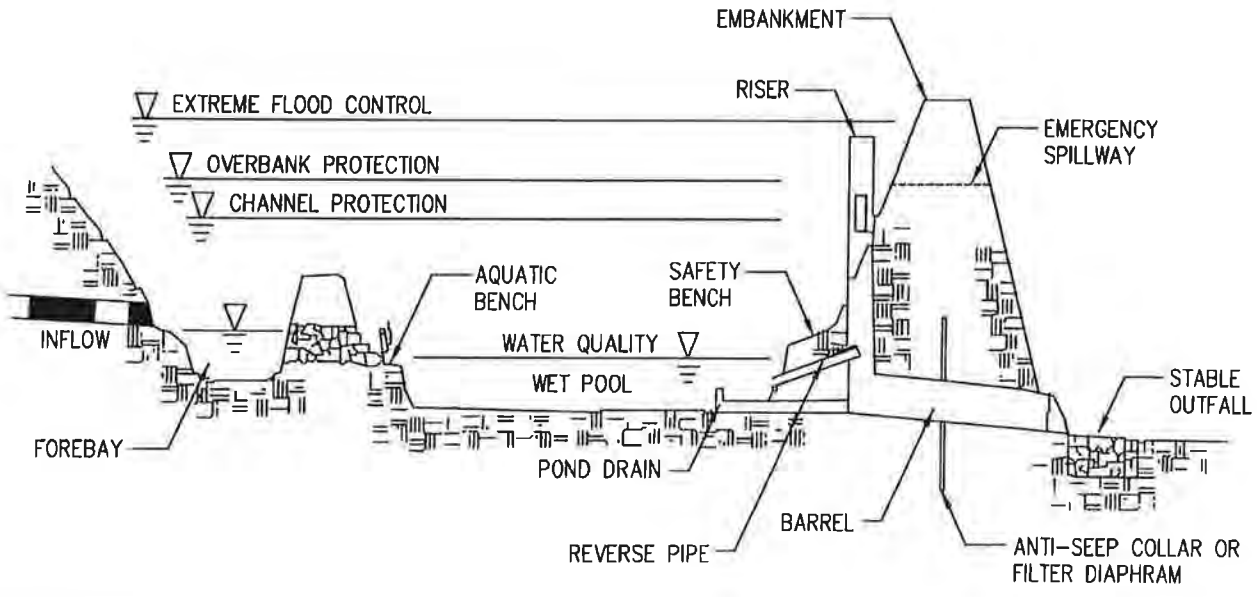
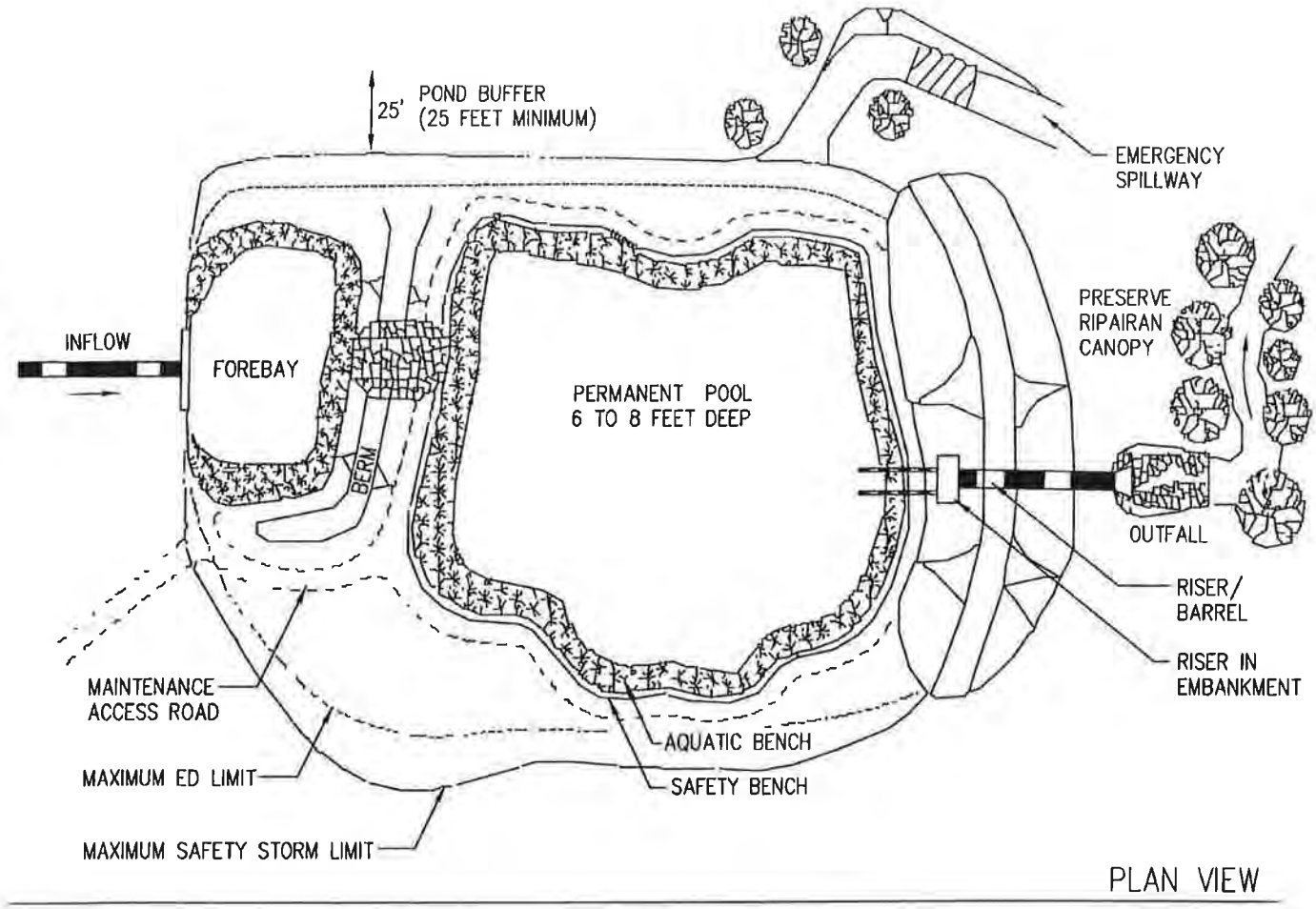


FIGURE 5-1. Micropool Extended Detention Pond



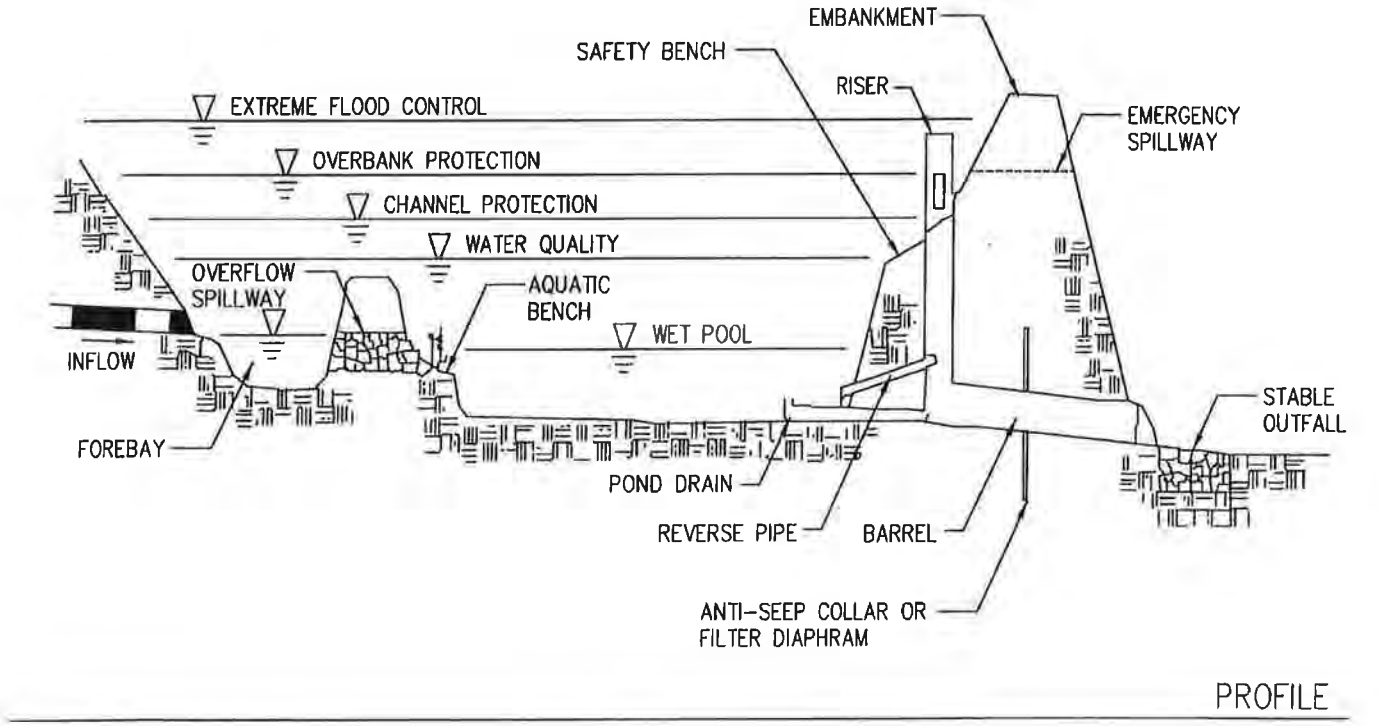


FIGURE 5-3. Wet Extended Detention Pond

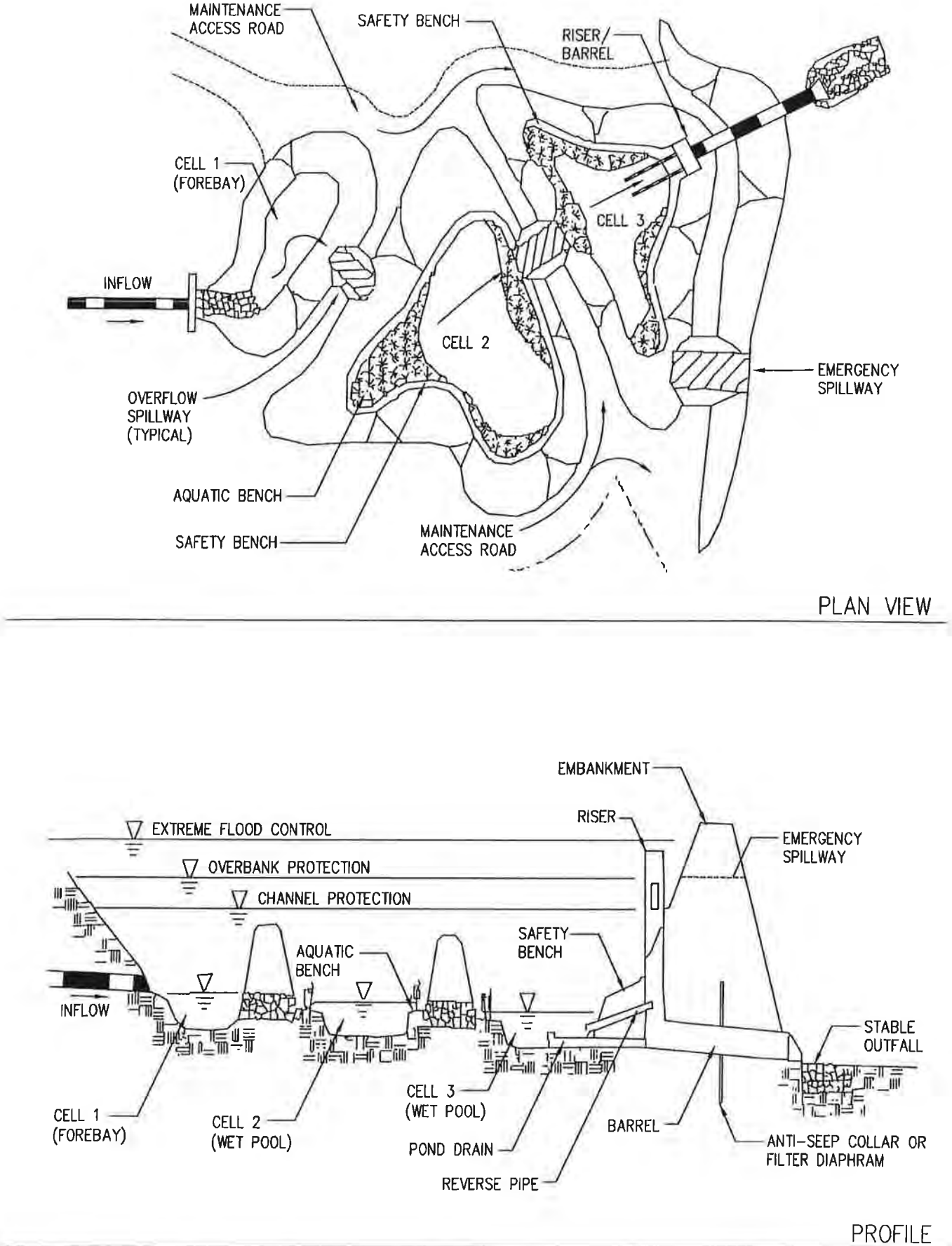


FIGURE 5–4. Multiple Pond System

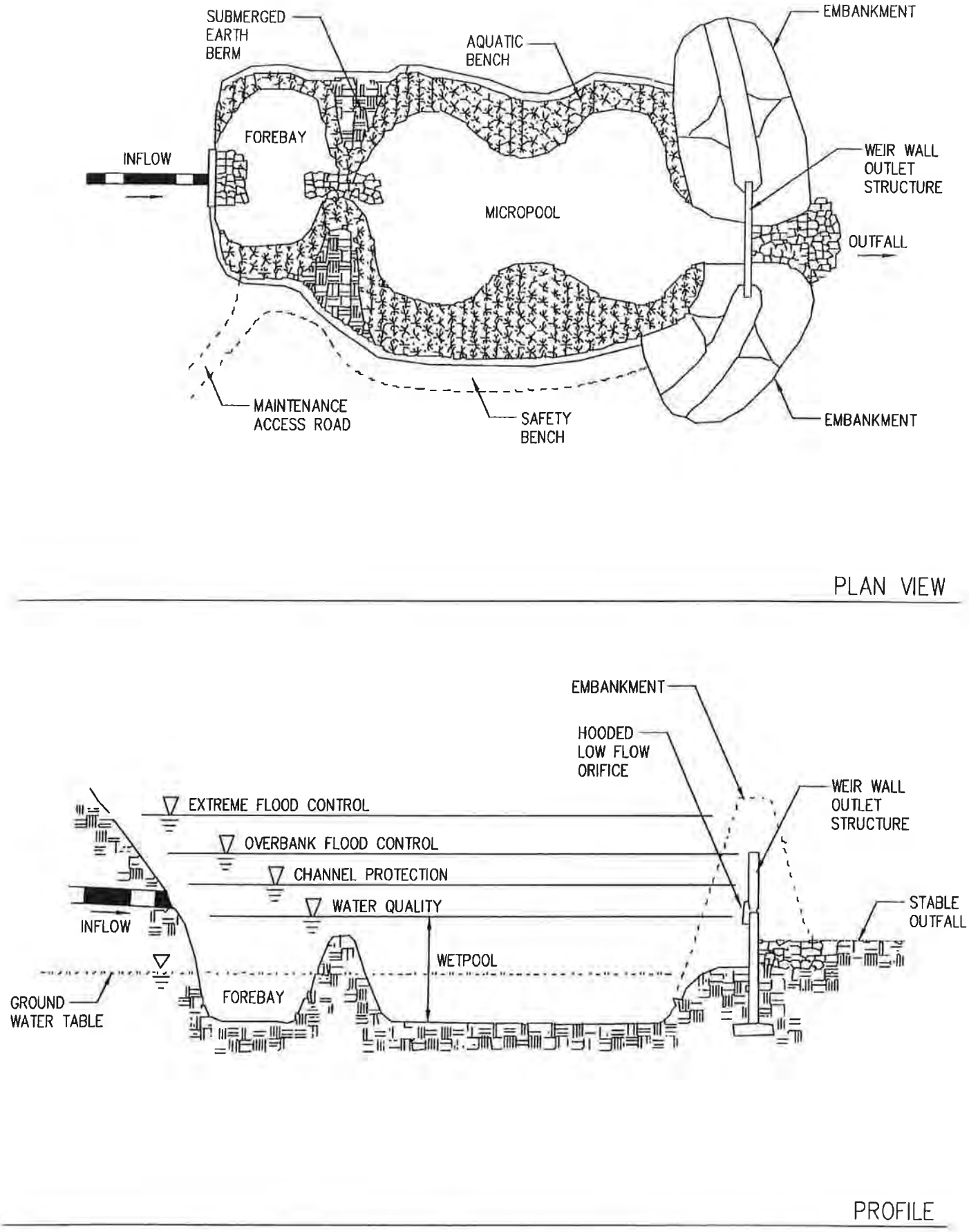


FIGURE 5–5. Pocket Pond

Dry extended detention ponds that have no permanent pool are not considered an acceptable "stand-alone" option for meeting WQ_v. However, with the approval of the Engineering Department, they may be used in conjunction with other STP's to meet the WQ_v requirement. They may also be used to meet the detention requirement.

5.2.1 *Feasibility Criteria*

When used to meet water quality requirements, a minimum contributing drainage area of ten acres or more is preferred for stormwater ponds, unless groundwater can be confirmed as the primary water source (i.e., pocket ponds).

Stormwater ponds shall not be located within jurisdictional waters, including wetlands.

Stormwater ponds shall be located within the parcel limits of the project under consideration, except as specified below. No stormwater ponds will be permitted within public road rights-of-way. Location of stormwater ponds immediately upstream or downstream of the project will be considered by special request if proper documentation is submitted with reference to practicality, feasibility, and proof of ownership or right-of-way use of the area proposed.

In no case shall the limits of maximum ponding for a stormwater pond be closer than 25 feet horizontally from any structure.

5.2.1.1 Safe Dam Act

National responsibility for the promotion and coordination of dam safety lies with FEMA. State responsibility for administration of the provisions of the Federal Dam Safety Act is given by Title 15, Chapter 22 of the Arkansas State Code. Rules and regulations relating to applicable dams are promulgated by the Arkansas Soil and Water Conservation Commission (ASWCC).

All dams within the state of Arkansas, except those that meet certain exemptions, must have a construction and operation permit from ASWCC. Under the ASWCC criteria, a dam is exempt from the regulations if it is less than 25 ft in height or has a normal storage volume less than 50 ac•ft. The ASWCC also allows an exemption if the crest height of the dam is below the ordinary high water mark of the stream at that location. However, smaller dams may also be required to meet the dam safety regulations as well. If persons downstream feel that their life or their property is endangered by a dam, they can petition the ASWCC for the dam safety regulations to be enforced *(2)*. Consult Reference *(2)* for more information on dam safety regulations, design criteria, and hazard classifications. Any questions regarding permits, exemptions, design criteria, or compliance with dam safety regulations should be directed to the ASWCC.

Dams which are greater than 10 feet in height but do not fall into State or Federal requirement categories shall be designed in accordance with the latest edition of the SCS Technical Release No. 60, "Earth Dams and Reservoirs," as Class "C" structures *(1), (8)*.

An analysis shall be furnished of any soil proposed for use in earthen dam construction. Borings of the foundation for an earthen dam may be requested by the Engineering Department. Earthen dam structures, of any height, shall be designed by a Professional Engineer registered to practice in the state of Arkansas.

5.2.1.2 Freeboard Criteria

All stormwater ponds shall have a minimum freeboard of one foot.

5.2.1.3 Minimum Geometric Criteria

The minimum length to width ratio for stormwater ponds is 1.5:1 (i.e., length relative to width). Long flow paths and irregular shapes are recommended.

5.2.1.4 Pond Benches

The perimeter of all deep pool areas (four feet or greater in depth) shall be surrounded by two benches:

- A safety bench that extends 15 feet outward from the normal water edge to the toe of the pond side slope. The maximum slope of the safety bench shall be 6%.
- An aquatic bench that extends up to 15 feet inward from the normal shoreline and has a maximum depth of eighteen inches below the normal pool water surface elevation.

5.2.1.5 Safety Features

Side slopes to the pond shall not exceed 3:1 (h:v), and shall terminate on a safety bench. Both the safety bench and the aquatic bench may be landscaped to prevent access to the pool. The bench requirement may be waived if slopes are 4:1 or flatter.

The principal spillway opening shall not permit access by small children, and endwalls above pipe outfalls greater than 24 inches in diameter shall be fenced to prevent a hazard.

5.2.2 *Detention Criteria*

When used to meet detention requirements, stormwater ponds shall be designed to limit the peak storm water discharge rate of the 10-, 25-, 50-, and 100-year storm frequencies after development to pre-development flow rates.

5.2.2.1 Volume of Detention

Volumes of detention shall be evaluated according to the following methods:

- Volumes of stormwater ponds with total drainage areas of 20 acres or less may be evaluated by the "Modified Rational Hydrograph Method."

- For basins with total drainage areas larger than 20 acres, the Owner's Engineer shall submit the proposed method of evaluation for the sizing of the stormwater pond to the Engineering Department. The method will be evaluated for professional acceptance, applicability, and reliability by the Engineering Department. No detailed review for projects larger than 20 acres will be rendered before the method of evaluation of the detention/retention basin is approved.

- The computed hydraulic detention volume shall be increased by 25 percent as a factor of safety and to provide for sediment storage. The Engineering Department may reduce this requirement depending on the development characteristics and stream stability of upstream tributary areas.

5.2.2.2 Routing Method

The hydrograph routing method used shall be the Modified Puls Method.

5.2.2.3 Stormwater Pond Design Procedure (Modified Rational Method)

1. Compute pre-development and post-development site characteristics:

- Drainage Area

- Composite Runoff Coefficient

- Time of Concentration

2. Determine rainfall intensity for pre-development conditions (10- through 100-year storm).

3. Compute pre-development peak runoff rates using Rational Formula. These flow rates will be the maximum allowable release rates from the detention basin.

4. Determine inflow hydrograph using Modified Rational Method (see example problem and Figure 5-6 in section 5.2.2.4).

5. Find estimated detention volume using Modified Rational Method

6. Size Stormwater Pond based on estimated required volume. Develop stage-storage curve for the detention basin.

7. Size release structure based on allowable release flow. Develop stage-discharge curve for the release structure.

8. Route the inflow hydrographs (developed using the Modified Rational Method for the 10- through 100-year storms) through the stormwater pond using Modified Puls Method.

9. Check routed hydrographs to ensure flows do not exceed pre-development peaks. Adjust stormwater pond and release structure if necessary.

5.2.2.4 Example Problem – Modified Rational Method

The following example problem describes the general procedure to complete a design of a stormwater pond using the Modified Rational Method. The values and information provided in this example do not represent actual data for the City of Fort Smith but are only provided to illustrate the procedure.

Given: A 10-acre site currently agricultural use is to be developed for townhouses. The entire area is the drainage area of the proposed stormwater pond.

Determine: Maximum release rate and required detention storage.

Solution:

Step 1: Determine 100-year peak runoff rate prior to site development. This is the maximum release rate from site after development.

NOTE: Where a stormwater pond is being designed to provide detention for both its drainage area and a bypass area, the maximum release rate is equal to the peak runoff rate prior to site development for the total of the areas minus the peak runoff rate after development for the bypass area. This rate for the bypass area will vary with the duration being considered.

Present Conditions $Q = CiA$ (See Section 2.4.1) (5.9)

$C = 0.30$
$T_c = 20$ minutes
$i_{100} = 7.0$ in./hr
$Q_{100} = 0.30(7.0)(10) = 21.0$ cfs (Maximum Release Rate)

Step 2: Determine inflow hydrograph for storms of various durations in order to determine maximum volume required with release rate determined in Step 1.

NOTE: Incrementally increase durations by 10 minutes to determine maximum required volume. The duration with a peak inflow less than the maximum release rate or where required storage is less than storage for the prior duration is the last increment.

Future Conditions (Townhouses)

$C = 0.80$
$T_c = 15$ minutes
$i_{100} = 7.7$ in./hr
$Q_{100} = 0.80(7.7)(10) = 61.6$ cfs

Check various duration storms.

20 min	$i = 7.0$	$Q_{in} = 0.80\ (7.0)\ (10) = 56.0$ cfs
30 min	$i = 5.8$	$Q_{in} = 0.80\ (5.8)\ (10) = 46.4$ cfs
40 min	$i = 5.0$	$Q_{in} = 0.80\ (5.0)\ (10) = 40.0$ cfs
50 min	$i = 4.4$	$Q_{in} = 0.80\ (4.4)\ (10) = 35.2$ cfs
60 min	$i = 4.0$	$Q_{in} = 0.80\ (4.0)\ (10) = 32.0$ cfs
70 min	$i = 3.7$	$Q_{in} = 0.80\ (3.7)\ (10) = 29.6$ cfs
80 min	$i = 3.4$	$Q_{in} = 0.80\ (3.4)\ (10) = 27.2$ cfs
90 min	$i = 3.1$	$Q_{in} = 0.80\ (3.1)\ (10) = 24.8$ cfs

The Maximum Storage Volume in cubic feet (cf) is determined by deducting the volume of runoff released during the time of inflow from the total outflow for each storm duration.

$$V = (time \times Q_{in} \times 60\ s/min) - (0.5 \times (time + T_c) \times Q_{out} \times 60\ s/min) \qquad (5.10)$$

15 min Storm Inflow 15 (61.6) (60) = 55,440 cf
Outflow 0.5 (30)(21.0)(60) = 18,900 cf

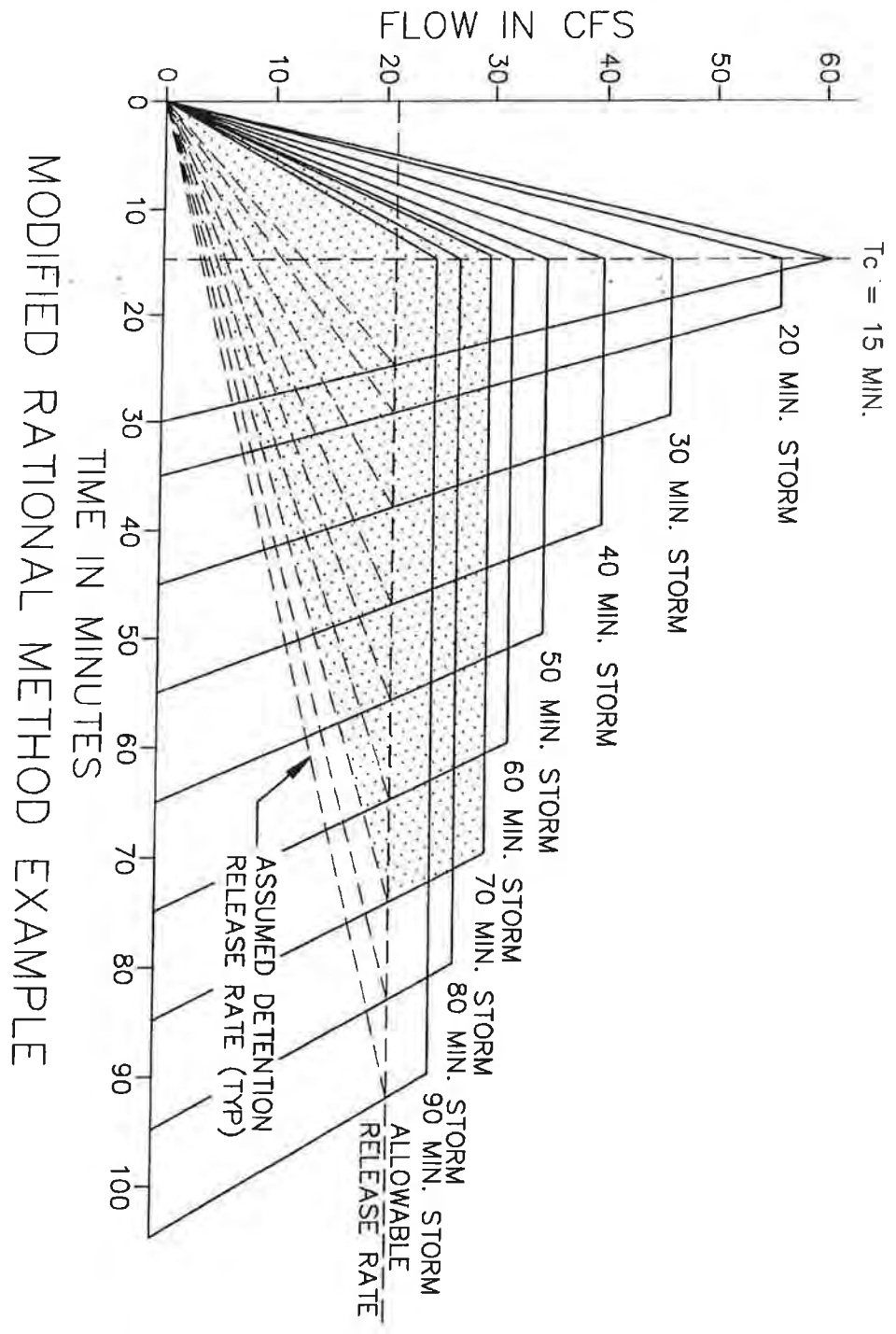
20 min Storm Inflow 20 (56.0) (60) = 67,200 cf
Outflow 0.5 (35)(21.0)(60) = 22,050 cf
Storage 45,150 cf

30 min Storm Inflow 30 (46.4) (60) = 83,520 cf
Outflow 0.5 (45)(21.0)(60) = 28,350 cf
Storage 55,170 cf

40 min Storm Inflow 40 (40.0) (60) = 96,000 cf
Outflow 0.5 (55)(21.0)(60) = 34,650 cf
Storage 61,350 cf

50 min Storm Inflow 50 (35.2) (60) = 105,600 cf
Outflow 0.5 (65)(21.0)(60) = 40,950 cf
Storage 64,650 cf

FIGURE 5-6. Example Problem, Modified Rational Method.



C:\City of Ft Smith\Engineering\Meeker\ Dentention Details.dwg 02/18/08-10:25 RBR Model

CONCEPT OF DETENTION POND MODIFIED RATIONAL METHOD EXAMPLE STANDARD DETAIL CITY OF FORT SMITH, ARKANSAS	The City of Fort Smith ARKANSAS	Project: Date: FEN. 2008 Scale: NONE Drawn By: RBR

60 min Storm Inflow 60 (32.0) (60) = 115,200 cf
Outflow 0.5 (75)(21.0)(60) = 47,250 cf
Storage 67,950 cf

70 min Storm Inflow 70 (29.6) (60) = 124,320 cf
Outflow 0.5 (85)(21.0)(60) = 53,550 cf
Storage 70,770 cf

80 min Storm Inflow 80 (27.2) (60) = 130,560 cf
Outflow 0.5 (95)(21.0)(60) = 59,850 cf
Storage 70,710 cf

90 min Storm Inflow 90 (24.8) (60) = 133,920 cf
Outflow 0.5 (105)(21.0)(60) = 66,150 cf
Storage 67,770 cf

Step 3: Route design storm hydrograph through the stormwater pond using the Modified Puls Routing Method or another approved method, based on final stormwater pond and release structure design. Computer programs to accomplish this are readily available.

5.2.2.5 Stormwater Detention Analysis Software

The City will allow the use of the following software or an acceptable equal approved by the Engineering Department for the analysis of storm water detention facilities: HEC-HMS, HEC-1, PondPack.

5.2.3 *Outlet Works*

Stormwater ponds shall be provided with effective outlet works. Safety considerations shall be an integral part of the design of all outlet works. Plan view and sections of the structure with adequate details shall be included in the plans.

The riser structure selected shall have documented evidence that it will control the 10-, 25-, 50-, and 100-year storm events. Generally, the full range of frequency control is achieved by selecting the 100-year and an intermediate frequency, such as the 10-year flood. Documented evidence shall also be provided that the riser will control the WQ_v if the stormwater pond is used to meet this requirement. The riser shall also be located within the embankment for maintenance access, safety and aesthetics. Access to the riser is to be provided by lockable manhole covers (the principal spillway opening can be "fenced" with pipe or rebar at 8 inch intervals for safety purposes). The principal spillway shall also be equipped with a trash rack that provides access for maintenance.

A non-clogging low flow orifice must be provided for the WQ_v. The low flow orifice shall have a minimum diameter of 3 inches, and shall be adequately protected from clogging by an

acceptable external trash rack. The preferred method is a submerged reverse-slope pipe that extends downward from the riser to an inflow point one foot below the normal pool elevation. Alternative methods are to employ a broad crested rectangular weir or a V-notch weir protected by a half-round CMP that extends at least 12 inches below the normal pool. Horizontal perforated pipe protected by geotextile and gravel shall not be used. Vertical perforated pipes shall not be used.

The emergency spillway may either be combined with the outlet works or be a separate structure or channel meeting the following criteria:

- Emergency spillways shall be designed so that their crest elevation is 0.5 feet or more above the maximum water surface elevation in the detention facility attained by the 100-year storm event *(1)*.

- In cases where the emergency spillway is not regulated by either State or Federal agencies, the emergency spillway shall be designed to pass the 100-year storm with 1 foot of freeboard (or as designated) from the design stage to the top of dam, assuming zero available storage in the basin and zero flow through the primary outlet *(1)*.

Each stormwater pond shall have a drain pipe that can completely or partially drain the pond. The drain pipe shall have an elbow within the pond to prevent sediment deposition, and a diameter capable of draining the pond within 24 hours. The pond drain should be sized one pipe size greater than the calculated design diameter. Care shall be exercised during pond drawdowns to prevent downstream discharge of sediments or anoxic water and rapid drawdown. The Engineering Department shall be notified before draining a pond.

The pond drain shall be equipped with an adjustable valve (typically a handwheel activated knife or gate valve). Valve controls shall be located inside of the riser at a point where they (a) will not normally be inundated and (b) can be operated in a safe manner. To prevent vandalism, the handwheel should be chained to a ringbolt, or other fixed object

Sharp-crested weir flow equations for no end contractions, two end contractions and submerged discharge conditions are presented below, followed by equations for broad-crested weirs, V-notch weirs, and orifices, or combinations of these facilities. If culverts are used as outlets works, procedures presented in the Culverts Chapter should be used to develop stage-discharge data. When analyzing release rates, the tailwater influence of the principal spillway culvert on the control structure (orifice and/or weirs) must be considered to determine the effective head on each opening. Slotted riser pipe outlet facilities shall not be used.

5.2.3.1 Sharp-Crested Weirs

A sharp-crested weir with no end contractions is illustrated in Figure 5-7. The discharge equation for this configuration is *(4)*:

$$Q = [3.27 + 0.4(H/H_c)]\, LH^{1.5} \tag{5.3}$$

where:
Q = discharge, ft^3/s
H = head above weir crest excluding velocity head, ft
H_c = height of weir crest above channel bottom, ft
L = horizontal weir length, ft

A sharp-crested weir with two end contractions is illustrated in Figures 5-7 and 5-8. The discharge equation for this configuration is *(4)*:

$$Q = [3.27 + 0.4(H/H_c)]\, (L - 0.2H)\, H^{1.5} \tag{5.4}$$

where: Variables are the same as Equation 5.1.

A sharp-crested weir will be affected by submergence where the tailwater rises above the weir-crest elevation. The result will be that the discharge over the weir will be reduced. The discharge equation for a sharp-crested submerged weir is *(3)*:

$$Q_S = Q_f(1 - (H_2/H_1)^{1.5})^{0.385} \tag{5.5}$$

where:
Q_s = submergence flow, ft^3/s
Q_f = free flow, ft^3/s
H_1 = upstream head above crest, ft
H_2 = downstream head above crest, ft

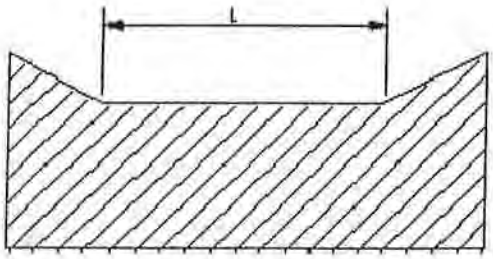


FIGURE 5-7.
Sharp-Crested Weir (No End Contractions)

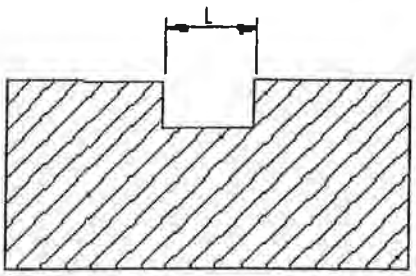


FIGURE 5-8.
Sharp-Crested Weir (Two End Contractions)

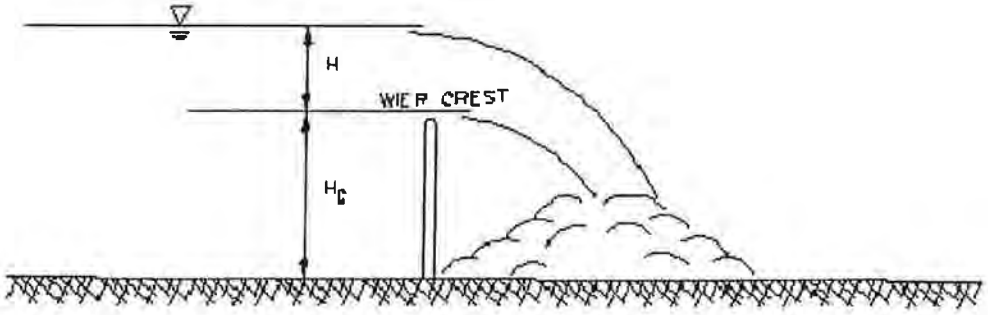


FIGURE 5-9. Sharp-Crested Weir and Head

5.2.3.2 Broad-Crested Weirs

The equation generally used for the broad-crested weir is *(3)*:

$$Q = CLH^{1.5} \tag{5.6}$$

where:
Q = discharge, ft^3/s
C = broad-crested weir coefficient
L = broad-crested weir length, ft
H = head above weir crest, ft

If the upstream edge of a broad-crested weir is so rounded as to prevent contraction and if the slope of the crest is as great as the loss of head due to friction, flow will pass through critical depth at the weir crest; this gives the maximum C value of 3.087. For sharp corners on the broad-crested weir, a minimum C value of 2.6 should be used. Additional information on C values as a function of weir crest breadth and head is given in Table 5-1.

TABLE 5-1. Broad-Crested Weir Coefficient *C* Values as a Function of Weir Crest Breadth and Head (ft)

Measured Head, H^1 (ft)	Breadth of the Crest of Weir (ft)										
	0.50	0.75	1.00	1.50	2.00	2.50	3.00	4.00	5.00	10.00	15.00
0.2	2.80	2.75	2.69	2.62	2.54	2.48	2.44	2.38	2.34	2.49	2.68
0.4	2.92	2.80	2.72	2.64	2.61	2.60	2.58	2.54	2.50	2.56	2.70
0.6	3.08	2.89	2.75	2.64	2.61	2.60	2.68	2.69	2.70	2.70	2.70
0.8	3.30	3.04	2.85	2.68	2.60	2.60	2.67	2.68	2.68	2.69	2.64
1.0	3.32	3.14	2.98	2.75	2.66	2.64	2.65	2.67	2.68	2.68	2.63
1.2	3.32	3.20	3.08	2.86	2.70	2.65	2.64	2.67	2.66	2.69	2.64
1.4	3.32	3.26	3.20	2.92	2.77	2.68	2.64	2.65	2.65	2.67	2.64
1.6	3.32	3.29	3.28	3.07	2.89	2.75	2.68	2.66	2.65	2.64	2.63
1.8	3.32	3.32	3.31	3.07	2.88	2.74	2.68	2.66	2.65	2.64	2.63
2.0	3.32	3.31	3.30	3.03	2.85	2.76	2.27	2.68	2.65	2.64	2.63
2.5	3.32	3.32	3.31	3.28	3.07	2.89	2.81	2.72	2.67	2.64	2.63
3.0	3.32	3.32	3.32	3.32	3.20	3.05	2.92	2.73	2.66	2.64	2.63
3.5	3.32	3.32	3.32	3.32	3.32	3.19	2.97	2.76	2.68	2.64	2.63
4.0	3.32	3.32	3.32	3.32	3.32	3.32	3.07	2.79	2.70	2.64	2.63
4.5	3.32	3.32	3.32	3.32	3.32	3.32	3.32	2.88	2.74	2.64	2.63
5.0	3.32	3.32	3.32	3.32	3.32	3.32	3.32	3.07	2.79	2.64	2.63
5.5	3.32	3.32	3.32	3.32	3.32	3.32	3.32	3.32	2.88	2.64	2.63

[1]Measured at least $2.5H$ upstream of the weir.

Source: Reference *(3)*.

5.2.3.3 V-Notch Weirs

The discharge through a V-notch weir can be calculated from the following equation *(3)*:

$$Q = 2.5 \tan(q/2)H^{2.5} \quad (5.7)$$

where:
Q = discharge, ft^3/s
q = angle of V-notch, degrees
H = head on apex of notch, ft

5.2.3.4 Orifices

Pipes smaller than 12 in. may be analyzed as a submerged orifice if H/D is greater than 1.5. For square-edged entrance conditions:

$$Q = 0.6A(2gH)^{0.5} \quad (5.8)$$

where:
Q = discharge, ft^3/s
A = cross-section area of pipe, ft^2
g = acceleration due to gravity, 32.2 ft/s^2
D = diameter of pipe, ft
H = head on pipe, from the center of pipe to the water surface, ft *

* Where the tailwater is higher than the center of the opening, the head is calculated as the difference in water surface elevations.

5.2.4 *Discharge Systems*

For site-specific runoff, the effectiveness of local stormwater ponds used for detention can be acknowledged in the design of any onsite downstream drainage facilities, assuming that the stormwater ponds comply with all criteria and that they are properly constructed and maintained.

In the case of regional stormwater ponds, sizing of the system below the control structure shall be for the total improved peak runoff tributary to the structure, with no allowance for detention unless approved in writing by the Engineering Department.

In the event the Engineer desires to incorporate the flow reduction benefits of existing upstream stormwater ponds, the following field investigations and hydrologic analysis shall be required:

- A field survey of the existing physical characteristics of both the outlet structure and ponding volume. Any departure from the original engineer's design must be accounted for. If a dual use for the stormwater pond exists, then this also must be accounted for.

- A comprehensive hydrologic analysis that simulates the attenuation of the contributing area ponds. This should not be limited to a linear additive analysis, but rather should consist of a network of hydrographs that considers incremental timing of discharge and potential coincidence of outlet peaks.

Please note that under no circumstances will the previously approved construction plans of the upstream pond or ponds suffice as an adequate analysis. While the responsibility of the individual site or subdivision plans rests with the Engineer of Record, any subsequent engineering analysis must assure that all the incorporated ponds work collectively.

5.2.5 *Conveyance Criteria*

Conveyance shall be provided which does not cause erosion. Primary outlet works, emergency spillways, and conveyance system entrances to stormwater ponds shall be equipped with energy dissipating devices as necessary to limit erosion on receiving channels *(1)*.

5.2.5.1 Inlet Protection

A forebay shall be provided at each inlet, unless the inlet provides less than 10% of the total design storm inflow to the pond. Inlet areas shall be protected to reduce erosion.

5.2.5.2 Adequate Outfall Protection

Outfalls shall be constructed such that they do not increase erosion or have undue influence on the downstream geomorphology of the stream.

Flared pipe sections that discharge at or near the stream invert or into a step-pool arrangement shall be used at the spillway outlet.

The channel immediately below the pond outfall shall be modified to prevent erosion and conform to natural dimensions in the shortest possible distance, typically by use of large rip-rap placed over filter cloth.

A stilling basin or outlet protection shall be used to reduce flow velocities from the principal spillway to non-erosive velocities.

If a pond daylights to a channel with dry weather flow, care should be taken to minimize tree clearing along the downstream channel, and to reestablish a forested riparian zone in the shortest possible distance. Excessive use of rip-rap should be avoided to reduce stream warming.

5.2.5.3 Pond Liners

When a pond is located in karst topography, gravelly sands or fractured bedrock, a liner may be needed to sustain a permanent pool of water. If geotechnical tests confirm the need for a liner, acceptable options include: (a) 6 to 12 inches of clay soil (minimum 15% passing the #200 sieve and a minimum permeability of 1×10^{-5} cm/sec), (b) a 30 ml poly-liner (c) bentonite, or (d) use of chemical additives (see NRCS Agricultural Handbook No. 387, dated 1971, or Engineering Field Manual).

5.2.6 *Water Quality Criteria*

5.2.6.1 Pretreatment Criteria

Each stormwater pond used to meet water quality requirements shall have a sediment forebay or equivalent upstream pretreatment. The forebay shall consist of a separate cell, formed by an acceptable barrier.

The forebay shall be 4 to 6 feet deep. It shall be sized to contain 0.1 inches of runoff per impervious acre of contributing drainage. The forebay storage volume counts toward the total WQ_v requirement. Exit velocities from the forebay shall be non-erosive.

Direct maintenance access for appropriate equipment shall be provided to the forebay. The bottom of the forebay may be hardened (e.g., using concrete, paver blocks, etc.) to make sediment removal easier.

A fixed vertical sediment depth marker should be installed in the forebay to measure sediment deposition over time.

5.2.6.2 Treatment Criteria

Stormwater ponds used to meet water quality requirement shall be designed to capture and treat the computed WQ_v through any combination of permanent pool, extended detention (ED) or wetland. Stormwater ponds shall release the WQ_v over a minimum period of 24-hours and within a maximum of 72-hours.

It is generally desirable to provide water quality treatment off-line when topography, head and space permit (e.g., apart from stormwater quantity storage).

Water quality storage can be provided in multiple cells. Performance is enhanced when multiple treatment pathways are provided by using multiple cells, longer flowpaths, high surface area to volume ratios, complex microtopography, and/or redundant treatment methods (combinations of pool, ED, and wetland).

If a micropool extended detention pond is constructed, the micropool shall be sized to contain 0.1 inches per impervious acre of contributing drainage.

5.2.7 *Landscaping Criteria*

5.2.7.1 Landscaping Plan

A landscaping plan for a stormwater pond and its buffer shall be prepared to indicate how aquatic and terrestrial areas will be vegetatively stabilized and established.

Wherever possible, wetland plants should be encouraged in a pond design, either along the aquatic bench (fringe wetlands), the safety bench and side slopes (ED wetlands) or within shallow areas of the pool itself.

The best elevations for establishing wetland plants, either through transplantation or volunteer colonization, are within six inches (plus or minus) of the normal pool.

The soils of a pond buffer are often severely compacted during the construction process to ensure stability. The density of these compacted soils is so great that it effectively prevents root penetration, and therefore, may lead to premature mortality or loss of vigor. Consequently, it is advisable to excavate large and deep holes around the proposed planting sites, and backfill these with uncompacted topsoil.

As a rule of thumb, planting holes should be 3 times deeper and wider than the diameter of the rootball (of balled and burlap stock), and 5 times deeper and wider for container grown stock. This practice should enable the stock to develop unconfined root systems. Avoid species that require full shade, are susceptible to winterkill, or are prone to wind damage. Extra mulching around the base of the tree or shrub is strongly recommended as a means of conserving moisture and suppressing weeds.

5.2.7.2 Pond Buffers and Setbacks

Pond buffers can be important in providing ample space for access and safety. The buffer can be planted or left in trees to discourage resident goose populations.

A pond buffer shall be provided that extends 25 feet outward from the maximum water surface elevation of the pond. The pond buffer shall be contiguous with other buffer areas, that are required by existing regulations (e.g., stream buffers). An additional setback may be provided to permanent structures.

Woody vegetation may not be planted on or allowed to grow within 15 feet of the toe of the embankment and 25 feet from the principal spillway structure.

Existing trees should be preserved in the buffer area during construction. It is desirable to locate forest conservation areas adjacent to ponds. To discourage resident geese populations, the buffer can be planted with trees, shrubs and native ground covers.

5.2.8 *Ownership of Stormwater Ponds*

Ownership of stormwater ponds in residential subdivisions accepted by the City shall be vested in the City of Fort Smith with the filing of the final plat. The Developer shall warrant the operation of the drainage system for 2 years after acceptance by the City by a Maintenance Bond provided by the Developer's Contractor or the Developer. The bond shall be required to be extended until 2 years after all phases of the subdivision or development that substantially drain into the stormwater pond are completed.

Ownership of stormwater ponds in commercial, industrial, private subdivisions, and non-residential areas shall be vested in the property owner.

5.2.9 *Maintenance of Stormwater Ponds*

When ownership of a stormwater pond is not vested in the City of Fort Smith, the maintenance responsibility for a pond and its buffer shall be vested with a responsible party by means of a legally binding and enforceable maintenance agreement that is executed as a condition of plan approval or the permitting process.

Stormwater ponds, when required, are to be built in conjunction with storm sewer installation and/or grading. Since these facilities are intended to control increased runoff, they must be partially or fully operational soon after the clearing of the vegetation. Silt and debris connected with construction activities shall be removed periodically from the detention area and control structure to maintain the facility's storage capacity.

Maintenance of stormwater ponds is divided into two components – short term maintenance and long term maintenance. Requirements for both are discussed in the following sections. Requirements for maintenance access are also discussed below.

5.2.9.1 Short Term Maintenance

For public stormwater ponds, short term or annual maintenance is the responsibility of the developer or property owners' association for two years after acceptance of the final plat or filing of the last subdivision phase that substantially adds storm water to a stormwater pond. The items considered short term maintenance are as follows:

- Sediment removal
- Outlet cleaning
- Mowing
- Herbicide Spraying
- Litter Control

5.2.9.2 Long Term Maintenance

Long term maintenance includes removal of sediment from the basin and outlet structure. Studies show that to be needed once every 5 to 10 years. Sediment removal in the forebay shall occur when 50% of the total forebay capacity has been lost. Where the City has accepted the stormwater pond, the City is responsible for long term maintenance. Where basins are not accepted by the City, the property owner is responsible for the long term maintenance.

5.2.9.3 Maintenance Access

A maintenance right of way or easement shall extend to the stormwater pond from a public road. Maintenance access shall be at least 20 feet wide; have a maximum slope of no more than 15%; and should be appropriately stabilized to withstand maintenance equipment and vehicles. The maintenance access shall extend to the forebay, safety bench, riser, and outlet and be designed to allow vehicles to turn around.

5.3 DESIGN CRITERIA – WETLANDS

Stormwater wetlands are practices that create shallow marsh areas to treat urban stormwater and often incorporate small permanent pools and/or extended detention storage to achieve the full WQ_v. Design variants include:

- Shallow Wetland (Figure 5-10)
- ED Shallow Wetland (Figure 5-11)
- Pond/Wetland System (Figure 5-12)
- "Pocket" Wetland (Figure 5-13)

Stormwater wetlands may be used in residential, private, commercial, and industrial subdivisions and developments to meet the detention and WQ_v requirements.

All of the pond criteria presented in 5.2 DESIGN CRITERIA – STORMWATER PONDS also apply to the design of stormwater wetlands. Additional criteria that govern the geometry and establishment of created wetlands are presented in this section.

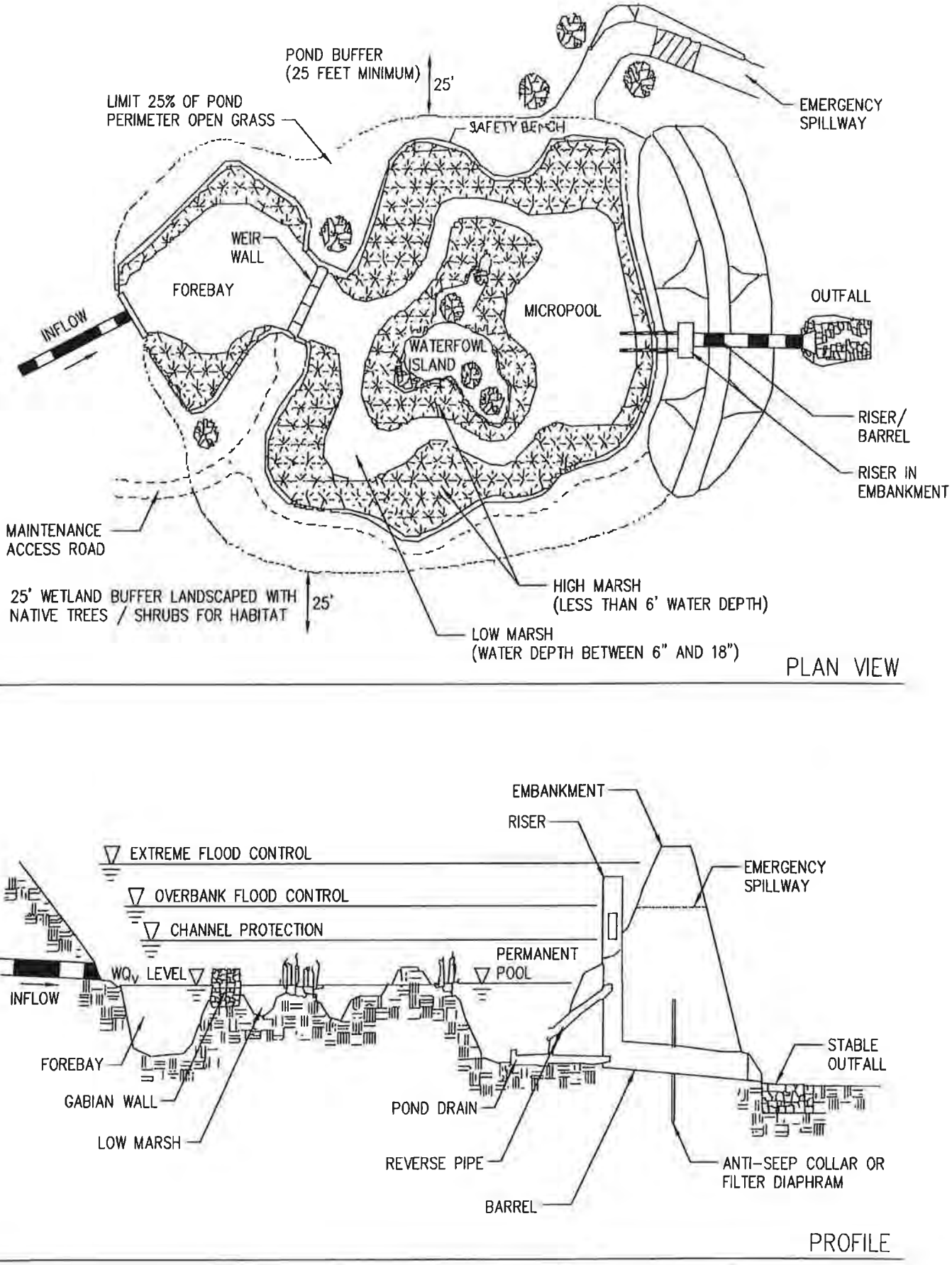
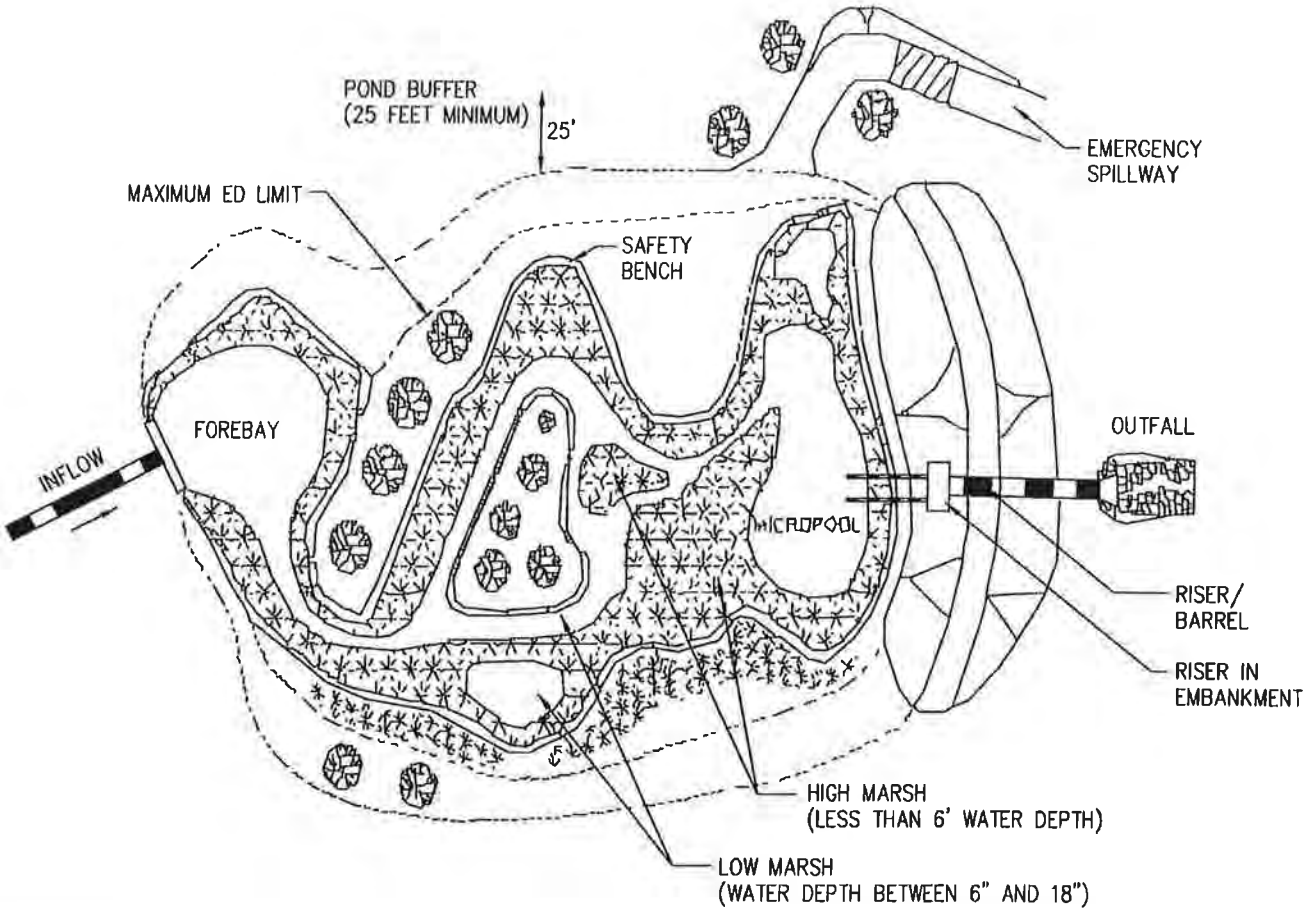


FIGURE 5-10. Shallow Wetland



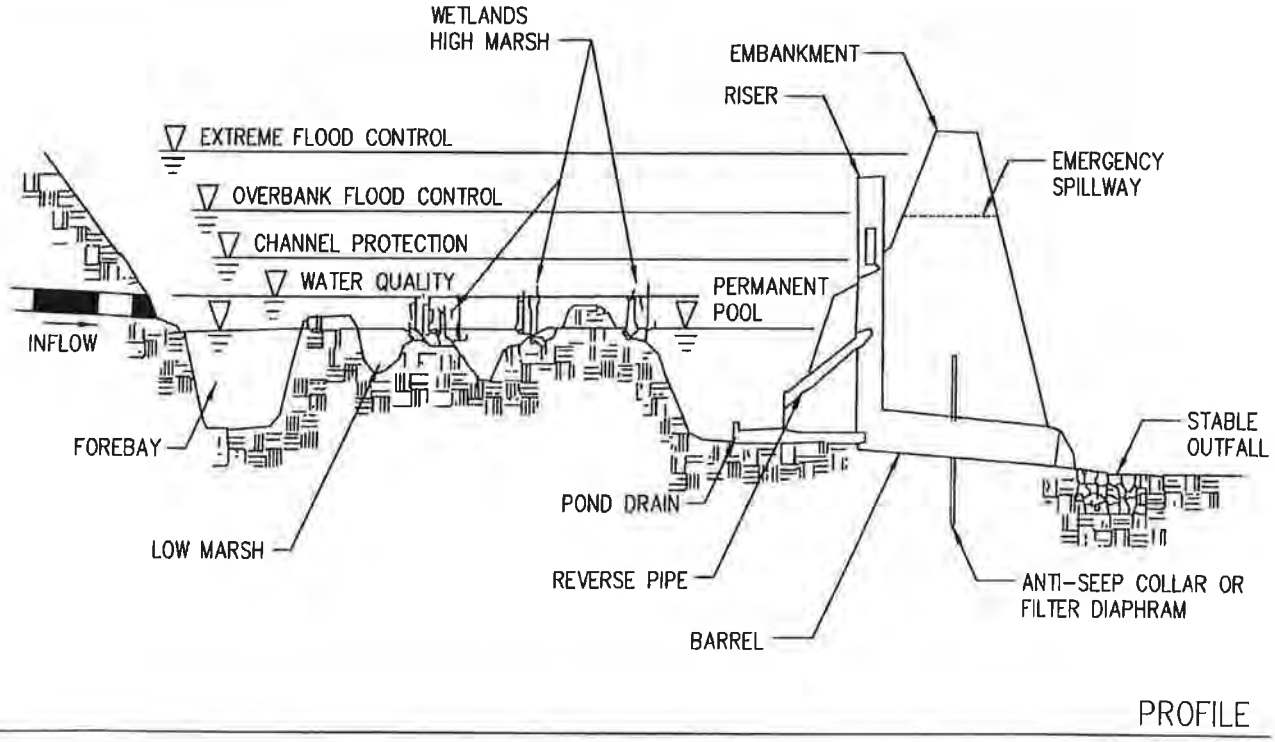
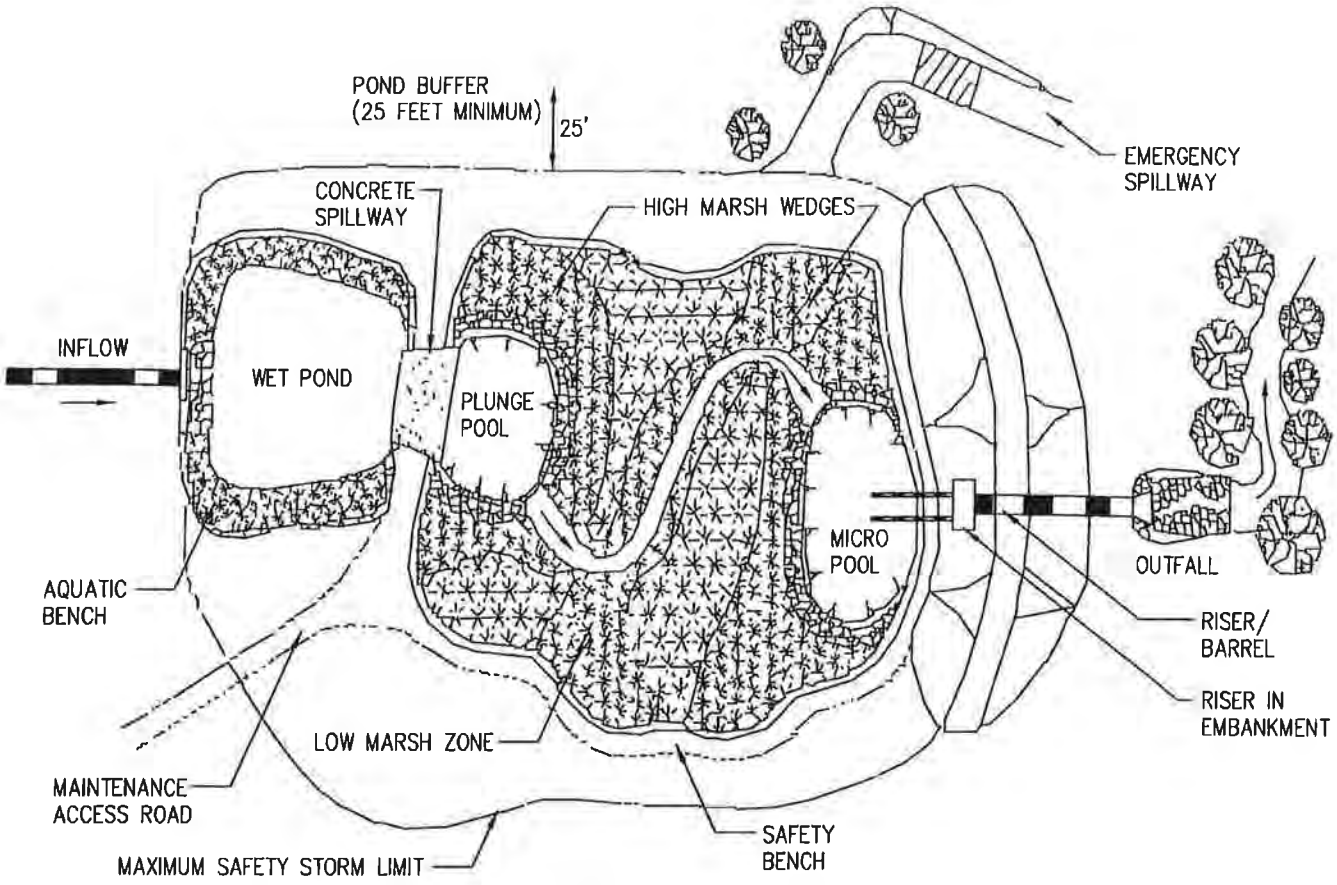


FIGURE 5-11. Extended Detention Shallow Wetland



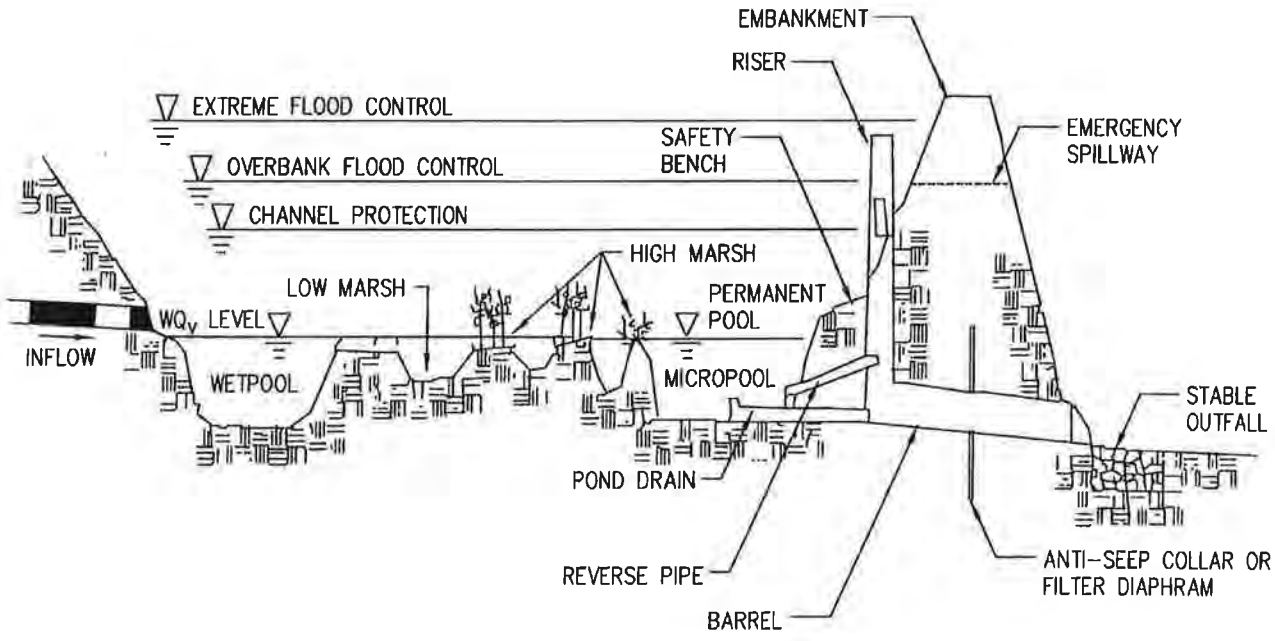
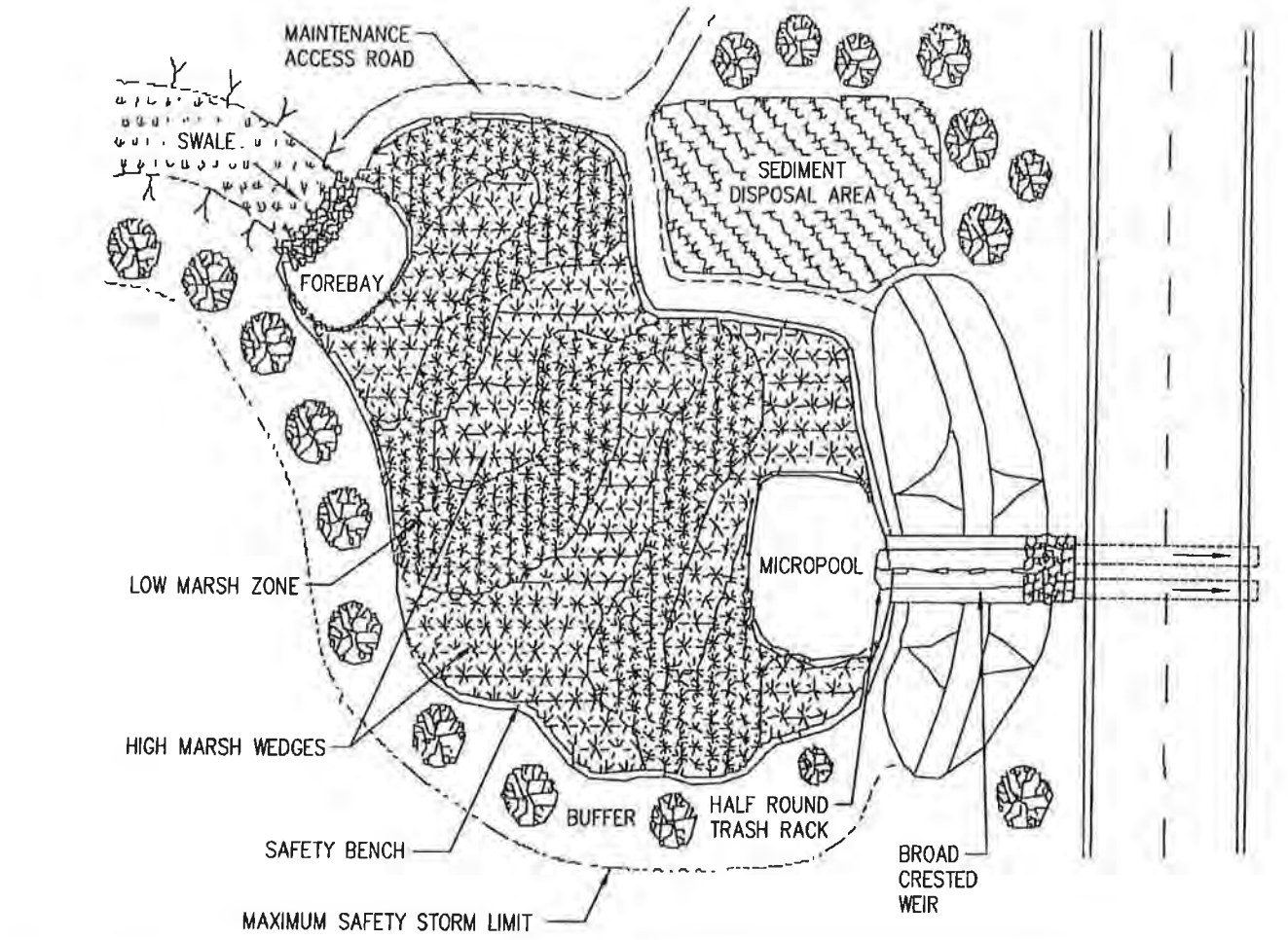


FIGURE 5-12. Pond/Wetland System



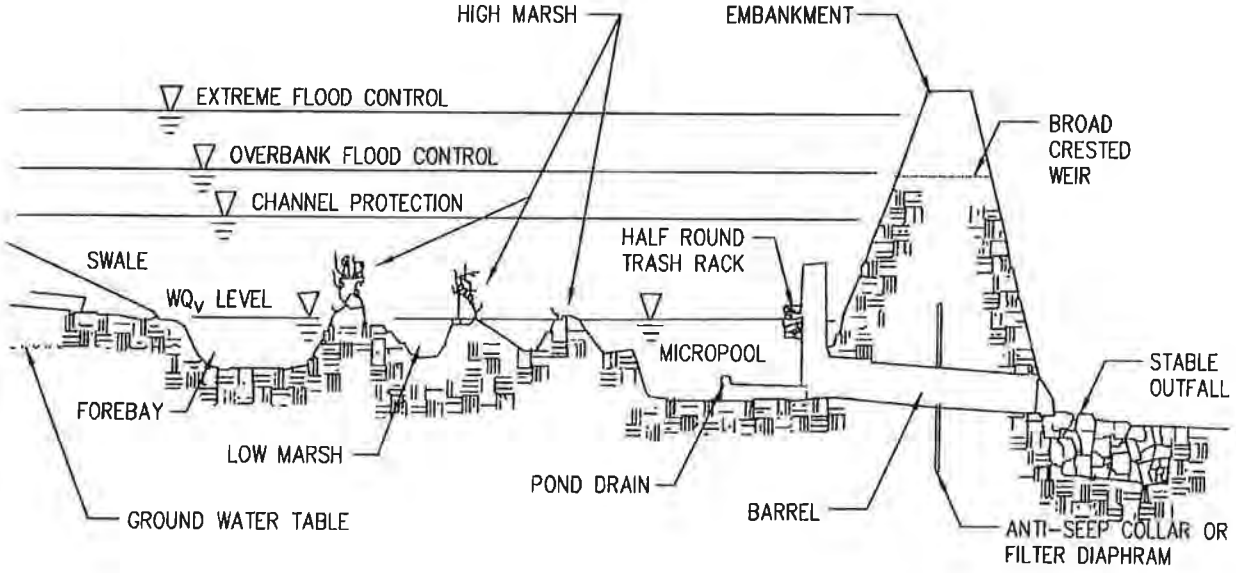


FIGURE 5–13. "Pocket" Wetland

5.3.1 *Feasability Criteria*

A water balance shall be performed to demonstrate that a stormwater wetland can withstand a significant drought at summer evaporation rates without completely drawing down.

Stormwater wetlands shall not be located within existing jurisdictional wetlands.

5.3.2 *Conveyance Criteria*

Flowpaths from the inflow points to the outflow points of stormwater wetlands shall be maximized. A minimum flowpath of 2:1 (length to relative width) shall be provided across the stormwater wetland. This path may be achieved by constructing internal berms (e.g., high marsh wedges or rock filter cells).

Microtopography is encouraged to enhance wetland diversity.

5.3.3 *Pretreatment Criteria*

Sediment regulation is critical to sustain stormwater wetlands. Consequently, a forebay shall be located at the inlet, and a micropool shall be located at the outlet. For forebay design criteria, consult 5.2 DESIGN CRITERIA – STORMWATER PONDS.

A micropool three to six feet deep shall be used to protect the low flow pipe from clogging and prevent sediment resuspension.

5.3.4 *Treatment Criteria*

The surface area of the entire stormwater wetland shall be at least one percent of the contributing drainage area (1.5% for shallow marsh design).

At least 25% of the WQ_v shall be in deepwater zones with a depth greater than four feet. The forebay and micropool may meet this criteria. In addition, the deepwater zones serve to keep mosquito populations in check by providing habitat for fish and other pond life that prey on mosquito larvae.

A minimum of 35% of the total surface area can have a depth of six inches or less, and at least 65% of the total surface area shall be shallower than 18 inches.

The bed of the wetland shall be graded to create maximum internal flow path and microtopography.

If extended detention is utilized in a stormwater wetland, the WQ_v -ED volume shall not comprise more than 50% of the total WQ_V, and its maximum water surface elevation shall not extend more than three feet above the permanent pool.

To promote greater nitrogen removal, rock beds may be used as a medium for growth of wetland plants. The rock should be one to three inches in diameter, placed up to the normal pool elevation, and open to flow-through from either direction.

5.3.5 *Landscaping Criteria*

A landscaping plan shall be provided that indicates the methods used to establish and maintain wetland coverage. Minimum elements of a plan include: delineation of pondscaping zones, selection of corresponding plant species, planting plan, sequence for preparing wetland bed (including soil amendments, if needed) and sources of plant material.

Structures such as fascines, coconut rolls, straw bales, or filter fence can be used to create shallow marsh cells in high energy areas of the stormwater wetland.

The landscaping plan should provide elements that promote greater wildlife and waterfowl use within the wetland and buffers.

A wetland plant buffer shall extend 25 feet outward from the maximum water surface elevation, with an additional 15 foot setback to structures.

5.3.6 *Wetland Establishment*

The most common and reliable technique for establishing an emergent wetland community in a stormwater wetland is to transplant nursery stock obtained from aquatic plant nurseries. The following guidance is suggested when transplants are used to establish a wetland.

Plant only during the transplanting window. Wetland plants need a full growing season to build root reserves needed to get through the winter. If at all possible, plants should be ordered at least three months in advance to ensure the availability of the desirable species.

The optimal depth requirements for several common species of emergent wetland plants are often six inches or less.

To add diversity to the wetland, five to seven species of emergent wetland plants should be planted.

No more than half the wetland surface area needs to be planted. If the appropriate planting depths are achieved, the entire wetland should be colonized within three years.

The wetland area should be subdivided into separate planting zones of more or less constant depth.

One plant species should be planted within each flagged planting zone, based on approximate depth requirements.

Individual plants should be planted 18 inches on center in clumps.

Post-nursery care of wetland plants is very important in the interval between delivery of the plants and their subsequent planting, as they are prone to dessication. Stock should be frequently watered and shaded while on-site.

A wet hydroseed mix should be used to establish permanent vegetative cover in the buffer outside the permanent pool. For rapid germination, scarify the soil to ½ inch prior to hydroseeding. Alternatively, grass species can be used as a temporary cover for the wet species.

Because most stormwater wetlands are excavated to deep subsoils, they often lack the nutrients and organic matter needed to support vigorous growth of wetland plants. At these sites, three to six inches of topsoil or wetland mulch should be added to all depth zones in the wetland from one foot below the normal pool to six inches above. Wetland mulch is preferable to topsoil if it is available.

The stormwater wetland should be staked at the onset of the planting season. Depths in the wetland should be measured to the nearest inch to confirm original planting zones. At this time, it may be necessary to modify the pondscaping plan to reflect altered depths or the availability of wetland plant stock. Surveyed planting zones should be marked on an "as-built" or design plan, and located in the field using stakes or flags. The wetland drain should be fully opened at least three days prior to the planting dates (which should coincide with the delivery date for the wetland plant stock).

Wetland mulch is another technique to establish a wetland plant community which utilizes the seedbank of wetland soils to provide the propagules for marsh development. The majority of the seedbank is contained within the upper six inches of the donor wetland soils. The mulch is best collected at the end of the growing season. Best results are obtained when the mulch is spread three to six inches deep over the high marsh and semi-wet zones of the wetland (-6 inches to +6 inches relative to the normal pool).

In some cases, the use of "volunteer wetlands," allowing cattails and phragmites to colonize may be appropriate.

Donor soils for wetland mulch should not be removed from natural wetlands.

5.3.7 *Ownership of Wetlands*

Ownership of stormwater wetlands in residential subdivisions accepted by the City shall be vested in the City of Fort Smith with the filing of the final plat. The Developer shall warrant the operation of the drainage system for 2 years after acceptance by the City by a Maintenance Bond provided by the Developer's Contractor or the Developer. The bond shall be required to be extended until 2 years after all phases of the subdivision or development that substantially drain into the stormwater wetland are completed.

Ownership of stormwater wetlands in commercial, industrial, private subdivisions, and non-residential areas shall be vested in the property owner.

5.3.8 *Maintenance of Wetlands*

Stormwater wetlands shall be required to meet all the maintenance requirements found in Section 5.2.9 *Maintenance of Stormwater Ponds.* In addition, stormwater wetlands shall also be required to meet the criteria below.

5.3.8.1 Minimum Coverage

If a minimum coverage of 50% is not achieved in the planted wetland zones after the second growing season, a reinforcement planting will be required.

5.4 DESIGN CRITERIA – STORMWATER INFILTRATION

Stormwater infiltration practices capture and temporarily store the WQ_v before allowing it to infiltrate into the soil over a two day period. Design variants include:

- Infiltration Trench (Figure 5-14)
- Infiltration Basin (Figure 5-15)

Extraordinary care must be taken to assure that long-term infiltration rates are achieved through post construction inspection and long-term maintenance.

Stormwater infiltration practices may be used in private, commercial, and industrial subdivisions and developments to meet the WQ_v requirement. In certain limited cases, with proper documentation, they may also be used in private, commercial, and industrial subdivisions and developments to meet the detention requirement.

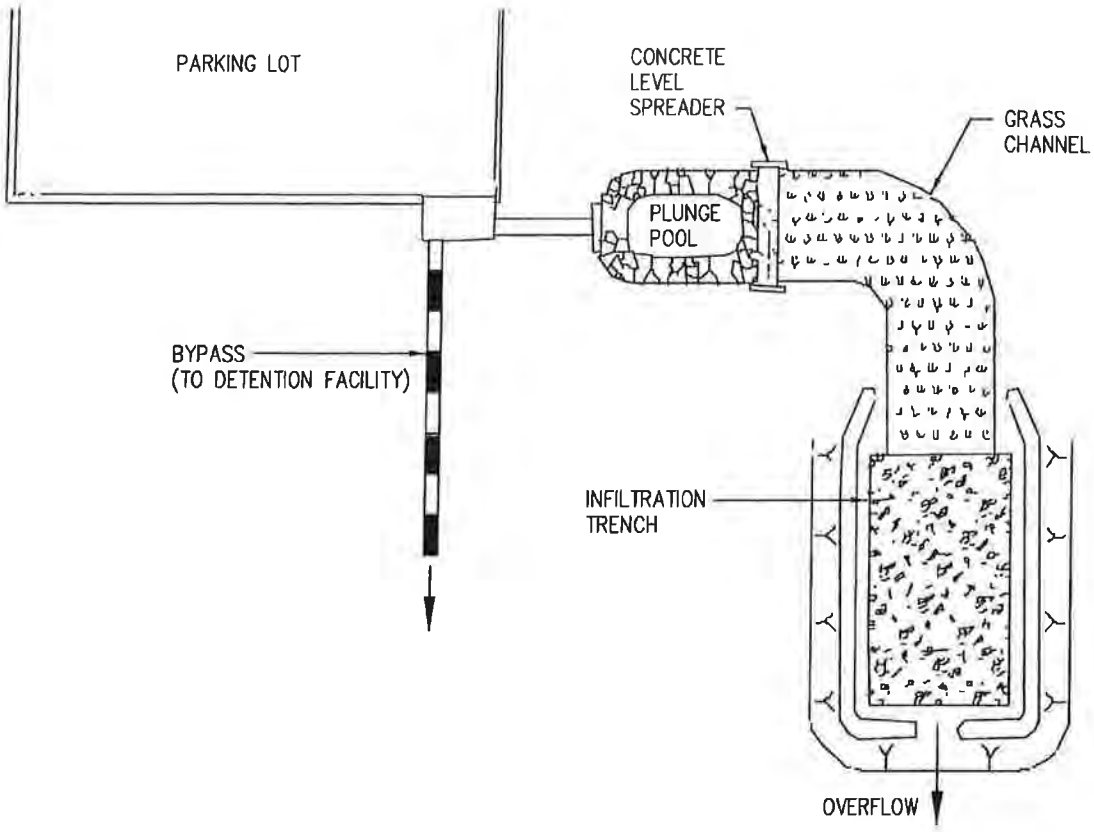
5.4.1 *Feasibility Criteria*

To be suitable for infiltration, underlying soils must have an infiltration rate (f_c) of 0.52 inches per hour or greater, as initially determined from NRCS soil textural classification, and subsequently confirmed by field geotechnical tests. The minimum geotechnical testing is one test hole per 5000 sf, with a minimum of two borings per facility (taken within the proposed limits of the facility).

Soils shall also have a clay content of less than 20% and a silt/clay content of less than 40%.

Infiltration cannot be located on slopes greater than 6% or within fill soils.

To protect groundwater from possible contamination, runoff from designated hotspot land uses or activities cannot be infiltrated.



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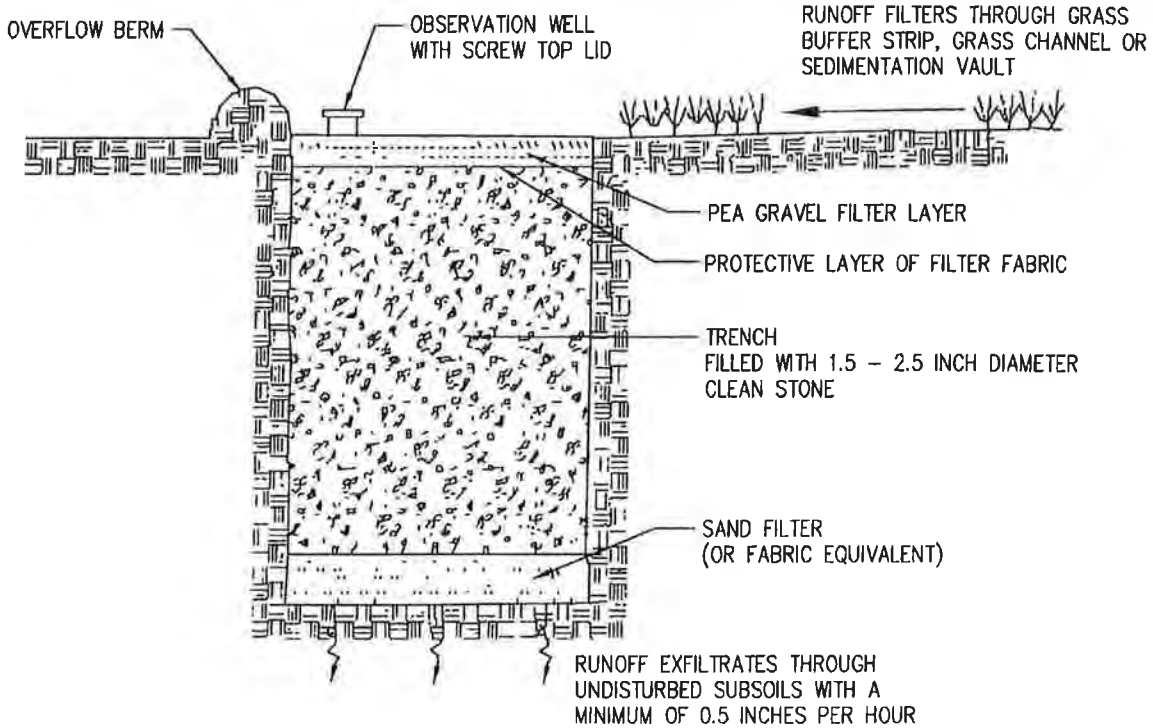
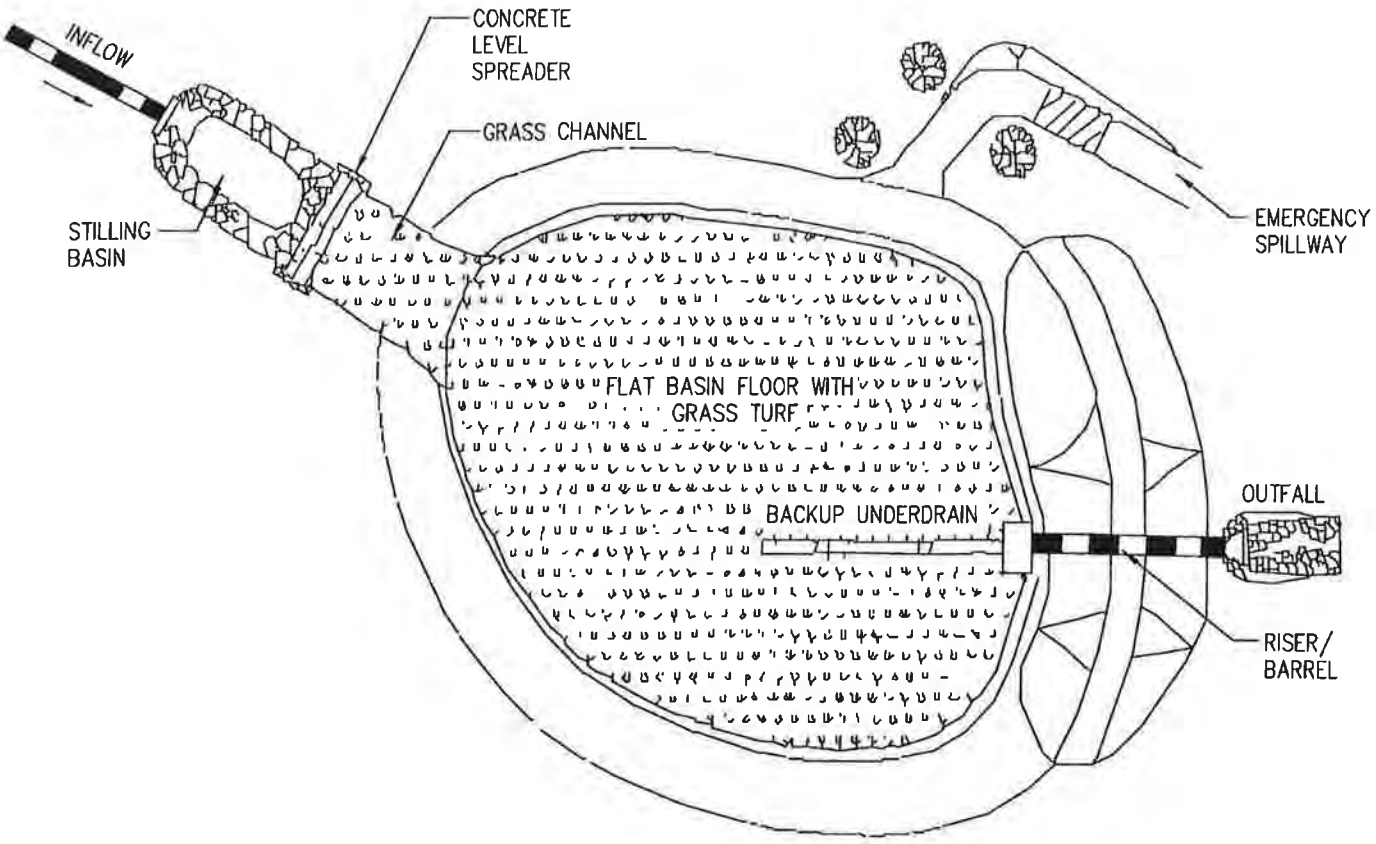


SECTION

FIGURE 5–14. Infiltration Trench



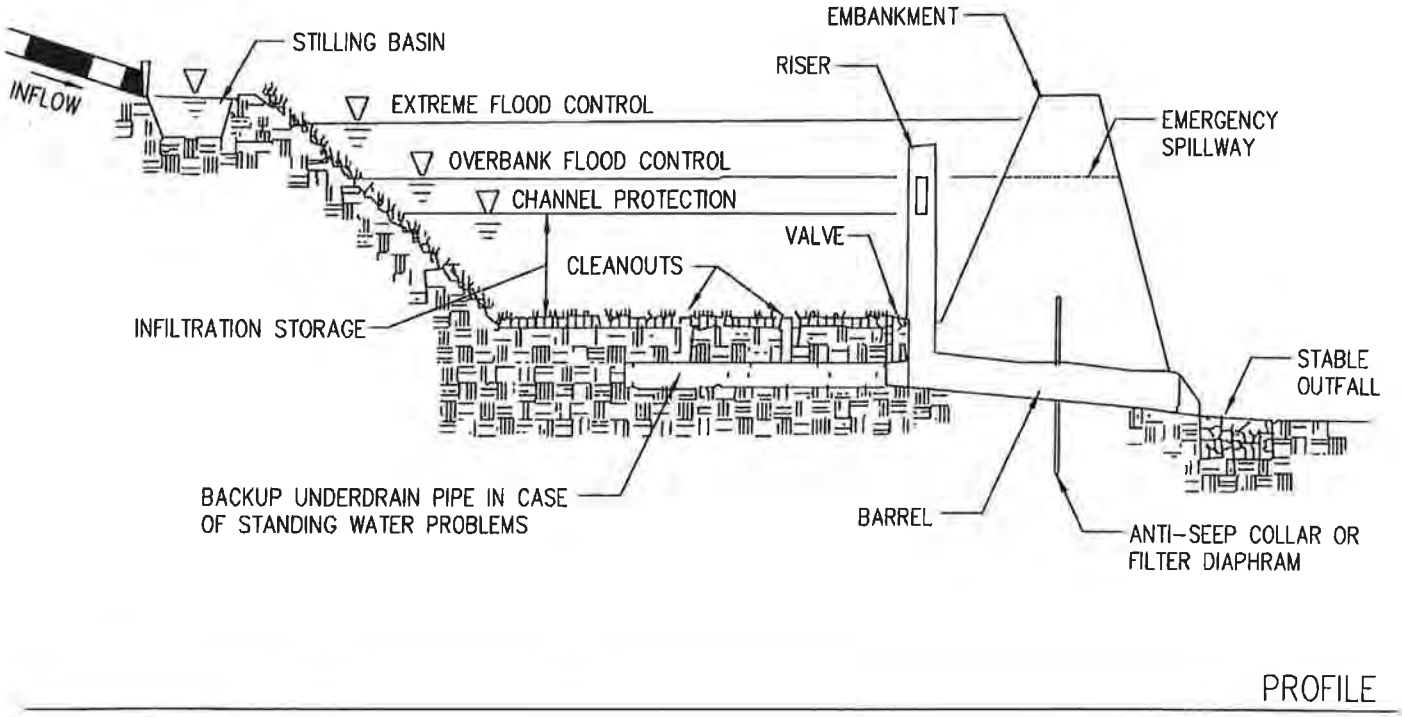


FIGURE 5-15. Infiltration Basin

The bottom of the infiltration facility shall be separated by at least four feet vertically from the seasonally high water table or bedrock layer, as documented by on-site soil testing.

Infiltration facilities can be located at least 100 feet horizontally from any water supply well.

Infiltration practices cannot be placed in locations that cause water problems to downgrade properties. Infiltration facilities must be setback at least 25 feet down-gradient from structures.

The maximum contributing area to an individual infiltration practice shall be less than 5 acres.

5.4.2 *Conveyance Criteria*

The overland flow path of surface runoff exceeding the capacity of the infiltration system can be evaluated to preclude erosive concentrated flow during the overbank events. If computed flow velocities exceed the non-erosive threshold, a overflow channel shall be provided to a stabilized water course.

All infiltration systems should be designed to fully de-water the entire WQ_v within 48 hours after the storm event.

If runoff is delivered by a storm drain pipe or along the main conveyance system, the infiltration practice must be designed as an off-line practice. Pretreatment shall be provided for storm drain pipes systems discharging directly to infiltration systems.

Adequate stormwater outfalls shall be provided for the overflow associated with the ten year design storm event (non-erosive velocities on the down-slope).

5.4.3 *Pretreatment Criteria*

5.4.3.1 Pretreatment Volume

A minimum pretreatment volume of at least 25% of the WQ_v must be provided prior to entry to an infiltration facility, and can be provided in the form of a sedimentation basin, sump pit, grass channel, plunge pool or other measure.

Exit velocities from pretreatment chambers shall be non-erosive (5 fps) during the two year design storm. If the f_c for the underlying soils is greater than 2.00 inches per hour, 50% of the WQ_v shall be treated by another method prior to entry into an infiltration facility.

5.4.3.2 Pretreatment Techniques to Prevent Clogging

Each infiltration system can have redundant methods to protect the long term integrity of the infiltration rate. Three or more of the following techniques must be installed in every facility:

- grass channel

- grass filter strip (minimum 20 feet and only if sheet flow is established and maintained)
- bottom sand layer
- upper filter fabric layer
- use of washed bank run gravel as aggregate

The sides of infiltration practices shall be lined with an acceptable filter fabric that prevents soil piping.

5.4.4 *Treatment Criteria*

Infiltration practices shall be designed to exfiltrate the entire WQ_v through the floor of each practice.

Infiltration practices are best used in conjunction with other practices, and often a stormwater pond is still needed downstream to meet the detention requirement.

A porosity value (V_v/V_t) of 0.32 can be used to design stone reservoirs for infiltration practices.

5.4.5 *Landscaping Criteria*

A dense and vigorous vegetative cover shall be established over the contributing pervious drainage areas before runoff can be accepted into the facility. Infiltration trenches shall not be constructed until all of the contributing drainage area has been completely stabilized.

5.4.6 *Ownership of Stormwater Infiltration*

Ownership of stormwater infiltration practices in commercial, industrial, private subdivisions, and non-residential areas shall be vested in the property owner.

Stormwater infiltration practices may not be used in residential subdivisions.

5.4.7 *Maintenance of Stormwater Infiltration*

The maintenance responsibility for a stormwater infiltration system shall be vested with a responsible party by means of a legally binding and enforceable maintenance agreement that is executed as a condition of plan approval or the permitting process.

Infiltration practices must never serve as a sediment control device during site construction phase. In addition, the Erosion and Sediment Control plan for the site shall clearly indicate how sediment entry will be prevented from entering the infiltration site. Normally, this is done by using diversion berms around the perimeter of the infiltration practice, along with immediate vegetative stabilization and/or mulching.

An observation well shall be installed in every infiltration trench, consisting of an anchored six-inch diameter perforated PVC pipe with a lockable cap installed flush with the ground surface.

Direct access shall be provided to infiltration practices for maintenance and rehabilitation. If a stone reservoir or perforated pipe is used to temporarily store runoff prior to infiltration, the practice shall not be covered by an impermeable surface.

Infiltration designs shall include dewatering methods in the event of failure. This can be accomplished with underdrain pipe systems that accomodate drawdown.

5.5 DESIGN CRITERIA – STORMWATER FILTERING SYSTEMS

Stormwater filtering system capture and temporarily store the WQ_v and pass it through a filter bed of sand, organic matter, soil or other media. Filtered runoff may be collected and returned to the conveyance system, or allowed to partially exfiltrate into the soil. Design variants include:

- Surface Sand Filter (Figure 5-16)
- Underground Sand Filter (Figure 5-17)
- Perimeter Sand Filter (Figure 5-18)
- Organic Filter (Figure 5-19)
- Bioretention (Figure 5-20)

Stormwater filtering systems may be used in private, commercial, and industrial subdivisions and developments to meet the WQ_v requirement. Filtering systems shall not be designed to provide the detention requirement. Filtering practices shall be combined with a separate facility to provide detention.

5.5.1 *Feasibility Criteria*

Most stormwater filters normally require two to six feet of head. The perimeter sand filter (Figure 5-18), however, can be designed to function with as little as one foot of head.

The maximum contributing area to an individual stormwater filtering system shall be less than 10 acres.

Sand and organic filtering systems are generally applied to land uses with a high percentage of impervious surfaces. Sites with imperviousness less than 75% shall require full sedimentation pretreatment techniques.

5.5.2 *Conveyance Criteria*

If runoff is delivered by a storm drain pipe or is along the main conveyance system, the filtering practice shall be designed off-line.

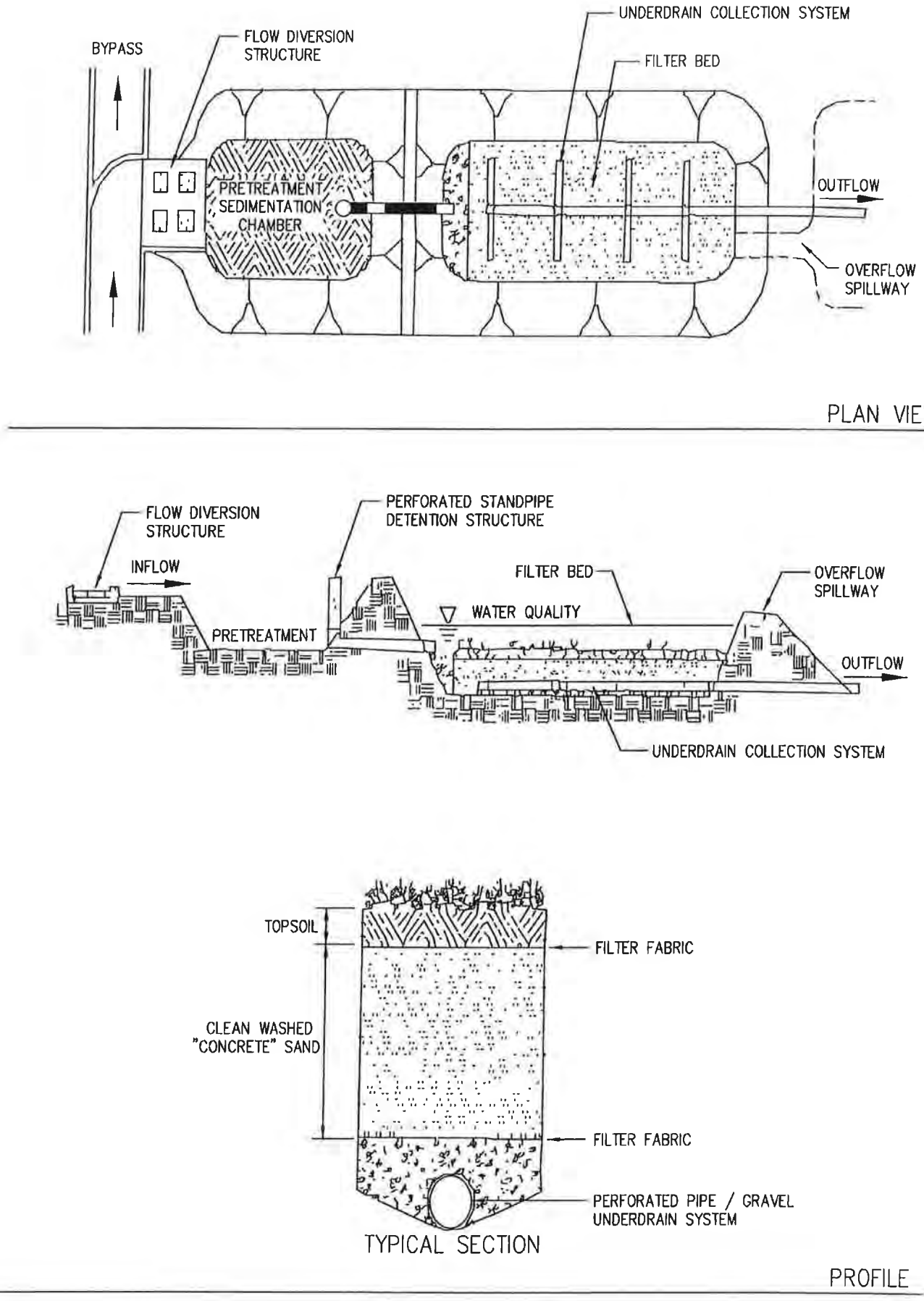
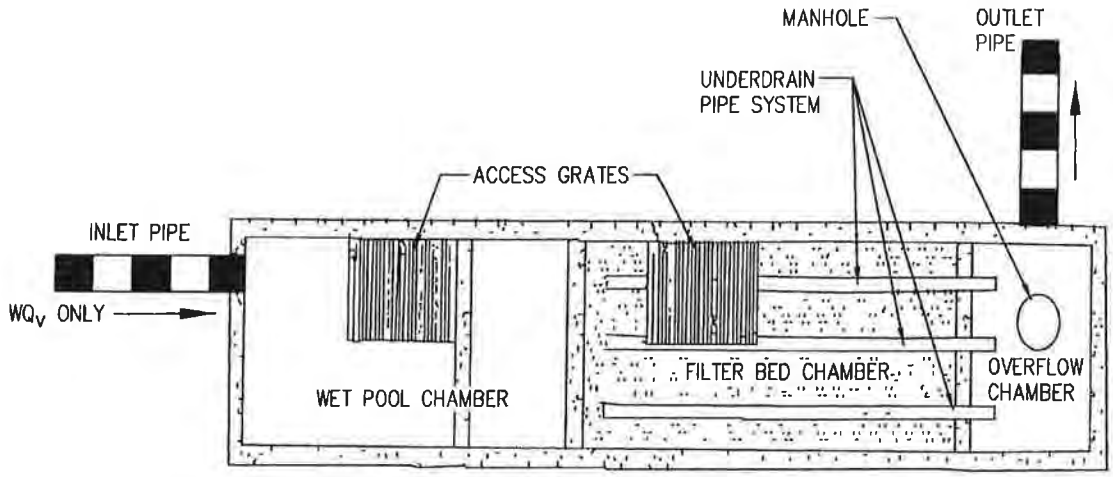
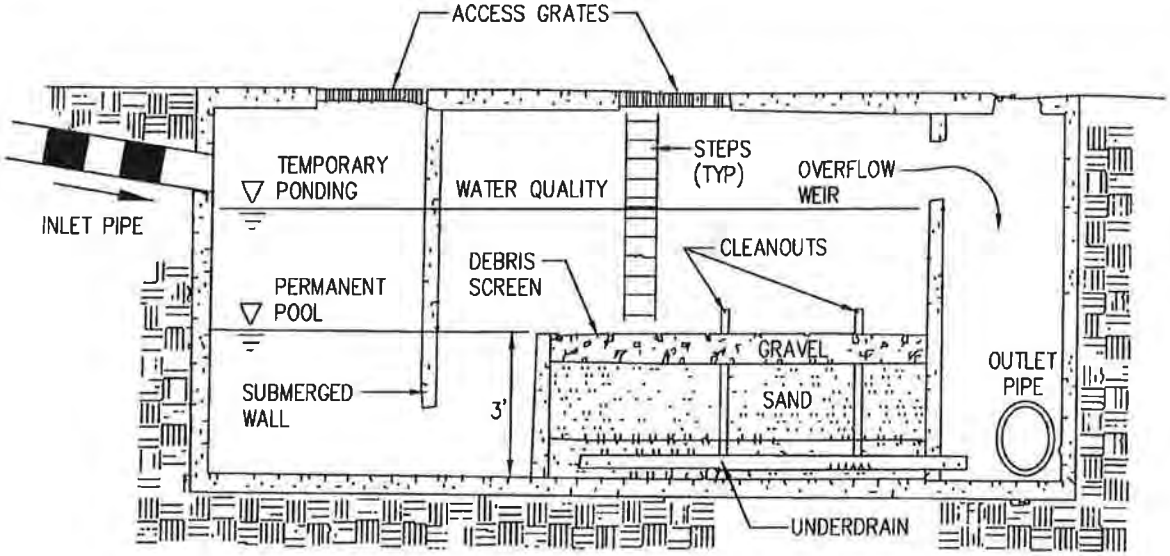
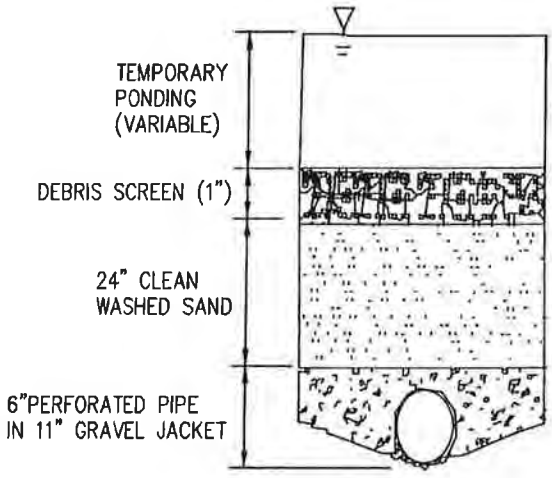


FIGURE 5–16. Surface Sand Filter



PLAN VIEW





TYPICAL SECTION

PROFILE

FIGURE 5-17. Underground Sand Filter

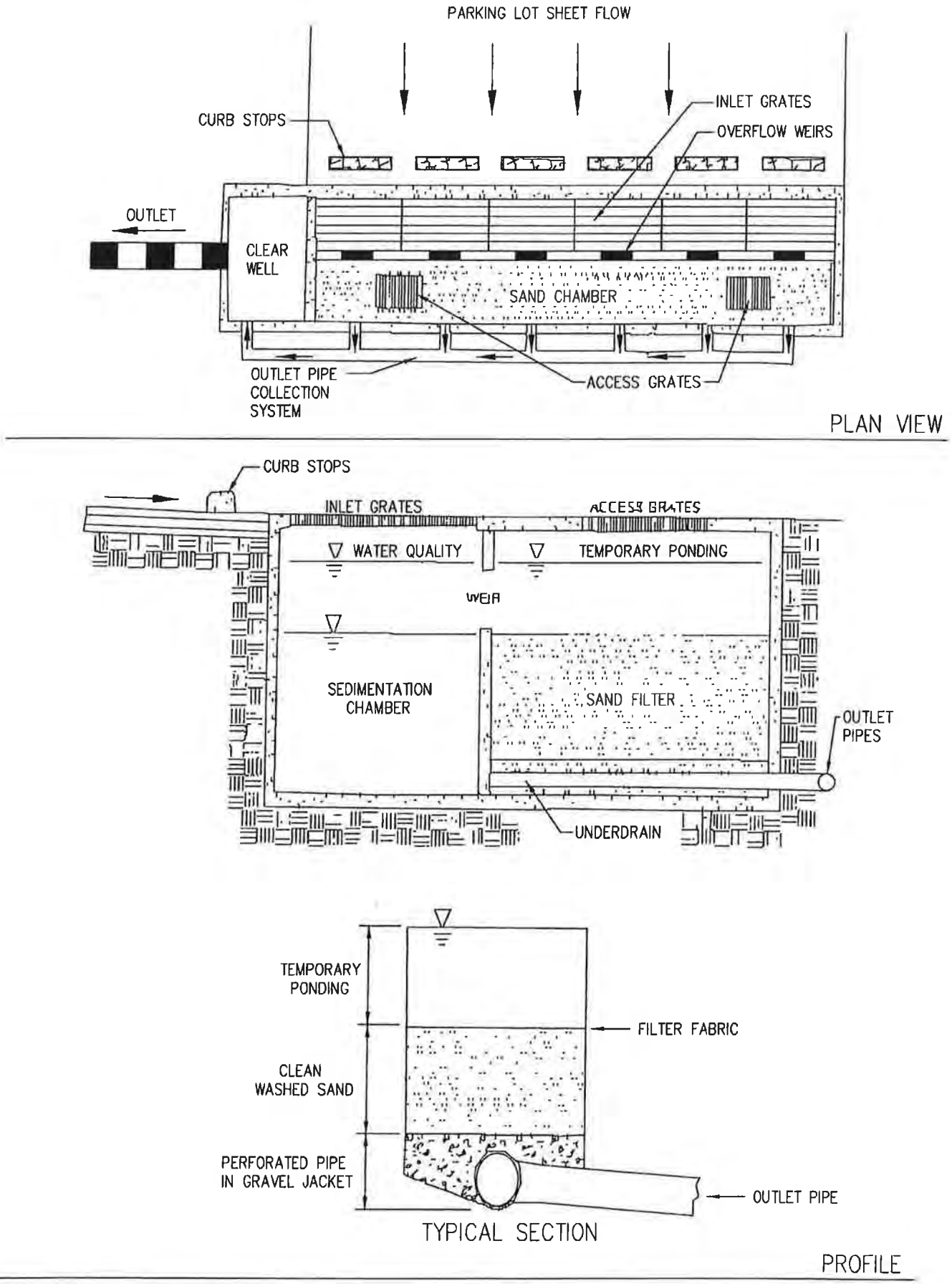
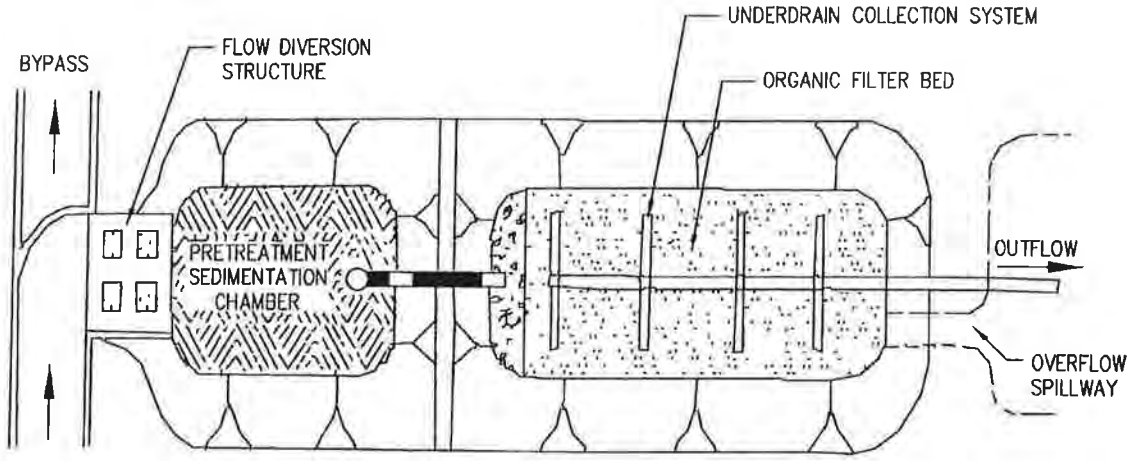
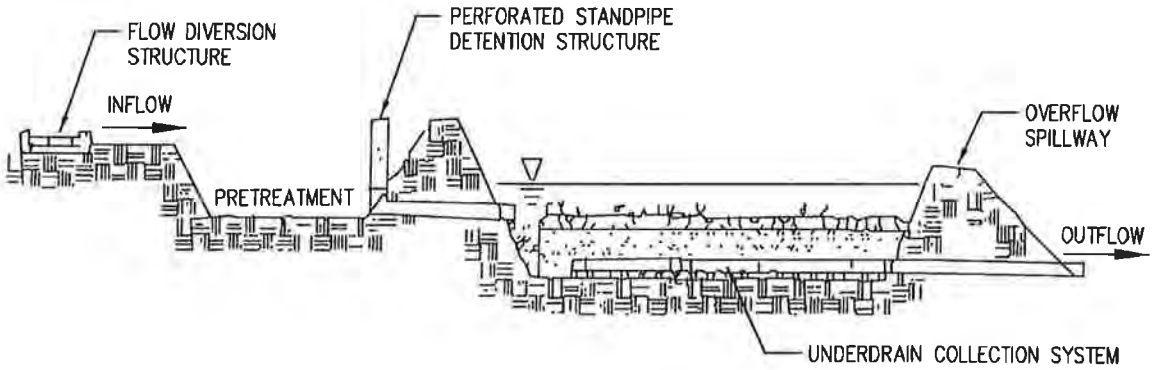
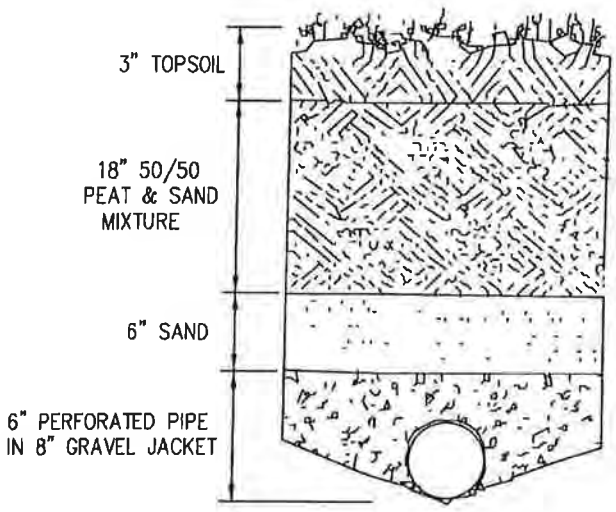


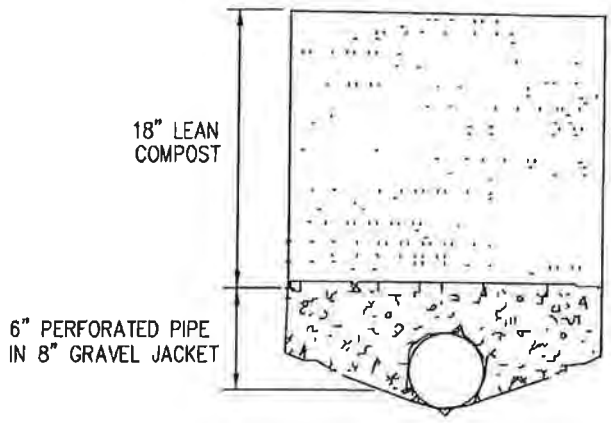
FIGURE 5–18. Perimeter Sand Filter



PLAN VIEW







TYPICAL SECTIONS

PROFILE

FIGURE 5–19. Organic Filter

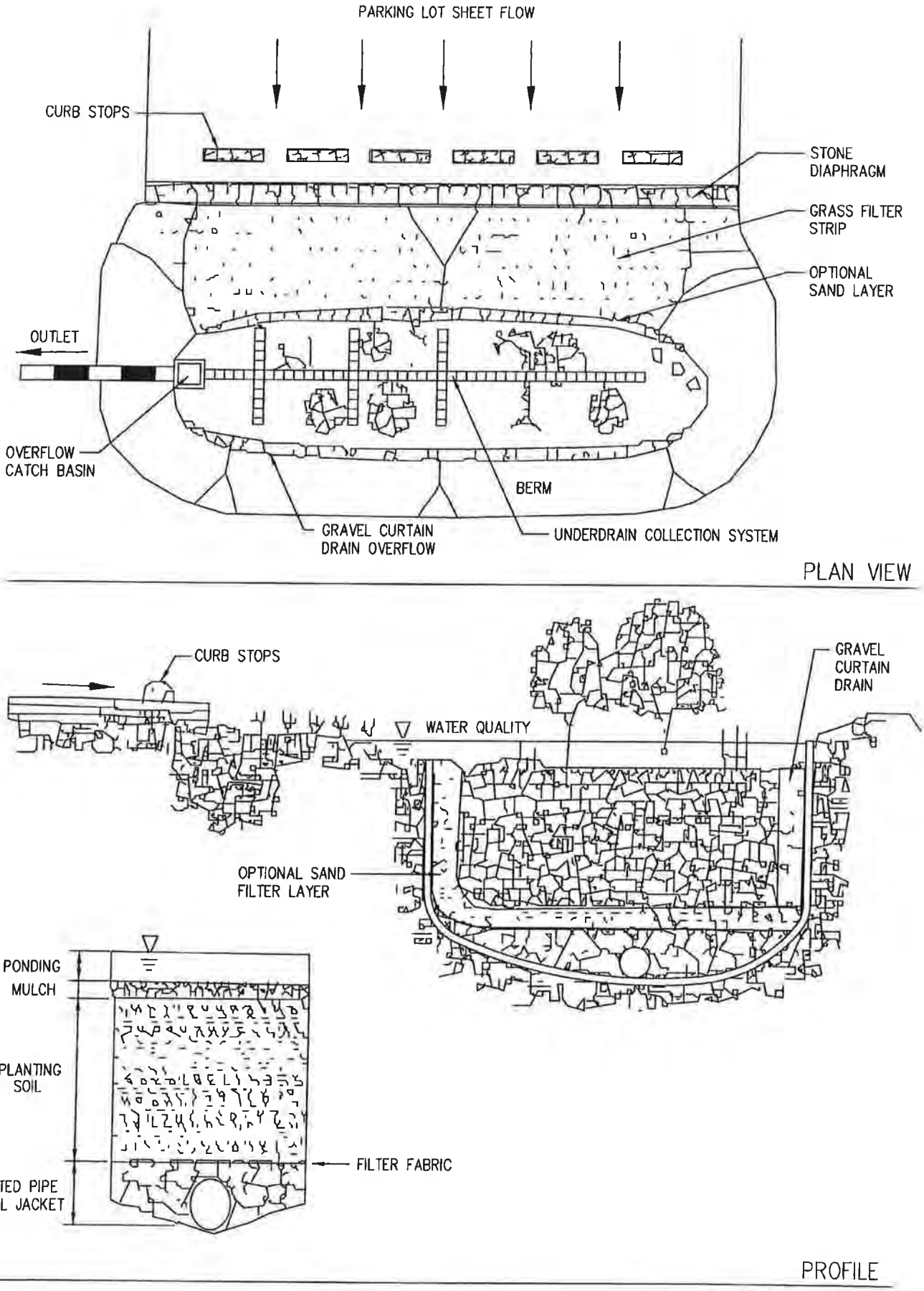


FIGURE 5–20. Bioretention

5.5.3 *Pretreatment Criteria*

Dry or wet pretreatment shall be provided prior to filter media equivalent to at least 25% of the computed WQ_v. The typical method is a sedimentation basin that has a length to width ratio of 2:1. The Camp-Hazen equation is used to compute the required surface area for sand and organic filters requiring full sedimentation for pretreatment *(9)* as follows:

The required sedimentation basin area is computed using the following equation:

$$A_s = (Q_o/W) = Ln\ (1\text{-}E) \qquad (5.9)$$

Where:

A_s = Sedimentation basin surface area (ft^2)
E = sediment trap efficiency (use 90%)
W = particle settling velocity (ft/sec)
use 0.0004 ft/sec for imperviousness (I) 75%
use 0.0033 ft/sec for I > 75%
Q_o = Discharge rate from basin = (WQ_v/24 hr)

Equation reduces to:

$$A_s = (0.066)\ (WQ_v)\ ft^2 \text{ for I } 75\% \qquad (5.10)$$

$$A_s = (0.0081)\ (WQ_v)\ ft^2 \text{ for I} > 75\% \qquad (5.11)$$

Adequate pretreatment for bioretention systems is provided when all of the following are provided: (a) grass filter strip below a level spreader, (b) gravel diaphragm and (c) a mulch layer. In this regard, bioretention systems are fundamentally different from other filtering practices.

5.5.4 *Treatment Criteria*

The entire treatment system (including pretreatment) shall temporarily hold at least 75% of the WQ_v prior to filtration.

The filter media shall consist of a medium sand (meeting ASTM C-33 concrete sand). Media used for organic filters may consist of peat/sand mix or leaf compost. Peat shall be a reed-sedge hemic peat.

The filter bed shall have a minimum depth of 18" with the following exception: The perimeter filter may have a minimum filter bed depth of 12".

The filter area for sand and organic filters shall be sized based on the principles of Darcy's Law. A coefficient of permeability (k) shall be used as follows:

- Sand: 3.5 ft/day *(5)*
- Peat: 2.0 ft/day *(7)*
- Leaf compost: 8.7 ft/day *(6)*
- Bioretention Soil: 0.5 ft/day *(6)*

Bioretention systems shall consist of the following treatment components: A four foot deep planting soil bed, a surface mulch layer, and a 6" deep surface ponding area.

The required filter bed area is computed using the following equation

$$A_f = (WQ_v)\,(d_f) / [\,(k)\,(h_f + d_f)\,(t_f)] \qquad (5.12)$$

Where:

A_f = Surface area of filter bed (ft^2)
d_f = filter bed depth (ft)
k = coefficient of permeability of filter media (ft/day)
h_f = average height of water above filter bed (ft)
t_f = design filter bed drain time (days)
(1.67 days or 40 hours is maximum for sand filters, 48 hours for bioretention)

5.5.5 *Landscaping Criteria*

A dense and vigorous vegetative cover shall be established over the contributing pervious drainage areas before runoff can be accepted into the facility.

Surface filters can have a grass cover to aid in the pollutant adsorption. The grass should be capable of withstanding frequent periods of inundation and drought.

Landscaping is critical to the performance and function of bioretention areas. Therefore, a landscaping plan must be provided for bioretention areas.

Planting recommendations for bioretention facilities are as follows:

- Native plant species should be specified over non-native species.
- Vegetation should be selected based on a specified zone of hydric tolerance.
- A selection of trees with an understory of shrubs and herbaceous materials should be provided.
- Woody vegetation should not be specified at inflow locations.
- Trees should be planted primarily along the perimeter of the facility.

5.5.6 *Ownership of Stormwater Filtering Systems*

Ownership of stormwater filtering systems in commercial, industrial, private subdivisions, and non-residential areas shall be vested in the property owner.

Stormwater filtering systems may not be used in residential subdivisions.

5.5.7 *Maintenance of Stormwater Filtering Systems*

The maintenance responsibility for a stormwater filtering system shall be vested with a responsible party by means of a legally binding and enforceable maintenance agreement that is executed as a condition of plan approval or the permitting process.

Sediment should be cleaned out of the sedimentation chamber when it accumulates to a depth of more than six inches. Vegetation within the sedimentation chamber shall be limited to a height of 18 inches. The sediment chamber outlet devices shall be cleaned/repaired when drawdown times exceed 36 hours. Trash and debris shall be removed as necessary.

Silt/sediment shall be removed from the filter bed when the accumulation exceeds one inch. When the filtering capacity of the filter diminishes substantially (i.e., when water ponds on the surface of the filter bed for more than 48 hours), the top few inches of discolored material shall be removed and shall be replaced with fresh material. The removed sediments should be disposed in an acceptable manner.

A stone drop of at least six inches shall be provided at the inlet of bioretention facilities (Figure 5-19) (pea gravel diaphragm). Areas devoid of mulch should be re-mulched on an annual basis. Dead or diseased plant material shall be replaced.

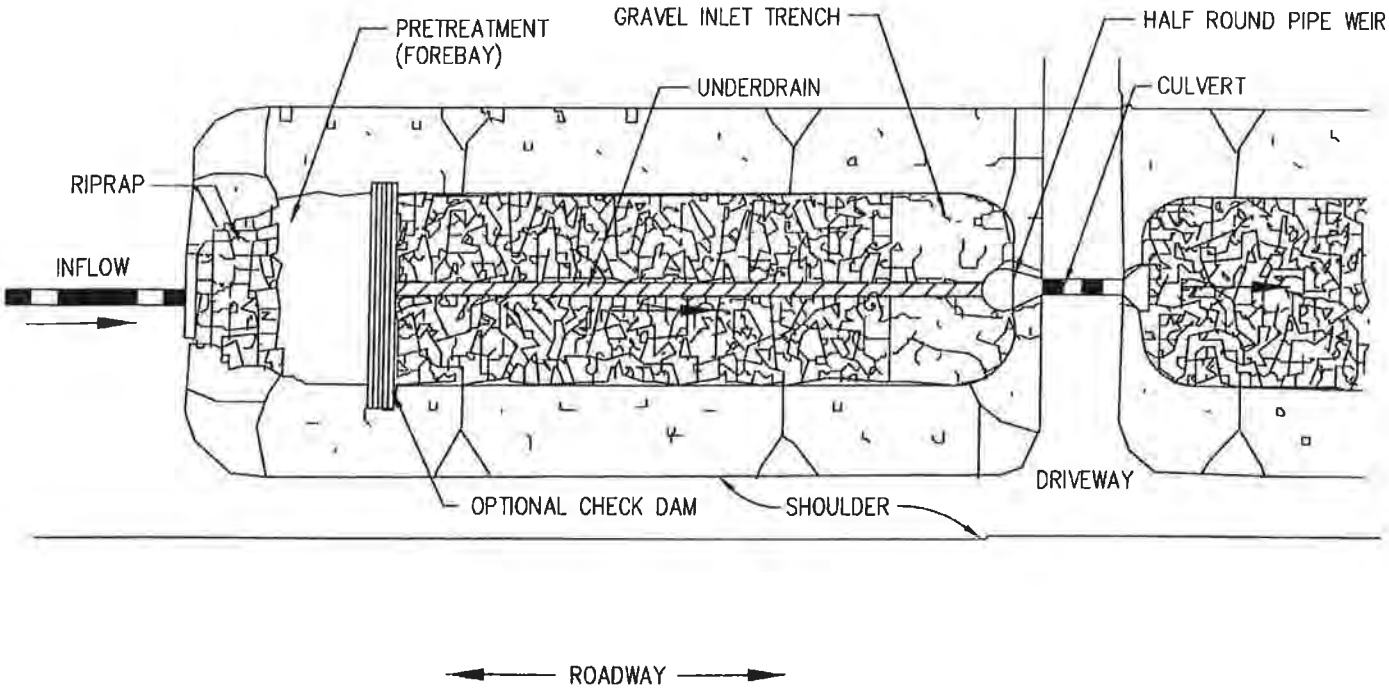
Direct maintenance access shall be provided to the pretreatment area and the filter bed.

5.6 DESIGN CRITERIA – OPEN CHANNEL SYSTEMS

Open channel systems are vegetated open channels that are explicitly designed to capture and treat the full WQ_v within dry or wet cells formed by checkdams or other means. Design variants include:

- Dry Swale (Figure 5-21)
- Wet Swale (Figure 5-22)
- Grass Channels (Figure 5-23)

Dry swales and grass channels may be used in residential, private, commercial, and industrial subdivisions and developments to meet the WQ_v requirement. Wet swales may only be used in private, commercial, and industrial subdivisions and developments. Open channel systems shall not be designed to provide the detention requirement. Open channel systems shall be combined with a separate facility to provide detention.



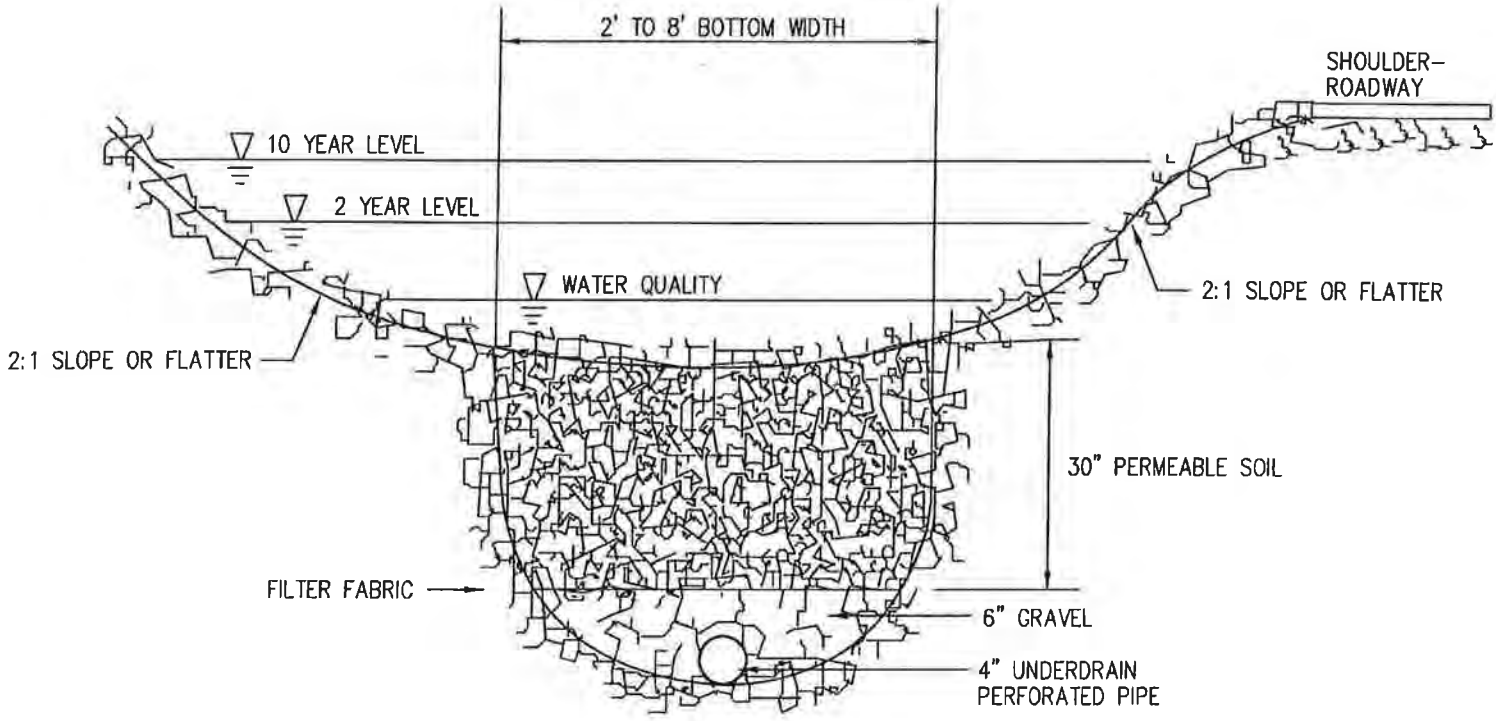
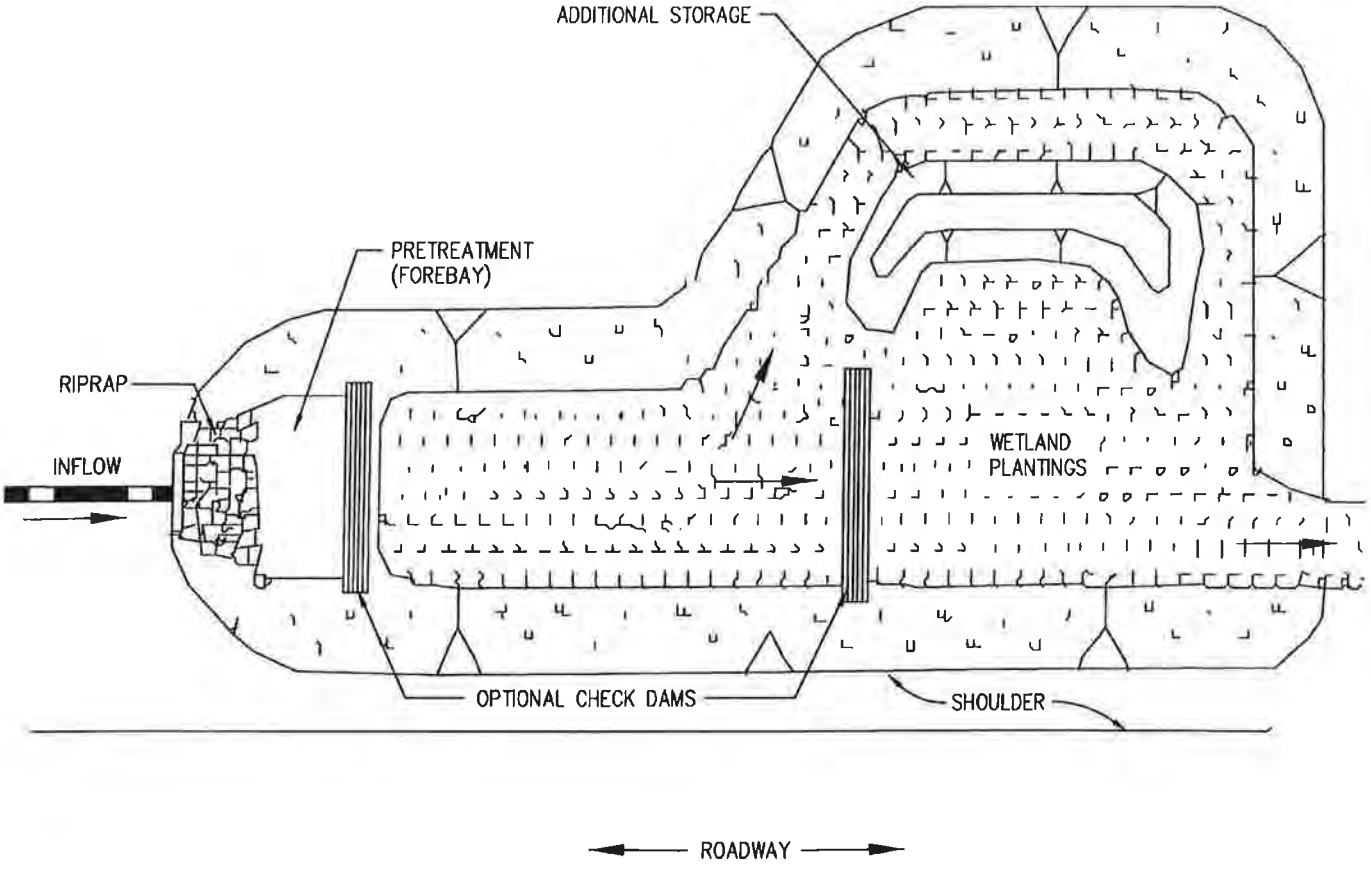


FIGURE 5-21. Dry Swale



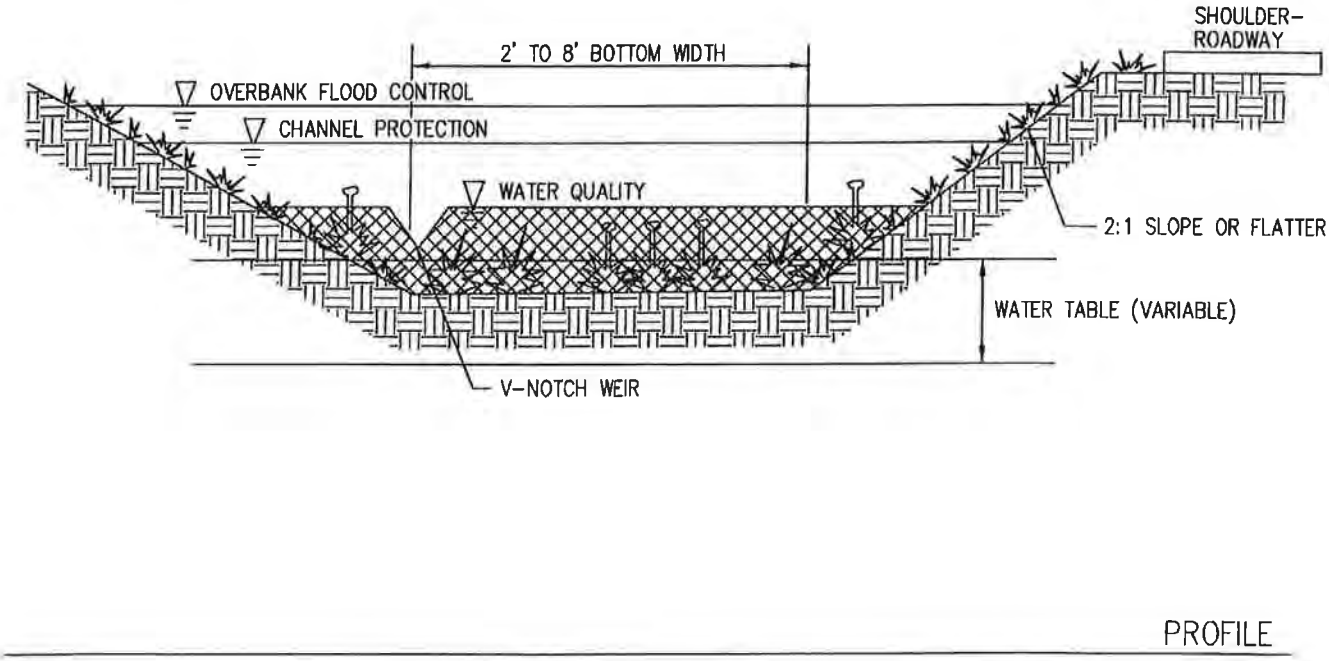


FIGURE 5–22. Wet Swale

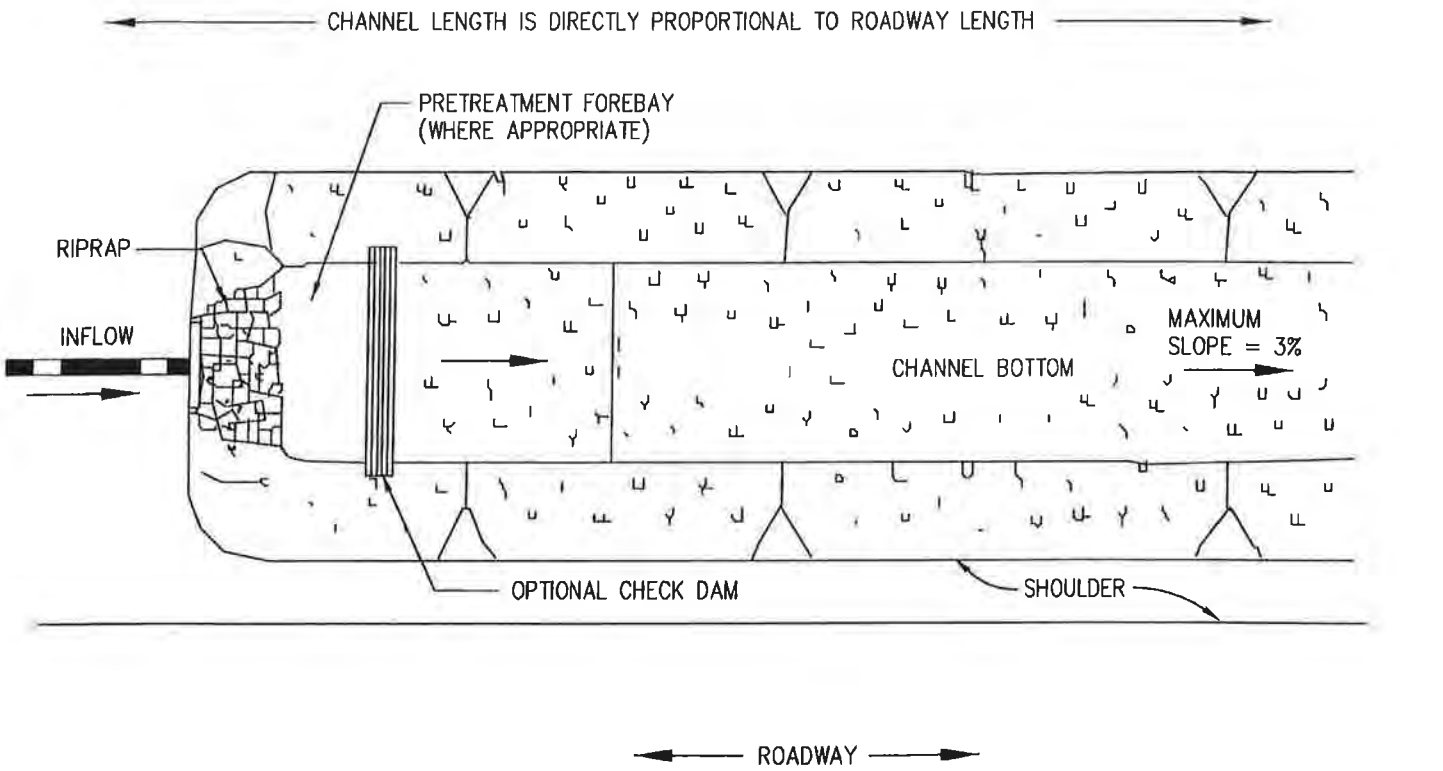


FIGURE 5-23. Grass Channels

5.6.2 *Conveyance Criteria*

The peak velocity for the 2 year storm must be non-erosive.

Open channels shall be designed to safely convey the ten year storm with a minimum of one (1.0') foot of freeboard.

Channels shall be designed with moderate side slopes for most conditions. Side slopes shall not be steeper than 4:1.

The maximum allowable temporary ponding time within a channel shall be less than 48 hours.

Open channel systems which directly receive runoff from impervious surfaces shall have a 6 inch drop onto a protected shelf (pea gravel diaphragm) to minimize the clogging potential of the inlet.

An underdrain system shall be provided for the dry swale to ensure a maximum ponding time of 48 hours.

5.6.3 *Pretreatment Criteria*

Pretreatment of 0.1 inch of runoff per impervious acre storage shall be provided. This storage is usually obtained by providing checkdams at pipe inlets and/or driveway crossings.

A pea gravel diaphragm and gentle side slopes shall be provided along the top of channels to provide pretreatment for lateral sheet flows.

5.6.4 *Treatment Criteria*

Dry and wet swales should be designed to temporarily store the WQ_v within the facility to be released over a maximum 48 hour duration.

Open channels should have a bottom width no wider than 8 feet to avoid potential gullying and channel braiding.

Dry and wet swales should maintain a maximum ponding depth of one foot at the "mid-point" of the channel, and a maximum depth of 18" at the end point of the channel (for storage of the WQ_v).

Grass channels should be designed to retain the water quality volume in the practice for a minimum of 10 minutes, with no greater than a 1.0 fps velocity.

Please note that the grass channel design is the only practice with a "rate-based" design. The designer determines the peak flow rate from the water quality storm event, and then uses

Manning's equation to ensure that the velocity required to retain flow can be achieved with the channel's cross section and slope.

5.6.5 *Landscaping Criteria*

Wet swales shall not be used for residential developments as they can create potential nuisance or mosquito breeding conditions.

Landscape design shall specify proper grass species and wetland plants based on specific site, soils and hydric conditions present along the channel.

5.6.6 *Ownership of Open Channel Systems*

Ownership of dry swales and grass channels in residential subdivisions accepted by the City shall be vested in the City of Fort Smith with the filing of the final plat. The Developer shall warrant the operation of the drainage system for 2 years after acceptance by the City by a Maintenance Bond provided by the Developer's Contractor or the Developer. The bond shall be required to be extended until 2 years after all phases of the subdivision or development that substantially drain to the dry swale or grass channel are completed.

Ownership of dry swales, grass channels, and wet swales in commercial, industrial, private subdivisions, and non-residential areas shall be vested in the property owner.

Wet swales may not be used in residential subdivisions.

5.6.7 *Maintenance of Open Channel Systems*

When ownership of an open channel system is not vested in the City of Fort Smith, the maintenance responsibility for the system shall be vested with a responsible party by means of a legally binding and enforceable maintenance agreement that is executed as a condition of plan approval or the permitting process.

Open channel systems and grass filter strips should be mowed as required during the growing season to maintain grass heights in the 4 to 6 inches range. Wet swales, employing wetland vegetation, do not require frequent mowing of the channel.

Sediment build-up within the bottom of the channel or filter strip should be removed when 25% of the original WQ_v volume has been exceeded.

5.7 DESIGN CRITERIA – SUBSTANDARD STP'S

Substandard STP's are not considered "stand alone" practices for stormwater treatment, and therefore, the acceptable STP's listed above must be considered first. However, substandard STP's may be used as pretreatment for one of the acceptable STP methodologies listed previously.

Site difficulties may prevent the use of acceptable STP's for treatment, especially with redevelopment projects. When site difficulties prevent the use of the acceptable STP's, combinations of substandard STP's may be utilized to form a "treatment train." This "treatment train" must be able to remove at least 80% of the TSS. Where appropriate, data must be submitted from the manufacturers of substandard STP's documenting the performance capabilities of the structures.

5.7.1 *Dry Extended Detention Ponds*

All of the pond criteria presented in 5.1 GENERAL and 5.2 DESIGN CRITERIA – STORMWATER PONDS also apply to the design of dry extended detention ponds.

5.7.2 *Deep Sump Catch Basins*

The sump shall be no shallower than 24 inches below the invert of the outlet pipe. The deep sump catch basin immediately upstream of the storm drain outfall must also have a hood inside the basin attached to the outlet.

5.7.3 *Other Substandard STP's*

Other substandard STP's shall be designed according to current engineering practice and according to the manufacturers' recommendations, as applicable. All accompanying data and calculations documenting reasonableness of design shall be submitted to the Engineering Department for review and approval.

5.7.4 *Ownership of Substandard STP's*

5.7.4.1 Ownership of Dry Extended Detention Ponds and Deep Sump Catch Basins

Ownership of dry extended detention ponds and deep sump catch basins in residential subdivisions accepted by the City shall be vested in the City of Fort Smith with the filing of the final plat. The Developer shall warrant the operation of the drainage system for 2 years after acceptance by the City by a Maintenance Bond provided by the Developer's Contractor or the Developer. The bond shall be required to be extended until 2 years after all phases of the subdivision or development that substantially drain to the dry extended detention pond or deep sump catch basin are completed.

Ownership of dry extended detention ponds and deep sump catch basins in commercial, industrial, private subdivisions, and non-residential areas shall be vested in the property owner.

5.7.4.2 Ownership of Other Substandard STP's

Public ownership of other substandard STP's within residential subdivisions shall be considered on a "case by case" basis by the Engineering Department. If approved, ownership shall be vested in the City of Fort Smith with the filing of the final plat. The Developer shall warrant the

operation of the drainage system for 2 years after acceptance by the City by a Maintenance Bond provided by the Developer's Contractor or the Developer. The bond shall be required to be extended until 2 years after all phases of the subdivision or development that substantially drain to the STP are completed. If an STP is not approved for public ownership, it may not be used in a residential subdivision.

Ownership of other substandard STP's in commercial, industrial, private subdivisions, and non-residential areas shall be vested in the property owner.

5.7.5 *Maintenance of Substandard STP's*

5.7.5.1 Maintenance of Dry Extended Detention Basins

Dry extended detention basins shall be required to meet all the maintenance requirements found in Section 5.9.4 *Maintenance of Stormwater Ponds.*

5.7.5.2 Maintenance of Other Substandard STP's

When ownership of a substandard STP is not vested in the City of Fort Smith, the maintenance responsibility for the STP shall be vested with a responsible party by means of a legally binding and enforceable maintenance agreement that is executed as a condition of plan approval or the permitting process.

Maintenance requirements for substandard STP's shall be in accordance with manufacturer's recommendations or specifications established by design engineer if the manufacturer's recommendations are unavailable.

5.8 STP SCREENING MATRICES

This section presents matrices that can be used as a screening process for selecting the best STP or group of STPs for a development site. The matrices presented can be used to screen practices in a step-wise fashion. Screening factors include:

- Land Use
- Stormwater Management Capability
- Pollutant Removal

5.8.1 *Land Use*

This matrix (see Figure 5-24) allows the designer to make an initial screen of practices most appropriate for a given land use.

Rural. This column identifies STPs that are best suited to treat runoff in rural or very low density areas.

Residential. This column identifies the best treatment options in medium to high density residential developments.

Roads and Highways. This column identifies the best practices to treat runoff from major roadways and highway systems.

Commercial Development. This column identifies practices that are suitable for new commercial development

Hotspot Land Uses. This last column examines the capability of an STP to treat runoff from designated hotspots. An STP that receives hotspot runoff may have design restrictions, as noted.

Ultra-Urban Sites. This column identifies STPs that work well in the ultra-urban environment, where space is limited and original soils have been disturbed. These STPs are frequently used at redevelopment sites.

5.8.2 *Stormwater Management Capability*

This matrix (see Figure 5-25) examines the capability of each STP option to meet stormwater management criteria. It shows whether an STP can meet requirements for:

Water Quality. The matrix tells whether each practice can be used to provide water quality treatment effectively. For more detail, consult the Pollutant Removal matrix in section 5.8.3.

Recharge. The matrix indicates whether each practice can provide groundwater recharge, however, it should be noted that groundwater recharge is not a requirement.

Channel Protection. The matrix indicates whether the STP can typically provide channel protection storage, however, it should be noted that channel protection is not a requirement.

Quantity Control The matrix shows whether an STP can typically meet the overbank flooding criteria for the site. Again, the finding that a particular STP cannot meet the requirement does not necessarily mean that it should be eliminated from consideration, but rather is a reminder that more than one practice may be needed at a site (e.g., a bioretention area and a downstream stormwater detention pond).

FIGURE 5-24. STP Selection Matrix, Land Use.

STP GROUP	STP DESIGN	Rural	Residential	Roads and Highways	Commercial / High Density	Hotspots	Ultra Urban
Pond	Micropool ED	○	○	○	◗	①	●
	Wet Pond	○	○	○	◗	①	●
	Wet ED Pond	○	○	○	◗	①	●
	Multiple Pond	○	○	◗	◗	①	●
	Pocket Pond	○	◗	○	◗	●	●
Wetland	Shallow Marsh	○	○	◗	◗	①	●
	ED Wetland	○	○	◗	◗	①	●
	Pond/Wetland	○	○	●	◗	①	●
	Pocket Marsh	○	◗	○	◗	●	●
Infiltration	Infiltration Trench	◗	◗	○	○	●	◗
	Shallow T-Basin	◗	◗	◗	◗	●	◗
Filters	Surface Sand	●	◗	○	○	②	○
	Underground SF	●	●	◗	○	○	○
	Perimeter SF	●	●	◗	○	○	○
	Organic SF	●	◗	○	○	②	○
	Pocket Sand Filter	●	◗	○	○	②	○
	Bioretention	◗	◗	○	○	②	○
Open Channels	Dry Swale	○	◗	○	◗	②	◗
	Wet Swale	○	●	○	●	●	●
	Grass Channel	○	◗	○	◗	●	◗

○	Yes. Good option in most cases.
◗	Depends. Suitable under certain conditions, or may be used to treat a portion at the site.
●	No. Seldom or never suitable.
①	Acceptable option, but may require a pond liner to reduce risk of groundwater contamination.
②	Acceptable option, if not designed as an exfilter.

Note: Infiltration practices, filtering practices, and wet swales may not be used in residential subdivsions or developments.

FIGURE 5-25. STP Selection Matrix, Stormwater Management Capability.

STP GROUP	STP DESIGN	WATER QUALITY?	RECHARGE?	CHANNEL PROTECTION?	FLOOD CONTROL?
Pond	Micropool ED	○	●	○	○
	Wet Pond	○	●	○	○
	Wet ED Pond	○	●	○	○
	Multiple Pond	○	●	○	○
	Pocket Pond	○	●	○	○
Wetland	Shallow Marsh	○	●	○	○
	ED Wetland	○	●	○	○
	Pond/Wetland	○	●	○	○
	Pocket Marsh	○	●	○	❷
Infiltration	Infiltration Trench	○	○	❷	❸
	Shallow I-Basin	○	○	❷	❸
Filters	Surface Sand	○	❶	❷	●
	Underground SF	○	●	●	●
	Perimeter SF	○	●	●	●
	Organic SF	○	❶	●	●
	Pocket Sand Filter	○	❶	●	●
	Bioretention	○	❶	❷	●
Open Channels	Dry Swale	○	❶	●	●
	Wet Swale	○	●	●	●
	Grass Channel	❷	❷	●	●

○	Practice generally meets this stormwater management goal.
●	Practice can almost never be used to meet this goal.
❶	Provides recharge only if designed as an exfilter system.
❷	Practice may partially meet this goal, or under specific site and design conditions.
❸	Can be used to meet flood control in rare conditions, with very cobbly or highly infiltrative soils.

Note: Only stormwater ponds and wetlands may be used in residential subdivisions or developments for flood control. Only stormwater ponds, wetlands, dry swales, and grass channels may be used in residential subdivisions or developments for water quality.

5.8.3 *Pollutant Removal*

This matrix (see Table 5-2) examines the capability of each STP option to remove specific pollutants from stormwater runoff. The matrix includes data for:

- Total Suspended Solids
- Total Phosphorous
- Total Nitrogen
- Metals
- Bacteria

TABLE 5-2. STP Selection Matrix, Pollutant Removal Efficiencies.

STP Selection Matrix. Pollutant Removal (Acceptable STP's)					
STP Group	**TSS**	**TP**	**TN**	**Metals[1]**	**Bacteria**
Ponds	80	51	33	62	70
Wetlands	76	49	30	42	78[2]
Filters[3]	86	59	38	69	37[2]
Infiltration	95[2]	70	51	99[2]	N/A
Open Channels [4]	81	34[2]	84[2,5]	61	-25[2]
(Sub-Standard STP's)					
STP Group	**TSS**	**TP**	**TN**	**Metals[1]**	**Bacteria**
Dry Extended Detention Ponds	61	19	31	26-54	N/A
Deep Sump Catch Basins	32	N/A	N/A	N/A	N/A
Water Quality Inlets[7]	35	5	20	5	N/A
Hydrodynamic Structures[7]	21	17	5[6]	17	N/A
Filter Strips (75 ft width)	54	-25	-27[6]	47	N/A
Filter Strips (150 ft width)	84	40	20[6]	55	N/A

1: Average of zinc and copper. Zinc only for infiltration and sub-standard STP's.
2: Based on fewer than five data points.
3: Excludes vertical sand filters and filter strips.
4: Highest removal rates for dry swales

5: No data available for grass channels 6: Nitrate + Nitrite 7: Percentages will vary. Refer to manufacturer for specific removal percentages. N/A: Not applicable. Data not available

5.9 STORMWATER CREDITS

The purpose of the stormwater credit system is to provide incentive to developers, engineers, and builders to implement better site design and locate new development in a manner that causes less impact to aquatic resources. By taking advantage of the credit system, developers and builders can reduce the stormwater management quality requirements. The credit system directly translates into cost savings to the developer by reducing the water quality volume that has to be captured and treated.

This section presents two broad types of credits: Site Design Credits and Watershed Credits. Site design credits act as incentives to encourage *Better Site Design* techniques by reducing required water quality volumes on site. Watershed credits are reductions or exemptions from stormwater management requirements to support watershed goals such as redevelopment or watershed zoning.

5.9.1 *Site Design Credits*

Site design credits allow developers to reduce or eliminate requirements for *Water Quality* in exchange for implementation of these non-structural site design elements. The credits are calculated as volumes that are based on the fraction of the total site area or site impervious area affected by the credit.

Specific design credits detailed in this section include the following:

- Conservation of Natural Areas
- Reforestation
- Rooftop Disconnection
- Non-Rooftop Disconnection
- Green Rooftops

5.9.1.1 Conservation of Natural Areas

This stormwater credit rewards protection of natural vegetation or critical resource areas on site. This credit may be given when natural areas are conserved at development sites, thereby retaining their pre development hydrologic and water quality characteristics. Examples of natural area conservation areas include:

- forest retention areas
- jurisdictional wetlands

- other lands in protective easement (floodplains, open space, steep slopes)

Under the credit, a designer can subtract conservation areas from total site area when computing the water quality volume.

The credit for the water quality volume can be based on the site area in natural conservation, such that:

$$C_{WQ} = (A_{NA}/A)(WQ_v) \quad (5.13)$$

Where:

C_{WQ} = Natural Area Credit for Water Quality (ac-ft)
A_{NA} = Natural Conservation Area (acres)
A = Total Site Area (acres)
WQ_v = Original Water Quality Volume (ac-ft)

The water quality volume can then be reduced by the value of C_{WQ}. The example in Figure 5-26 illustrates how this credit would be applied.

5.9.1.2 Reforestation

This credit is similar to the credit for *Conservation of Natural Areas*, except that it rewards active reforestation, rather than preservation of existing forest. This credit can apply to both *reforestation* and *afforestation*. The credit for afforestation shall be weighted higher because the afforestation implies a net increase of forest cover on the site, while reforestation only compensates for trees cleared on site.

A reforestation credit shall be applied where tree planting is used to supplement existing tree cover, or to compensate for forest cleared during development. The areas in reforestation and afforestation can be applied to water quality volumes.

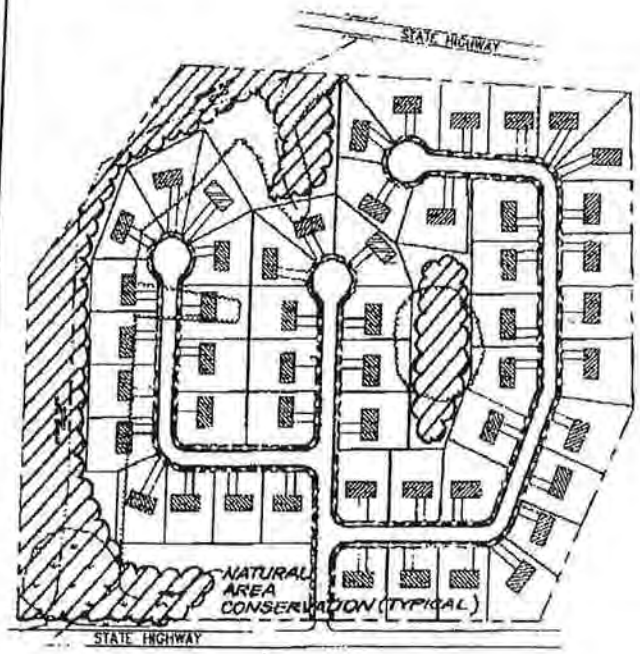
In order to receive credit, the following criteria must be met:

- Tree species used for afforestation or reforestation shall be native to the City of Fort Smith, and selected from a list of approved species established by the Parks Department.
- Reforestation shall be guaranteed with a performance bond, letter of credit, or similar surety measure. The bond shall be returned after two successful growing seasons.
- Plantings shall be from nursery stock, at a minimum of 1.5" diameter at chest height.

Natural Area Conservation Credit Example

Site Data: 51 Single Family Lots
Area = 38 ac
Conservation Area = 7.0 ac

Original WQ_v = 1.08 ac-ft



Computation of Stormwater Credits

$C_{WQ} = (7.0 / 38)(1.08 \text{ ac-ft}) = 0.20 \text{ ac-ft}$

$WQ_v = 1.08 \text{ ac-ft} - 0.20 \text{ ac-ft} = 0.88 \text{ ac-ft}$

FIGURE 5-26. Example, Natural Area Conservation Credit.

The credit for the water quality volume can be expressed based on the area in reforestation and afforestation, such that:

$$C_{WQ} = (1.5A_A+0.5A_R)/A)(WQ_v) \quad (5.14)$$

Where:

C_{WQ} = Reforestation Credit for Water Quality (ac-ft)
A_A = Afforestation Area (acres)
A_R = Reforestation Area (acres)
A = Total Site Area (acres)
WQ_v = Original Water Quality Volume (ac-ft)

The water quality volume can then be reduced by the value of C_{WQ}. The example in Figure 5-27 illustrates how this credit would be applied.

5.9.1.3 Rooftop Disconnection

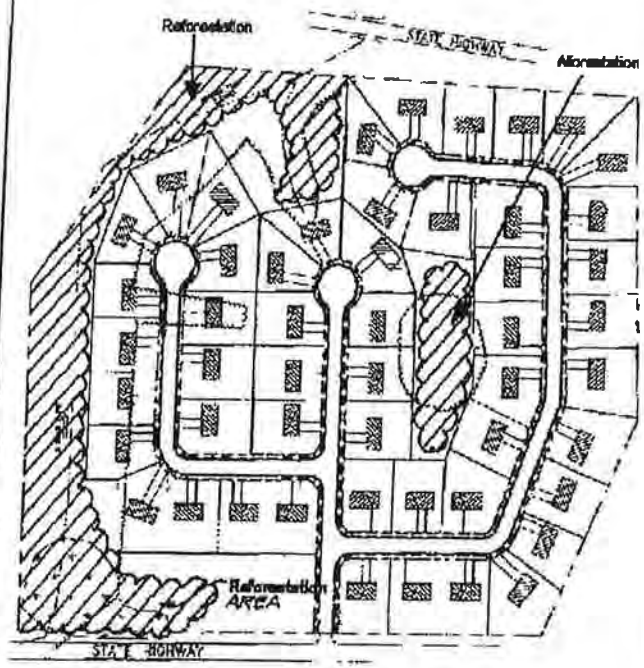
This credit can be applied to encourage disconnection of rooftops, thus promoting overland treatment of these surfaces. Credits can be applied to water quality requirements. In order to receive the credit, disconnections must meet the following criteria:

- The rooftop cannot be a designated hotspot.
- Disconnection must ensure no basement seepage.
- The contributing length of rooftop to a discharge location shall be 75 feet or less.
- The rooftop contributing area shall be no more than 1,000 sq. feet per disconnection.
- The length of the "disconnection" shall be equal to or greater than the contributing rooftop length.
- Disconnections will only be credited for residential lot sizes greater than 6000 sq. ft.
- The entire vegetative "disconnection" shall be on a slope less than or equal to 3.0%.
- The disconnection must drain continuously through a vegetated channel, swale, or through a filter strip to the property line or STP.
- Downspouts must be at least 10 feet away from the nearest impervious surface to discourage "re-connections."
- Disconnections are encouraged on relatively permeable soils (HSGs A and B) without soil testing.
- In less permeable soils (HSGs C and D), the water table and permeability shall be tested by a geotechnical engineer to determine if a spreading device is needed to provide sheetflow over grass surfaces. In some cases, dry wells, french drains or other temporary underground storage devices may be needed to compensate for a poor infiltration capability.
- For those rooftops draining directly to a stream buffer, one can only use either the rooftop disconnection credit or the stream buffer credit, not both.

Reforestation Credit Example

Site Data: 51 Single Family Lots
Area = 38 ac
Reforestation Area = 5.0 ac
Afforestation Area = 2.0 ac
Impervious Area = 13.8 ac

Original WQ_v = 1.08 ac-ft



Computation of Stormwater Credits

C_{WQ} = [((1.5 x 2.0 ac) + (0.5 x 5.0 ac)) / 38ac] x 1.08 ac-ft = 0.16 ac-ft

WQ_v = 1.08 ac-ft – 0.16 ac-ft = 0.92 ac-ft

FIGURE 5-27. Example, Reforestation Credit.

The water quality credit can be calculated with the following equation:

$$C = (A_{DR}/A_I)WQ_v \quad (5.15)$$

Where:

C = Rooftop Disconnection Credit (ac-ft)
A_{DR} = Disconnected Roof Area (acres)
A_I = Site Impervious Area (acres)
WQ_v = Original Water Quality Volume.

The water quality volume would both be reduced by the credit (C). The example in Figure 5-28 illustrates how this credit would be applied.

FIGURE 5-28. Example, Rooftop Disconnection Credit.

Rooftop Disconnection Credit Example

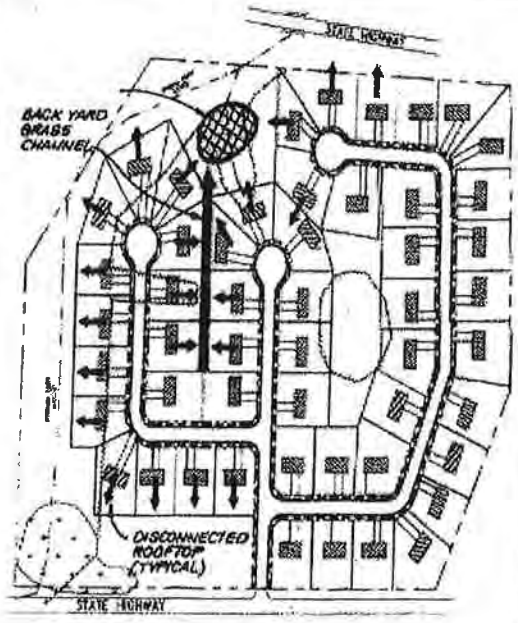
Site Data: 51 Single Family Lots
Area = 38 ac
Original Impervious Area = 13.80 ac

# of Disconnected Rooftops = 22
Original WQ_v = 1.08 ac-ft

22 Lots Disconnected (2500 sq ft each)

Net impervious area reduction

(22)(2500) / (43560) = 1.3 ac



Computation of Stormwater Credits

C = (1.3 / 13.8)(1.08 ac-ft) = 0.10 ac-ft

WQ_v = 1.08 ac-ft – 0.10 ac-ft = 0.98 ac-ft

5.9.1.4 Non-Rooftop Disconnection

This credit is applied to credit disconnection of other impervious surfaces by encouraging drainage to overland treatment such as swales or filter strips. In order to receive the credit, disconnections must meet the following criteria:

- The maximum contributing impervious flow path length shall be 75 feet.
- Runoff cannot come from a designated hotspot.
- The disconnection must drain continuously through a vegetated channel, swale, or filter strip to the property line or STP.
- The length of the "disconnection" must be equal to or greater than the contributing length.
- The entire vegetative "disconnection" shall be on a slope less than or equal to 3.0%.
- The surface imperviousness area to any one discharge location cannot exceed 1,000 ft^2.
- Disconnections discharging over relatively permeable soils (HSGs A and B) do not require geotechnical testing.
- If the site has less impermeable soils (HSGs C and D), testing by a geotechnical engineer is needed to determine if a spreading device, such as a french drain, gravel trench or other temporary storage device is needed to compensate for poor infiltration capability.

The water quality credit can be calculated with the following equation:

$$C = (A_D/A_I)WQ_v \tag{5.16}$$

Where:

C = Non-Rooftop Credit (ac-ft)
A_D = Disconnected Impervious Area (acres)
A = Total site area (acres)
A_I = Site Impervious Area (acres)
WQ_v = Original Water Quality Volume.

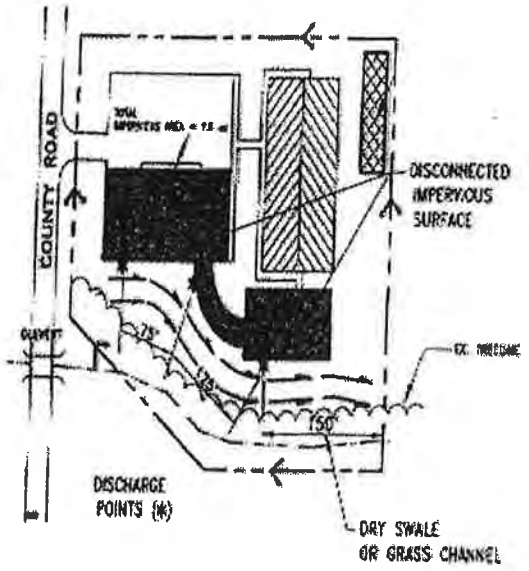
The water quality volume can then be reduced by the credit (C). The example in Figure 5-29 how this credit would be applied.

Non-Rooftop Disconnection Credit Example

Site Data: Community Center
Area = 3.0 ac
Original Impervious
Area = 1.9 ac = 63.3%

Original $WQ_v = 6{,}752\ ft^3$

0.8 ac of surface
imperviousness disconnected



Computation of Stormwater Credits

$C = (0.8 / 1.9)(6{,}752\ ft^3) = 2{,}843\ ft^3$

$WQ_v = 6{,}752\ ft^3 - 2{,}843\ ft^3 = 3{,}909\ ft^3$

FIGURE 5-29. Example, Non-Rooftop Disconnection Credit.

5.9.1.5 Green Rooftop Credit

The term "green rooftops" refers to a few practices that detain and treat stormwater runoff on rooftops using vegetation on the roof surface. Several different options exist, including variations on the type of vegetation used, and the specific design of the green roof. The criteria presented below are adapted from the Portland Stormwater Manual criteria for the Eco-Roof. In order to receive the credit, green rooftops must meet the following criteria:

- The system shall include a 6" soil bed, with a silt loam texture.
- The soil bed shall be underlain with a 2" gravel layer, and these two layers shall be separated by a layer of filter fabric.
- An impermeable layer shall be placed between the rooftop and the gravel layer.
- The roof shall have a maximum slope of 25%
- The roof shall be designed to hold an additional 25 lbs/sf, beyond minimum regional design criteria
- Vegetation shall be established within two growing seasons.
- Vegetation should require minimal fertilization, watering and pesticides.
- A 2" mulch layer shall be immediately placed above the soil layer to prevent erosion.
- The vegetation and mulch layer shall be maintained at least quarterly, removing dead vegetation and eroded mulch.
- If the rooftop is used as an amenity (e.g., a rooftop sitting area) as well as to detain stormwater, credit shall only be applied to pervious sections of the rooftop.
- The credit shall only apply for businesses where owners sign a maintenance agreement.

The water quality credit can be calculated with the following equation:

$$C = (A_{GR}/A_I)WQ_v \quad (5.17)$$

Where:

C = Green Rooftop Credit (ac-ft)
A_{GR} = Green Rooftops (acres)
A_I = Site Impervious Area (acres)
WQ_v = Original Water Quality Volume (ac-ft)

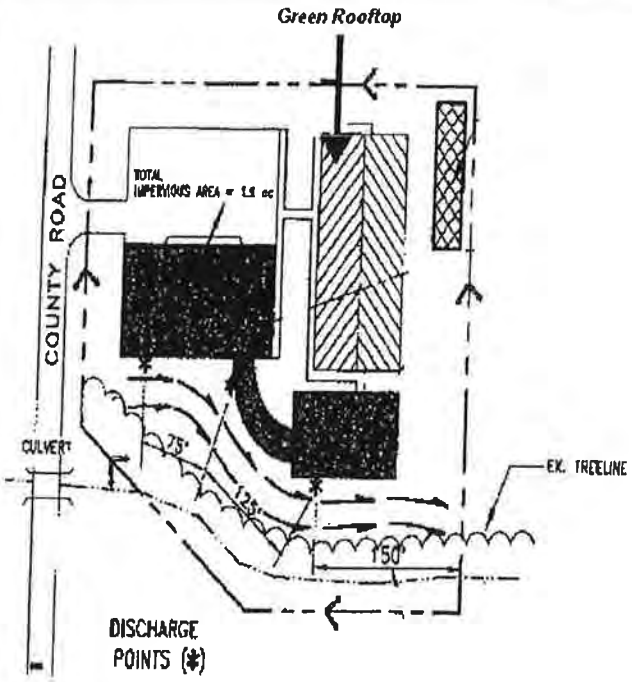
The water quality volume is then reduced by the credit, C. The example in Figure 5-30 illustrates how this credit would be applied.

Green Rooftop Credit Example

Site Data: Community Center
Area = 3.0 ac
Original Impervious
Area = 1.9 ac = 63.3%

Original $WQ_v = 6{,}752\ ft^3$

0.5 ac of green rooftops



Computation of Stormwater Credits

$C = (0.5 / 1.9)(6{,}752\ ft^3) = 1{,}777\ ft^3$

$WQ_v = 6{,}752\ ft^3 - 1{,}777\ ft^3 = 4{,}975\ ft^3$

FIGURE 5-30. Example, Green Rooftop Credit.

5.9.2 *Watershed Credits*

Watershed credits focus on the location of the development, rather than on the design of the site. They reward developers who locate in areas that result in less impact to water resources by encouraging development in already urbanized or highly degraded areas. Three watershed credits are presented in this section:

- Watershed Zoning
- Infill
- Redevelopment

5.9.2.1 Watershed Zoning

This credit reduces stormwater management requirements in developments that support a strategy of *watershed zoning* by locating in subwatersheds that are designated as *non-supporting*. A watershed Zoning Credit can be awarded to developments that meet the following criteria:

- Must be located in a subwatershed with greater than 25% impervious cover
- Shall not contribute more than 5% impervious cover to the subwatershed, or to the drainage of any 2nd order or larger stream.

The water quality credit received is a function of the impervious cover fraction in the subwatershed, times the water quality volume. This credit will not be given if the development is located in a watershed that discharges directly to a stream with a published Total Maximum Daily Load (TMDL). Furthermore, this credit will not be given if it is found that the development will impact a relatively high quality reach within the subwatershed.

5.9.2.2 Infill Credit

The infill credit acts as an incentive for developing infill lots, as opposed to greenfields away from existing development. Infill development results in lower infrastructure costs, fewer miles driven, and a net reduction in impervious cover creation when compared with greenfield development.

An infill credit can be applied to all sites that are built within the current sewer envelope, and are smaller than 5 acres for residential development, and 2 acres for commercial or industrial uses. Sites that meet these criteria can receive a 20% water quality credit. This credit will not be given if the development is located in a watershed that discharges directly to a stream with a published TMDL. Furthermore, this credit will not be given if it is found that the development will impact a relatively high quality reach within the subwatershed.

5.9.2.3 Redevelopment Credit

The redevelopment credit encourages development on sites that have previous commercial, industrial, or residential land use. The credit allows reduction in required treatment and

management volumes, depending on the existing conditions at the site. For redevelopment projects, treatment is only required for the additional stormwater generated on site.

The redevelopment credit may be awarded for all redevelopment sites. The water quality credit is based on pre-developed impervious cover. The credit can be expressed as:

$C = I_P WQ_v$
Where:
C = Credit (ac-ft)
I_P = Pre-Developed Impervious Cover

This credit can then be subtracted from the water quality volume.

Redevelopment Credit Example
Consider a site with a pre-developed impervious cover of 25% and a water quality volume of 10,000 ft^3.
Redevelopment Credit Calculation $C = (10{,}000\ ft^3)(25\%) = 2{,}500\ ft^3$ $WQ_v = 10{,}000\ ft^3 - 2{,}500\ ft^3 = 7{,}500\ ft^3$

It should be noted that stormwater treatment is not required for redevelopment projects less than one acre in size or projects where the impervious area will not be increased.

5.10 REFERENCES

(1) American Public Works Association, Kansas City Metropolitan Chapter. *Division V, Construction and Material Specifications, Section 5600 Storm Drainage Systems and Facilities.* February 2006.

(2) Arkansas Soil and Water Conservation Commission. *Title VII, Rules Governing Design and Operation of Dams.* October 1993.

(3) Brater, E. F. and H. W. King. *Handbook of Hydraulics.* 6th edition. McGraw Hill Book Company, New York, NY, 1976.

(4) Chow, V. T. *Open Channel Hydraulics.* McGraw Hill Book Company, New York, 1959.

(5) City of Austin, TX. 1988. Water Quality Management. Environmental Criteria Manual. Environmental and Conservation Services. Austin, TX.

(6) Claytor, R.A., and T.R. Schueler. 1996. Design of Stormwater Filtering Systems. The Center for Watershed Protection, Silver Spring, MD.

(7) Galli, F. 1990. Peat-Sand Filters: A Proposed Stormwater Management Practice for Urban Areas. Metropolitan Washington Council of Governments. Washington, DC.

(8) US Soil Conservation Service (SCS). August 1981. Technical Release No. 60, "Earth Dams and Reservoirs", as Class "C" structures.

(9) Washington State Department of Ecology (WSDE). 1992. Stormwater Management Manual for the Puget Sound Basin. Olympia, WA.

APPENDIX 5A

40 CFR 122.26(b)(14) Subpart (i) – (xi)

(Source: ADEQ)

INDUSTRIAL FACILITIES THAT MUST SUBMIT APPLICATIONS FOR STORM WATER PERMITS

40 CFR 122.26(B)(14) Subpart	Description	
(i)	Facilities subject to storm water effluent limitations guidelines, new source performance standards, or toxic pollutants effluent standards under 40 CFR, Subchapter N [except facilities which are exempt under category (xi)].	
(ii)	Facilities classified as:	
	SIC 24 (EXCEPT 2434)	Lumber and Wood Products
	SIC 26 (EXCEPT 265 and 267)	Paper and Allied Products
	SIC 28 (EXCEPT 283 and 285)	Chemicals and Allied Products
	SIC 29	Petroleum and Coal Products
	SIC 311	Leather Tanning and Finishing
	SIC 32 (except 323)	Stone, Clay and Glass Products
	SIC 33	Primary Metal Industries
	SIC 3441	Fabricated Structural Metal
	SIC 373	Ship and Boat Building and Repairing

40 CFR 122.26(B)(14) Subpart	Description
(iii)	Facilities classified as SIC 10 through 14, including active or inactive mining operations and oil and gas exploration, production, processing, or transmission facilities that discharge storm water contaminated by contact with, or that has come into contact with, any overburden, raw material, intermediate products, finished products, byproducts, or waste products located on the site of such operations. SIC 10 Metal Mining SIC 11 Anthracite Mining SIC 12 Coal Mining SIC 13 Oil and Gas Extraction SIC 14 Nonmetallic Minerals, except Fuels
(iv)	Hazardous waste treatment, storage, or disposal facilities, including those that are operating under interim status or a permit under Subtitle C of the Resource Conservation and Recovery Act (RCRA).
(v)	Landfills, land application sites, and open dumps that receive or have received any industrial wastes including those that are subject to regulation under subtitle D or RCRA.

40 CFR 122.26(B)(14) Subpart	Description
(vi)	Facilities involved in the recycling of material, including metal scrap yards, battery reclaimers, salvage yards, and automobile junkyards, including but limited to those classified as: SIC 5015 — Motor Vehicle Parts, Used SIC 5093 — Scrap and Waste Materials
(vii)	Steam electric power generating facilities, including coal-handling sites.
(viii)	Transportation facilities which have vehicle maintenance shops, equipment cleaning operations, or airport de-icing operations. Only those portions of the facility that are either involved in vehicle maintenance (including vehicle rehabilitation, mechanical repairs, fueling, and lubrication), equipment cleaning operations, or airport de-icing operations, or which are otherwise listed in another category, are included. SIC 40 — Railroad Transportation SIC 41 — Local Suburban Transit SIC 42 (except 4221-25) — Motor Freight and Warehousing SIC 43 — U.S. Postal Service SIC 44 — Water Transportation SIC 45 — Transportation by Air SIC 5171 — Petroleum Bulk Stations and Terminals

40 CFR 122.26(B)(14) Subpart	Description
(ix)	Treatment works treating domestic sewage or any other sewage sludge or wastewater treatment device or system, used in the storage, treatment, recycling, and reclamations of municipal or domestic sewage, including lands dedicated to the disposal of the sewage sludge that are located within the confines of the facility, with a design flow of 1.0 million gallons per day or more, or required to have an approved pretreatment program under 40 CFR Part 403. Not included are farm lands, domestic gardens, or lands used for sludge management where sludge is beneficially reused and which are not physically located in the confines of the facility, or areas that are in compliance with Section 405 of the Clean Water Act.
(x)	Construction activity including clearing, grading, and excavation activities except operations that result in the disturbance of less than 5 acres of total land area and those that are not part of a larger common plan of development or sale. *

40 CFR 122.26(B)(14) Subpart	Description	
(xi)	Facilities under the following SICs [which are not otherwise included in categories (ii)-(x)], including only storm water discharges where material handling equipment or activities, raw materials, intermediate products, final products, waste materials, byproducts, or industrial machinery are exposed to storm water. *	
	SIC 20	Food and Kindred Products
	SIC 21	Tobacco Products
	SIC 22	Textile Mill Products
	SIC 23	Apparel and Other Textile Products
	SIC 2434	Wood Kitchen Cabinets
	SIC 25	Furniture and Fixtures
	SIC 265	Paperboard Containers and Boxes
	SIC 267	Converted Paper and Paper Board Products (except containers and boxes)
	SIC 27	Printing and Publishing
	SIC 283	Drugs
	SIC 285	Paints, Varnishes, Lacquer, Enamels
	SIC 30	Rubber and Misc. Plastics Products
	SIC 31 (except 311)	Leather and Leather Products
	SIC 323	Products of Purchased Glass
	SIC 34 (except 3441)	Fabricated Metal Products
	SIC 35	Industrial Machinery and Equipment, except Electrical
	SIC 36	Electronic and Other Electric Equipment
	SIC 37 (except 373)	Transportation Equipment

40 CFR 122.26(B)(14) Subpart	Description	
	SIC 38	Instruments and Related Products
	SIC 39	Miscellaneous Manufacturing Industries
	SIC 4221	Farm Products Warehousing and Storage
	SIC 4222	Refrigerated Warehousing and Storage
	SIC 4225	General Warehousing and Storage

Source: Federal Register, Volume 55, Number 222, Page 48065, November 16, 1990.

* On June 11, 1992, the U.S. Court of Appeals for the Ninth Circuit remanded the exemption for construction sites of less than five acres in Category (x) and for manufacturing facilities in category (xi) which do not have materials or activities exposed to storm water to the EPA for further rulemaking. (Nos. 90-70671 & 91-70200).