



Stormwater Drainage Design and Stormwater Quality Control Regulations

CHAPTER 9—STORM DRAINAGE DESIGN AND STORMWATER QUALITY REGULATIONS

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Chapter 9—STORM DRAINAGE DESIGN AND STORMWATER QUALITY REGULATIONS

This Chapter presents the storm drainage design and technical criteria for storm drainage facilities. Applications for various types of land use applications such as subdivision plats, conditional use permits that include development, phased multi-year build outs, and commercial/industrial building permits submitted for County approval will require storm drainage system analysis, downstream conveyance system analysis, and appropriate drainage system design. The following information should be viewed as minimum requirements. Changes to these standards must receive prior written approval from the County.

9-01 STORM DRAINAGE DESIGN AND TECHNICAL CRITERIA

9-01-01 GENERAL

The County adopted the following design standards, criteria, and policies for all storm drainage management and should be used in the design and analysis of all storm drainage facilities. The County reserves the right to issue and enforce more stringent criteria should adverse conditions exist. All designs that vary from the standards and criteria presented in this Chapter, shall obtain approval from the Director of the Public Works Department prior to completing construction plans and/or analysis reports.

The provisions for adequate drainage are necessary to preserve and promote the general health, welfare, and economic wellbeing of the region. Drainage is a regional feature that affects all governmental jurisdictions and all parcels of property. When planning drainage facilities, the following policies and criteria are to be used in directing your effort.

Standards and technical criteria not specifically addressed in this Section shall follow the provisions of the Mile High Flood District (MHFD) (Formerly Urban Drainage and Flood Control District - UDFCD) "Urban Storm Drainage Criteria Manual" (Manual, or referred to as Volume 1, 2, or 3), as amended. In addition, the engineer should refer to the Colorado Department of Transportation Standard Plans (M&S Standards), as amended, for additional design details not covered in this Chapter.

9-01-02 REQUIRED DESIGN SUBMITTALS

Drainage Plans submitted to the County for review shall contain a detailed hydrologic analysis and comprehensive drainage design in accordance with these criteria and other applicable standards (local, state, and federal). Prior to receiving approval, the final Drainage Plans must be sealed and signed by a Colorado Registered Professional Engineer. Drawings submitted without being signed and sealed will not be reviewed.

All preliminary and final drainage plans and reports shall include certification statements regarding engineered plans and construction. Copies of these certification statements are included in the Appendices of these regulations.

Table 9.1 presents the minimum level of storm drainage study to be prepared and submitted to the County for approval. Based on the application and size of the project being submitted, the level of analysis and design detail required varies and can be determined by the checklist (see Appendices) in the application package and/or by contacting the County. All required information is to be submitted for County review prior to receiving an approved application or permit.

Table 9.1—Level of Storm Drainage Study

Type of Application	*Expected Increase in Impervious Area or Re-development of Existing Impervious Area	Level of Storm Drainage Study (SDS) & Plan
Commercial/Industrial Building Permits, Apartment/Condominium/Town home Complexes	3,000-10,000 square feet	Level 2 – SDS
	>10,000 square feet	Level 3 – SDS
Residential Plats and/or Planned Unit Developments	500-3,000 square feet	Level 1 – SDS
	3,000-10,000 square feet	Level 2 – SDS
	>10,000 square feet	Level 3 – SDS
All Other Plats and/or Planned Unit Developments	3,000-10,000 square feet	Level 2 – SDS
	>10,000 square feet	Level 3 – SDS
Multi-year build out developments	N/A	Develop a Master SDS for the full build out and updated prior to each filing.
Change-in-materials Application	500-3,000 square feet	Level 1 – SDS
	3,000-10,000 square feet	Level 2 – SDS
	>10,000 square feet	Level 3 – SDS
<p>The County may impose an SDS (also referred to as a Grading and Drainage Plan) for any type of application if it is determined the new drainage will have significant impacts on adjacent properties.</p> <p>The County may grant administrative relief from the criteria if the increase in impervious area is less than 5% of the overall development and if the nature of the work applied for meets the intent of these standards and specifications. Such relief shall be based upon technical justification, sealed by a Colorado Registered Professional Engineer, submitted with the SDS. Such relief does not include installation of water quality treatment facilities, as required under Section 9-04 Post-construction Run-off Regulations.</p> <ul style="list-style-type: none"> • An “increase in impervious area” refers to an increase in new impervious area above historic, undeveloped conditions, as well as impervious area proposed due to re-development of existing impervious areas that do not meet current drainage detention and water quality standards. No credit is to be given for existing impervious surfaces/areas. 		

9-01-03 POLICIES AND GENERAL REQUIREMENTS

9-01-03-01 SPACE PLANNING

Stormwater drainage facilities serve conveyance, water quality and storage functions for management of stormwater. When a channel is planned as a conveyance feature, an outlet as well as downstream storage structure is required.

Therefore, during the review process and prior to approval, the County will require the submission of all appropriate information to insure:

- 1) Adequate space is properly allocated for drainage facilities,
- 2) There are no conflicts with other land uses that result in downstream water damage or impairment of runoff from upstream properties,
- 3) There is no impairment with the functionality of other urban systems.

9-01-03-02 MULTI-USE RESOURCE

Stormwater runoff is an urban resource and potentially has many beneficial uses. However, runoff is a limited resource; quality aspects of the water become important and should be planned for in the design of storm drainage management facilities. Therefore, during the review process and prior to approval, the County will encourage stormwater runoff to be considered as a multi-use resource and require a reflection of this philosophy in all submitted designs.

9-01-03-03 WATER RIGHTS

The Developer is responsible to ensure that water rights are not impacted as a result of a proposed project.

9-01-03-04 REGISTRATION OF STORM DRAINAGE FACILITIES

All flood control drainage facilities that detain stormwater must be registered on the State-wide Notification Compliance Portal (SNCP). It is the responsibility of the Engineer of Record to register the drainage facility on the SNCP. The drainage facility must be registered on the SNCP when the facility becomes operational and prior to the engineer of record submitting the final facility's drainage certification to the County. The County is required by the State of Colorado to verify the registration of the drainage facility within 30 days of posting.

9-01-03-05 IRRIGATION DITCH CROSSINGS

Various privately owned irrigation ditches and canals traverse the County. It is the policy of the County that irrigation ditches are not acceptable as drainage recipients or as part of a drainage plan.

9-01-03-06 JURISDICTIONAL BOUNDARIES

Since drainage considerations and problems are regional in nature, and do not respect jurisdictional boundaries, the County will emphasize regional cooperation in all submitted designs.

9-01-03-07 BASIN TRANSFER

Colorado drainage law recognizes the difficulties of transferring the burden of managing storm drainage from one location or property to another. Liability questions may also arise when the historic drainage is altered. Therefore, during

the review process and prior to approval, the County will discourage the diversion of storm runoff from one basin to another unless specific and/or prudent reasons justify such a transfer. In such cases the proponent will need to demonstrate and provide facilities to insure no increase in flood damage potential from any level of runoff event.

9-01-03-08 MASTER DRAINAGE PLAN

Drainage boundaries are non-jurisdictional and regional cooperation is required to receive approval for all new development or re-development projects. Therefore, the County has and will continue to participate in future regional master drainage plans to define the major drainageway facilities. Potential fees may be imposed to cover the cost of master drainage plan preparation in unplanned basins being proposed for new development and/or redevelopment. Master Drainage Plans are adopted from time to time by the BoCC through resolution.

Whenever a Master Drainage Plan exists, its recommendations shall be followed to the maximum extent possible.

9-01-03-09 PUBLIC IMPROVEMENTS

During the review process and prior to approval, the County may require that new development and/or redevelopment projects participate in public improvements proposed in developed drainage reports and construction plans, direct flow areas, outfall systems plans, and Master Drainage Plans for both local drainage systems (i.e., curb and gutter, inlets and storm sewers, culverts, bridges, swales, ditches, channels, detention areas, and other drainage facilities within the development) and major drainageway systems (i.e., channels, storm sewers, bridges, detention areas, and other facilities serving more than the subdivision or property in question).

9-01-03-10 FLOODPLAIN MANAGEMENT

As part of its zoning resolutions, the County has adopted floodplain regulations necessary to preserve and promote the general health, welfare, and economic wellbeing of the region. The general purposes of floodplain regulations are summarized as follows:

- 1) To reduce the hazard of floods to life and property;
- 2) To protect and preserve hydraulic characteristics of watercourses used for conveyance of floodwaters;
- 3) To protect the public from the extraordinary financial expenditures for flood control and relief; and
- 4) To promote the multipurpose resource concept, previously outlined, with the intent to provide and preserve quality open space, trails, and tree lines.

These regulations are presented in Chapter 3 of these standards and regulations. It is the responsibility of the designer to comply with the most current zoning and floodplain regulations.

9-01-03-11 RETENTION

Retention is not allowed.

9-01-03-12 DETENTION AND WATER QUALITY

The County considers storm runoff detention to be a viable method for reducing overall (construction and maintenance) urban drainage degradation. Temporarily detaining a stormwater runoff can significantly reduce downstream flood hazards as well as pipe and channel requirements in urban areas. In addition, the storage of runoff provides for sediment and debris collection, which enhances downstream water quality. However, all benefits can only be obtained through consistent administration of detention and water quality policies. Therefore, during the review process and prior to approval, the County will require all new applicable development and/or redevelopment projects include onsite detention and water quality treatment. The minimum capacity and maximum release rates for the 5-year and 100-year recurrence interval storms will be determined by procedures and criteria presented in this Chapter.

The County does not allow the use of parking lots as detention structures.

The treatment of stormwater quality from surface runoff is required by Section 9-04, as well as in regulations by federal and state agencies. Developers shall meet the minimum design standards listed in Section 9-04 by calculating the Water Quality Capture Volume as set forth in Volume 3, Chapter 3, Section 3, "Calculation of the Water Quality Capture Volume" of the Mile High Flood District's Urban Storm Drainage Criteria Manual, as amended.

9-01-03-13 POST-CONSTRUCTION STORMWATER QUALITY TREATMENT FACILITIES

In accordance with Adams County's Municipal Separate Storm Sewer (MS4) Permit, Adams County is mandated to require that development/redevelopment sites that disturbs (1) one acre or greater within unincorporated Adams County MS4 Area, or sites that disturbs less than one (1) acre but are part of a larger common plan of development or sale larger than one (1) or more acres, shall implement an allowed form of permanent stormwater quality treatment facilities to treat and reduce stormwater pollutants that leaves such site. Refer to Section 9-04 Post-construction Run-off Regulations.

9-01-03-14 LOW IMPACT DEVELOPMENT (LID) STANDARDS AND REQUIREMENTS

All construction projects shall reduce drainage impacts to the maximum extent practicable. Development and re-development projects shall incorporate the four (4)-step-design-process described on the Urban Drainage Criteria Manual, and implement practices such as:

1. On-site structural and non-structural BMPs to promote infiltration, evapotranspiration or use of stormwater,

2. Minimization of Directly Connected Impervious Area (MDCIA),
3. Green Infrastructure (GI),
4. LID techniques,
5. Preservation of natural drainage systems that result in the infiltration, evapotranspiration or use of stormwater in order to protect water quality and aquatic habitat.
6. Use of vegetation, soils, and roots to slow and filter stormwater runoff.
7. Management of stormwater as a resource rather than a waste product by creating functional, attractive, and environmentally friendly developments.
8. Treatment of stormwater flows as close to the impervious area as possible.
9. Other innovative measures to reduce runoff volume and protect water quality.

Examples:

- Bioretention/rain gardens
- Pervious pavers
- Green roofs
- Detached sidewalks/walkways
- Dry wells to promote groundwater infiltration
- Disconnection of roof downspouts
- Above or ground-level infiltration planters
- Street bump-outs infiltration planters
- Below ground cistern or above ground rain barrels to harvest rainwater from residential single-family home's roof tops. Not to exceed storage capacity of 110 gallons due to Water Right's regulations.
- Residential green driveways
- Tree trench/pit
- Tree canopy increase
- Green alleys
- Green street gutters
- Street bump-outs/pocket parks
- Low-water and native landscaping.
- Natural soil berms or vegetated screening materials other than walls.
- Green landscaping island and medians
- Cascade infiltration/dispersion stormwater outfall design.

For non-residential projects, LID BMPs shall be allowed to be incorporated into the landscaping and buffer areas.

LID shall be designed and maintained to meet standards of this Regulation; the Mile High Flood District's Urban Storm Drainage Criteria Manual, Volume 3; as the same may be amended from time to time. These manuals may be updated and expanded

from time to time, at the discretion of the County, based on improvements in engineering, science, monitoring and local maintenance experience.

All proposed LID techniques shall be described on the Drainage Report and documented on the Construction Plans.

9-01-03-15 TOTAL MAXIMUM DAILY LOAD (TMDL) REQUIREMENTS

The County reserves the right to impose additional requirements during Development Review, if a stormwater-based TMDL has been adopted for the stream segment or lake into which the proposed development will discharge. Additional requirements may include pollution source controls, buffer zones, runoff treatment of a specific pollutant, selection of post-construction BMP according to the TMDL's pollutant removal goals, etc.

9-01-03-16 STORM DRAINAGE STRUCTURES OWNERSHIP

Adams County owns and maintains the public storm drainage system in unincorporated Adams County. Unless otherwise noted in approved plans, written agreements or recorded documents, the delineation between the public and private storm drainage systems is typically located within the public right-of way or County property. The private system may extend up to the connection to the main public storm sewer line. Storm culvert pipes installed to access a property are considered private.

9-01-03-17 STORM DRAINAGE SYSTEM OPERATIONS AND MAINTENANCE

Maintenance of any type of drainage feature on private property is the responsibility of the property owner.

Routine maintenance of the access and drainage improvements within County ROW shall be the responsibility of the adjacent property owner. The adjacent property owner maintenance responsibility includes debris and trash removal, as well as mowing. Key issues in the long-term performance of all storm drainage systems are the proper operations and continued maintenance of the drainage facility (i.e. grading and sediment removal). Grading and sediment removal is not included in the adjacent property owner maintenance. In order to ensure proper system operations and maintenance of private drainage infrastructure, the County may perform periodic inspections of all drainage facilities and conveyance structures.

Any landscaping placed in roadside ditches shall require an encroachment agreement. Any landscaping invert shall match the invert of the existing ditch and cause no pooling of water from the upstream side.

Refer to Section 9-04 Post-construction Run-off Regulations for maintenance requirements of the storm drainage system.

9-01-03-18 STREAM CORRIDOR IN PRIVATE PROPERTY

The property owner is responsible for maintenance of the natural stream corridor on either side of a stream or dry watercourse within private property, including, but not limited to, the stream bed and all existing and future bank stabilization measures, in order to ensure that all such facilities remain in proper working condition. A permanent storm drainage easement along the banks for the stream or dry watercourse shall be dedicated to the County during development review at no cost to allow access to the area for inspection and enforcement purposes, regardless of a planned trail system or not.

Properties within a natural stream corridor shall preserve a vegetated 50-foot stream buffer area from the edge of the stream bank, on either side of a stream or dry watercourse, to provide benefits for overall water quality of the watershed. The benefits include: reduction of structure flooding, reduction of sediment loss into adjacent water bodies, enhanced stream bank stabilization, reduction of nitrogen, maintenance of more constant water temperature, provision of wildlife habitat, and the extension of natural corridors between habitat areas. The vegetation in these areas must be protected. Dead trees and invasive plant species should be removed and only native vegetation used. All work should be conducted by hand if possible in a manner not to disturb other existing vegetation.

9-01-04 STORM DESIGN AND VOLUME CONTROL CRITERIA

In addition to land use, all drainage systems being designed within the County shall take into account both the minor (5 to 10-year) and the major (100-year) storm. The objectives of drainage system planning for the minor storm are to allow for the proper design of minor drainage systems (i.e. curb and gutters, storm sewers, open channels and detention ponds) while minimizing minor damage and maintenance costs. The objectives of drainage planning for the major storm are to allow for proper design of major drainage systems (i.e. bridges, storm sewers, open channels and detention ponds) while minimizing the possibility of major damage and/or loss of life. (Refer to Table 9.2 - Return Periods.)

It is the responsibility of the design engineer to develop, justify, and submit values used in the preparation of drainage plans prepared for County review and approval.

9-01-04-01 STORM DRAINAGE PLANNING

When determining design storm flows, the engineer shall follow appropriate criteria and guidelines such as the MHFD Volumes 1, 2, and 3, to assure that minimum design standards and a regional based drainage solution are developed. The information presented below shall be used by the engineer in the development of design storm runoff for both onsite and offsite flows.

9-01-04-01-01 ONSITE FLOW ANALYSIS

When performing analysis on the onsite basin to determine peak volumes and time of concentrations, the engineer shall use the proposed fully developed land use

plan to determine runoff coefficients and consider changes in flow patterns (from the undeveloped site conditions) caused by the proposed plan (including street alignments). When evaluating the estimated time of concentrations, the proposed lot grading shall be used to calculate the time of concentration. The proposed project shall in no way change historic runoff values, cause downstream damage, or adversely impact adjacent properties. In addition, phased or partial development analysis will not be accepted. The entire platted parcel shall be analyzed for full build-out in order to properly site and size detention/retention areas and conveyance systems.

Different levels of onsite analysis may be required depending on the size of project or as directed by the County. Refer to the Appendices for a copy of the Application Package for analysis requirements.

9-01-04-01-02 OFFSITE FLOW ANALYSIS

The analysis of offsite runoff is dependent on regional drainage characteristics (whether or not the tributary offsite area lies within a major drainage basin) and the existing/proposed land use and topographic features. If an existing Storm Drainage Master Plan has been adopted by resolution for the region being developed, the engineer shall use this as a baseline document (prior approval from the County on the Master Plan is required) and update it with proposed information. However, should no offsite information be available for fully developed flows (5-, 10- and 100-year), the engineer must perform a regional analysis to ensure the proposed development does not change historic runoff values, cause downstream damage, or adversely impact adjacent properties.

Different levels of offsite analysis may be required depending on the size of project or as directed by the County. Refer to the Appendices for a copy of the Application Package for analysis requirements.

9-01-04-02 STORM RETURN PERIOD

The minor and major storm return period shall not be less than those found in Table 9.2 for all vital drainage structures or critical points of surface water flow.

Table 9.2—Return Periods

Land Use	Return Period (Yrs) for Minor Drainage Systems	Return Period (Yrs) for Major Drainage Systems
Residential-Urban	5	100
Residential-Rural	10 ^a	100
Commercial	5	100
Industrial	5	100
Open Space	5	100
School	5	100

^a All roadside ditches and culverts shall be sized to carry the 10-year peak runoff.

9-01-04-03 RAINFALL

Presented in this Section are guidelines for the development of rainfall data to be used in preparing a hydrological analysis (storm runoff) for a proposed development within the County.

The rainfall intensity information published by the National Oceanic and Atmospheric Administration (NOAA) in the “Precipitation-Frequency Atlas of the Western United States” was used to develop incremental rainfall distributions presented in Table 9.5. The incremental rainfall distributions presented in this table are based on procedures developed by the MHFD. However, refinements have been made to closely match conditions within the County.

9-01-04-04 TIME-INTENSITY-FREQUENCY CURVES

A time-intensity-frequency curve was developed for the County by using one-hour point rainfall values (see Table 9.3) and factors for durations of less than one hour (see Table 9.4); both obtained from the NOAA Atlas. The outcomes of this distribution are point values that were then converted to intensities and plotted as Figure 9.1. Rainfall data from the Mile High Flood District (MHFD) may be used as an alternative (see MHFD Criteria Manual).

Table 9.3—One-Hour Point Rainfall (inches)

2-Year	5-Year	10-Year	50-Year	100-Year
1.00	1.42	1.68	2.35	2.71

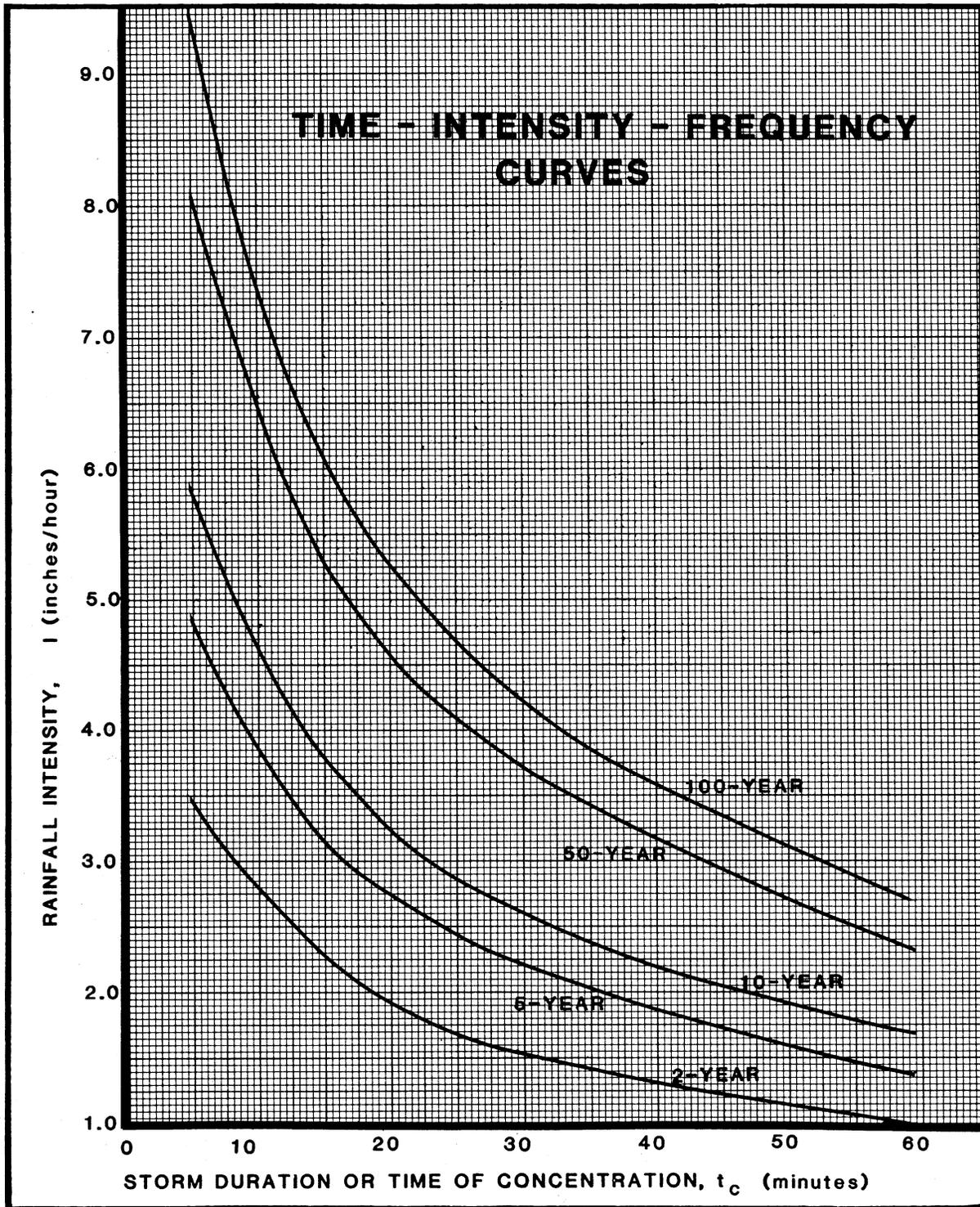
Table 9.4—Factors for Durations of Less than One Hour

Duration (minutes)	5	10	15	30
Ratio to 1-hour depth	0.29	0.45	0.57	0.79

Table 9.5—Incremental Rainfall Depths

Time (min)	Incremental Rainfall Depth (Inches)														
	Basins <5 SQ. Miles					Basins between 5 and 10 SQ. Miles					Basins between 10 and 20 SQ. Miles				
	Return Period (Yr.)					Return Period (Yr.)					Return Period (Yr.)				
	2	5	10	50	100	2	5	10	50	100	2	5	10	50	100
5	0.02	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.03
10	0.04	0.05	0.06	0.08	0.08	0.04	0.05	0.06	0.08	0.08	0.04	0.05	0.06	0.08	0.08
15	0.08	0.12	0.14	0.12	0.12	0.08	0.12	0.14	0.12	0.12	0.08	0.12	0.14	0.12	0.12
20	0.16	0.22	0.25	0.19	0.22	0.15	0.21	0.25	0.19	0.22	0.14	0.20	0.25	0.19	0.22
25	0.25	0.36	0.42	0.35	0.38	0.24	0.35	0.40	0.34	0.36	0.23	0.32	0.38	0.32	0.34
30	0.14	0.18	0.20	0.59	0.68	0.13	0.17	0.19	0.57	0.65	0.13	0.16	0.18	0.53	0.61
35	0.06	0.08	0.09	0.28	0.38	0.06	0.08	0.09	0.27	0.36	0.06	0.08	0.09	0.25	0.34
40	0.05	0.06	0.07	0.19	0.22	0.05	0.06	0.07	0.19	0.22	0.05	0.06	0.07	0.19	0.22
45	0.03	0.05	0.06	0.12	0.17	0.03	0.05	0.06	0.12	0.17	0.03	0.05	0.06	0.12	0.17
50	0.03	0.05	0.05	0.12	0.14	0.03	0.05	0.05	0.12	0.14	0.03	0.05	0.05	0.12	0.14
55	0.03	0.04	0.05	0.08	0.11	0.03	0.04	0.05	0.08	0.11	0.03	0.04	0.05	0.08	0.11
60	0.03	0.04	0.05	0.08	0.11	0.03	0.04	0.05	0.08	0.11	0.03	0.04	0.05	0.08	0.11
65	0.03	0.04	0.05	0.08	0.11	0.03	0.04	0.05	0.08	0.11	0.03	0.04	0.05	0.08	0.11
70	0.02	0.04	0.05	0.06	0.05	0.02	0.04	0.05	0.06	0.05	0.02	0.04	0.05	0.06	0.05
75	0.02	0.03	0.05	0.06	0.05	0.02	0.03	0.05	0.06	0.05	0.02	0.03	0.05	0.06	0.05
80	0.02	0.03	0.04	0.04	0.03	0.02	0.03	0.04	0.04	0.03	0.02	0.03	0.04	0.04	0.03
85	0.02	0.03	0.03	0.04	0.03	0.02	0.03	0.03	0.04	0.03	0.02	0.03	0.03	0.04	0.03
90	0.02	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.03
95	0.02	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.03
100	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.03
105	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.03
110	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.03	0.03	0.03
115	0.01	0.02	0.03	0.03	0.03	0.01	0.02	0.03	0.03	0.03	0.01	0.02	0.03	0.03	0.03
120	0.01	0.02	0.02	0.03	0.03	0.01	0.02	0.02	0.03	0.03	0.01	0.02	0.02	0.03	0.03
125											0.01	0.02	0.02	0.02	0.02
130											0.01	0.01	0.02	0.02	0.02
135											0.01	0.02	0.01	0.02	0.02
140											0.01	0.02	0.01	0.02	0.02
145											0.01	0.01	0.01	0.02	0.02
150											0.01	0.01	0.01	0.01	0.02
155											0.01	0.01	0.01	0.01	0.01
160											0.01	0.01	0.01	0.01	0.01
165											0.01	0.01	0.01	0.01	0.01
170											0.01	0.01	0.01	0.01	0.01
175											0.01	0.01	0.01	0.01	0.01
180											0.01	0.01	0.01	0.00	0.00
	1.15	1.61	1.89	2.72	3.12	1.12	1.58	1.86	2.68	3.05	1.22	1.68	1.97	2.76	3.14

Figure 9.1—Time-Intensity-Frequency Curves



9-01-04-05 RUNOFF COEFFICIENTS

The runoff coefficients to be used within the Rational Method, Colorado Urban Hydrograph Procedure (CUHP) or approved hydrologic models are to be determined based on existing and/or proposed land use and surface characteristics. When using the Rational Method and/or CUHP, the County requires the use of runoff coefficients presented in the Urban Storm Drainage Criteria Manual, Volume 1.

Recycled concrete will not be permitted as a ground covering surface.

9-01-04-06 TIME OF CONCENTRATION

In order to determine the rate of runoff at a designated outfall, the time of concentration must be determined. The time of concentration is the time it takes for water to flow from the most remote part of the drainage basin to the outfall of the study area. For the Rational Method, a separate time of concentration is necessary for the overall basin and each sub-basin. The time of concentration (T_c) is composed of the sheet or overland flow time (t_{ov}) and channel flow time (t_t). The time of concentration formula shall be as described in the Urban Storm Drainage Criteria Manual, Volume 1 for this Section.

9-01-04-07 STORM FLOW ANALYSIS

The engineer shall use the Rational Method for basins less than 90 acres. CUHP or other approved hydrologic models shall be used for basins larger than 160 acres. Basins between 90 acres and 160 acres in area may use either method.

9-01-04-07-01 RATIONAL METHOD EQUATION

Equation 9.4
 $Q=CIA$

Where

- Q = Flow Rate, cfs
- A = Total Area of Basin, acres
- C = Runoff Coefficient (refer to Section 9-01-04-05)
- I = Rainfall Intensity, inches per hour (refer to Section 9-01-04-04)

9-01-04-07-02 COMPUTER AIDED HYDROLOGIC MODELS

For analyzing larger basins (greater than 90 acres), the engineer may either use the CUHP latest revision. (information detailed in Mile High Flood District's Criteria Manual) or another appropriate hydrology/hydraulics model. When using other hydrology/hydraulics models, the engineer will be required to develop unit, flood, routing and combination hydrographs for use in determining peak flows and time of concentrations at vital drainage structures or critical points of surface water runoff. A unit hydrograph is defined as the direct runoff hydrograph that results from 1-inch

of rainfall excess uniformly distributed throughout the basin over a specified duration. From this unit hydrograph, direct runoff hydrographs must be developed for a design storm by creating flood hydrographs. In addition, where surfaces (pervious and impervious) within the basin vary in characteristics, weighted or composite coefficients for each basin must be used in development of the unit and flood hydrographs. This is typically accomplished by breaking each basin into the appropriate number of sub-basins and using the corresponding surface coefficients. Each computer-aided model has default parameters for typical surface characteristics and soil types; the selection of these parameters is the key to a successful analysis and therefore must be submitted with the Storm Drainage Study.

9-01-05 OPEN CHANNELS

In many instances, special design or evaluation techniques will be required for stormwater conveyance. With exceptions as modified herein, all open channel criteria shall be in accordance with the Urban Storm Drainage Criteria Manual, Volumes 1 and 2.

For the purpose of design in this Section, all drainageways (major and minor) shall be designed using the Urban Storm Drainage Criteria Manual, Volumes 1 and 2. Due to the complexities of open channels, there is a wide range of design options available to the engineer. The exact method of analysis and design shall be clearly documented and submitted as part of the Storm Drainage Study.

Flood control channels for major drainageways shall include a low-flow channel with a capacity to convey the average annual flow rate, or other appropriate flow rate as determined through a sediment transport and channel stability analysis, without excessive erosion or channel migration, with an adjacent overbank floodplain to convey the remainder of the 100-year flow. The channel improvement shall not cause increased velocities or erosive forces upstream or downstream of the improvement.

9-01-06 STORM SEWERS

Storm sewers are to be viewed as an integral part of all Minor Drainage Systems. The installation of storm sewer systems is required when the other parts of the minor system (i.e. curb, gutter and roadside ditches) no longer have capacity to accommodate the runoff from the minor storm or spread widths exceed those requirements presented in this Section.

Except as modified herein, the design of storm sewers shall be in accordance with the Mile High Flood District (MHFD)'s Urban Storm Drainage Criteria Manual Section on "Storm Sewers." The engineer is referred to the Manual and other references cited for additional discussion and basic design concepts.

The use of computer programs in the design of storm sewer systems will be permitted provided the model input and justifications are submitted to the County for review and approval.

9-01-06-01 LOCATION OF STORM DRAINAGE SYSTEM RELATED TO OTHER POLLUTION SOURCES

The storm sewer system shall not be extended through an area that is a real or potential source of contamination to stormwater, unless approved protection is provided.

If corrosive soils are present, or pipe is being proposed in a potential contaminated area such as, but not limited to a Brownfield or historic landfill, the designer shall incorporate appropriate measures to protect the pipe from damage and infiltration of pollutants into the storm drainage system such as continuous lining of the pipes.

The following minimum horizontal distances between the storm drainage system and bodies of water to On-Site Wastewater Treatment Systems (OWTS) can only be superseded by TCHD Regulations:

1. Septic tank: Minimum distance from Lake, water course, stream or wetland: 50ft
2. Unlined System Leach Field/Seepage Bed: Minimum distance from lake, water course, stream or wetland: 100ft
3. Lined System Leach Field/Seepage Bed: Minimum distance from lake, water course, stream or wetland: 50ft
4. Septic Tank: Minimum distance from dry gulch: 10ft
5. Unlined System Leach Field/Seepage Bed: Minimum distance from dry gulch: 25ft
6. Lined System Leach Field/Seepage Bed: Minimum distance from dry gulch: 10ft

All surface drainage must be diverted around the perimeter of the field and the field must be sufficiently crowned to provide good runoff.

A diversion ditch and/or berm shall be provided on the uphill side(s) of the bed to deflect precipitation and other outside water away from the evapo-transpiration system.

9-01-06-02 STORM DRAINAGE LOCATE SYSTEM

All new underground facilities, including laterals up to the structure or building being served, installed on or after August 8, 2018 must be electronically locatable when installed, per C.R.S. Title 9-1.5-101.

Public and private drainage structures must be provided with a tracer wire or alternative approved method according to detail shown in Appendices.

9-01-06-03 CONSTRUCTION MATERIALS

All storm sewers within the County right-of-way shall be constructed using reinforced concrete pipe class III (RCP class III) and/or reinforced concrete box culverts (RCBC). If a pipe is installed by boring & jacking, RCP class V or equivalent shall be used. The required pipe strength shall be determined from the actual depth of cover, true load, and proposed field conditions. Typical design strength calculations shall be submitted as part of the Storm Drainage Study.

Pipe joints shall be watertight and flexible gasket joints, both between pipe joints and for all pipe-structure connections. Pipe joints shall consist of resilient connections complying with the requirements of ASTM C-443 or ASTM C-923, as appropriate.

9-01-06-04 HYDRAULIC DESIGN

Storm sewers within the County right-of-way shall be designed to convey the minor storm runoff peaks without surcharging the sewer. To ensure this objective is achieved, the hydraulic and energy grade lines shall be computed by calculating both the major and minor losses (i.e. friction, expansion, contraction, bend, and junction losses). The methods for estimating these losses are presented in the following Sections and in the Manual. The final energy grade line shall be at or below the proposed ground surface.

9-01-06-05 PIPE FRICTION LOSSES

Manning n-values to be used in the calculation of storm sewer capacity and velocity are to be based on the material being proposed. Table 9.9 presents typical Manning n-values.

9-01-06-06 PIPE FORM LOSSES

Generally, between the inlet and outlet the flow encounters a variety of configurations in the flow passageway (i.e. changes in pipe size, branches, bends, junctions, expansions, and contractions). These variations of configuration impose losses in addition to those resulting from pipe friction. These form loss values shall be submitted, with full justification for the values chosen, as part of the Storm Drainage Study.

9-01-06-07 VERTICAL ALIGNMENT

The storm sewer grade shall be such that a minimum cover is maintained to withstand a live load conforming to AASHTO HS-20 (or as designated by the County) loading on the pipe. The minimum cover depends upon the pipe size, type and class, and soil bedding condition.

The minimum vertical clearance between the storm sewer and a sanitary sewer shall be 18 inches. In addition, when a sanitary sewer main lies above a storm sewer, the sanitary sewer (or storm sewer) shall have an impervious concrete, steel or ductile iron encasement for a minimum of 5-feet on each side of the crossing centerline and this casing pipe shall be sealed to prevent intrusion at both ends.

A minimum vertical clearance of 18 inches is required between a storm sewer and a water main. The minimum clearances shall occur from outer pipe diameter to outer pipe diameters. Clearances shall also be in accordance with the appropriate Water and Sanitation District and as discussed in Chapter 7, Section 7-06-03, as amended.

9-01-06-08 HORIZONTAL ALIGNMENT

The storm sewer alignment may be curvilinear for pipe with diameters of 48-inches or greater but only when approved by the County. The applicant must demonstrate the need for a curvilinear alignment. The limitations on the radius for pulled-joint pipe are dependent on the pipe length and diameter, and amount of opening permitted in the joint. The maximum allowable joint pull shall be $\frac{3}{4}$ inch. The minimum parameters for radius type pipe are shown in Table 9.9. The radius requirement for pipe bends is dependent upon the manufacturer's specifications.

The County requires a minimum clearance of 10-feet between the storm sewer and a water line or sanitary sewer line. Clearance shall occur from the outer pipe diameter to the outer pipe diameter.

9-01-06-09 PRIVATE CONNECTIONS TO THE PUBLIC DRAINAGE SYSTEM

All storm drain connections shall be subject to approval of the County and shall be in accordance with applicable standards and specifications. Permits shall be required to connect to the public storm drainage system. Cross connections between sanitary and storm systems are prohibited. Underground drains from fire hydrants, pits, or underground structures (valve pits, meter pits) shall not be directly connected to storm drains without County approval. Roof downspouts, roof drains, or roof

drainage piping shall discharge onto the ground and shall not be directly connected to the storm drainage system

The discharge pipe of sump pumps discharging uncontaminated groundwater must daylight according to Colorado Revised Statutes 37-87-105.

Table 9.9—Storm Sewer Alignment and Size Criteria

<u>Vertical Dimension Of Pipe (inches)</u>	<u>Maximum Allowable Distance Between Manholes and/or Cleanouts</u>	
18 to 36	400 ft	
42 and larger	500 ft	
<u>Minimum Radius of Curvature for Radius Pipe</u>		
<u>Diameter of Pipe</u>	<u>Radius of Curvature</u>	
48" to 54"	28.50 ft	
57" to 72"	32.00 ft.	
78" to 108"	38.00 ft.	
Short radius bends shall not be used on sewers 42 inches or less in diameter		
<u>Type</u>	<u>Minimum Pipe Diameter</u>	
	<u>Minimum Equivalent Pipe Diameter</u>	<u>Minimum Cross- Sectional Area</u>
Main Trunk	18 in	1.77 sf
*Lateral from inlet	18 in	1.77 sf
*Minimum size of lateral shall also be based upon a water surface inside the inlet with a minimum distance of 1 ft below the grate or throat.		
<u>Sewer Type</u>	<u>Manning n-Value</u>	
	<u>Capacity Calculation</u>	<u>Velocity Calculation</u>
Concrete (newer pipe)	0.013	0.011
Concrete (older pipe)	0.015	0.012
Concrete (preliminary sizing)	0.015	0.012
Plastic	0.011	0.009
Reference: Manual		

9-01-06-10 PIPE SIZE

The minimum allowable pipe size for storm sewers is dependent upon the estimated flows and a practical diameter from a maintenance perspective. In addition, the length of the sewer affects the maintenance and, therefore, the minimum diameter. Table 9.9 presents the minimum pipe size for storm sewers located in the County right-of-way.

9-01-06-11 MANHOLES AND MANHOLE COVERS

Manholes or maintenance access ports will be required whenever there is a change in size, direction, elevation, grade, or where there is a junction of two or more conduits. Manholes are also required along long straight sections of pipe for maintenance

purposes, with the distance between manholes dependent on pipe size, but not more than 400 feet.

Blind connections to storm sewer pipes shall not be allowed. In addition, a manhole may be required at the beginning and/or at the end of the curved section of storm sewer. The maximum spacing between manholes for various pipe sizes shall be in accordance with Table 9.9. Refer to Table 9.10 for the required manhole size.

Table 9.10—Manhole Size

Sewer Diameter	Minimum Manhole Inside Diameter
18"	4'
21" to 42'	5'
48"	6'
54" and larger	As approved by the County

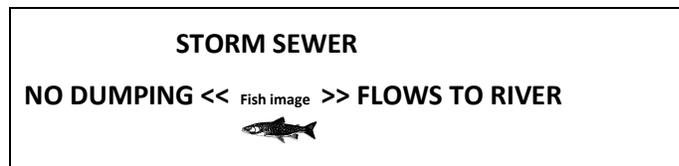
Larger manhole diameters or a junction structure may be required when sewer alignments are not straight, or more than one (1) sewer line goes through the manhole. Manhole diameter may be increased should conditions require such.

The invert of a pipe leaving a manhole should be at least 0.1 foot lower than the incoming pipe to ensure positive low flows through the manhole.

Whenever possible, match the pipe soffit elevations when the downstream pipe is larger to minimize backwater effects on the upstream pipe. Additional manholes may be necessary to “step down” a steep grade, allowing pipe slopes to be much flatter than the slope of the street above. This is done to prevent velocities in storm drain pipes from exceeding the recommended maximum velocity of 20 ft/sec.

All publicly owned storm sewer manhole lids/covers shall have the Adams County manhole cover design. Refer to the Appendices for this detail.

All privately owned storm sewer manhole lids/covers shall be permanently imprinted with the image of a fish and must incorporate the County’s approved educational message. The message must include the following (or equivalent) statement:



Storm sewer manhole cover requirement also applies to public and private manholes placed to access storm sewer inlets concrete boxes. Refer to Appendices for detail drawing.

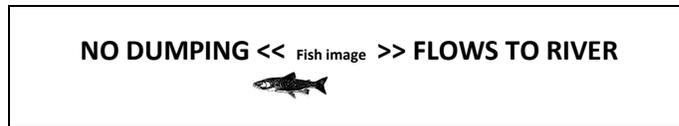
9-01-07 STORM SEWER INLETS

Presented in the following Subsection is a discussion on the criteria and methodology for design and evaluation of storm sewer inlets in the County.

9-01-07-01 STANDARD INLETS

The standard inlets permitted for uses in the County are presented in Table 9.11. Other inlet types may be considered on a case-by-case basis. All open pipe inlets shall be provided with trash racks.

All public and private curb inlets and iron grates shall be permanently imprinted with the image of a fish and must incorporate the County’s approved educational message. The message must include the following (or equivalent) statement:



Refer to Appendices for detail drawing.

Table 9.11—Inlet Types

Inlet Type	Permitted Use
Curb Opening Inlet Type R	All street types
Grated Inlet Type C or D	All streets with a roadside or median ditch
Grated Inlet Type 13	Alleys or private drives with a valley gutter (private areas only)
Combination Inlet Types 13 and 16	All street types

See standard detail drawings in Appendices

9-01-07-02 INLET HYDRAULICS

The procedures and basic data to define the capacities of the standard inlets under various flow conditions shall be calculated or obtained from the Urban Storm Drainage Criteria Manual, Volume 1, in the Section on “Storm Inlets”, as amended. The engineer shall submit assumptions, and calculated inlet capacities as part of the Storm Drainage Study.

Inlet types and grates shall be selected to be appropriate for the intended use and location.

9-01-08 STREETS

Urban and rural streets, specifically the curb and gutter or the roadside ditches, should be viewed as an integral part of a Minor Drainage System. When the drainage in the street exceeds allowable limits, a storm sewer system or an open channel is required to

convey the design flows. In addition, streets may be viewed as a critical part (subject to certain limitations) of the Major Drainage System when it conveys nuisance flows (flows less than minor events) quickly and efficiently to the storm sewer or open channel drainage without interfering with traffic movement.

Design criteria for the collection and conveyance of surface runoff on public streets is based on a reasonable frequency and magnitude of traffic interference (see Table 9.12 through Table 9.14). That is, depending on the classification of the street, certain traffic lanes can be fully inundated during a major storm event. However, during lesser intense storms, runoff will also inundate traffic lanes, but to a lesser degree. The streets in the County are classified for drainage according to the average daily traffic (ADT) for which the street is designed. The larger the ADT, the more restrictive the allowable drainage encroachment into the driving lanes will be. The limits of storm runoff encroachment for each Drainage Classification and storm condition are presented in Table 9.12.

Table 9.12—Theoretical Design of Streets for Minor Storm Runoff

Drainage Classification	Maximum Theoretical Street Encroachment
Urban Industrial and Local Residential	No curb overtopping, but flow may spread to crown of street (flow may spread to back of sidewalk).
Collector	No curb overtopping and flow spread must leave at least one 10-foot lane free of water (5-feet on each side of the street crown).
Major Arterial and Minor Arterial	No curb overtopping and flow spread must leave at least two 10-foot lanes free of water (10-feet each side of the street crown or median).

Table 9.13—Allowable Use of Streets for Major Storm Runoff

Drainage Classification	Maximum Theoretical Depth
Local Industrial, Local Residential, and Collector	Building structures shall not be inundated at the ground line. The depth of water at street crown shall not exceed 6-inches.
Major Arterial and Minor Arterial	Building structures shall not be inundated at the ground line. To allow for emergency vehicles, the depth of water shall not exceed the street crown and 12-inches at the gutter flow line, whichever is more restrictive.

Table 9.14—Allowable Cross Street Flow

Drainage Classification	Minor Storm Maximum Depth	Major Storm Maximum Depth
Local Industrial and Local Residential	6-inches of depth in cross pan or at gutter flow line.	12-inches of depth in cross pan or at gutter flow line.
Collector	6-inches of depth at gutter flow line.	12-inches of depth at gutter flow line.
Major Arterial and Minor Arterial	None	6"
<p>Cross street flow can occur in an urban drainage system under three conditions. One condition occurs when the runoff in a gutter spreads across the street crowns to the opposite gutter. The second is when cross-pans are used. The third condition occurs when the flow in a drainageway exceeds the capacity of a road culvert and subsequently overtops the crown of the street.</p>		

9-01-09 CULVERTS

A culvert is defined as a conduit that conveys, by gravity, surface drainage runoff under a road, highway, railroad, canal, or other embankment (except detention outlets). For County roads serving new development, culverts shall be constructed using reinforced concrete pipe and/or reinforced concrete box culverts (RCBC). All roadway culverts shall be designed to a minimum AASHTO HS-20 loading criteria. Private driveway culverts for residential properties may be allowed to use corrugated metal pipe and different loadings upon approval from the County since maintenance and replacement of these culverts are the property owner’s responsibility.

9-01-09-01 CULVERT HYDRAULICS

The procedures and basic data to be used for the hydraulic evaluation of culverts being proposed for installation in the County shall be in accordance with the Urban Drainage Criteria Manual, Volume 2 for this Section, as amended, except as modified herein.

The use of computer programs developed for the design of culverts will be permitted, provided the model input, justifications and related calculations are submitted to the County as part of the Storm Drainage Study.

9-01-09-02 INLET AND OUTLET CONFIGURATION

All culverts are to be designed with headwalls and wing walls, or with flared-end sections at the inlet and outlet. Flared-end sections are only allowed on pipes with a diameter of 42 inches (or equivalent) or less. Additional protection at the outlet may be required to minimize the potential of channel erosion. Refer to Section -9-03 Construction Stormwater Management for erosion protection design guidelines.

9-01-09-03 HYDRAULIC DATA

The design and evaluation of the capacity for a culvert shall be calculated using the appropriate methods. The computed culvert capacities must never exceed

manufacturer’s recommendations or best engineering practices. The assumptions and model input shall be submitted as part of the Storm Drainage Study.

9-01-09-04 VELOCITY CONSIDERATIONS

In designing culverts, both the minimum and maximum velocities must be considered. A flow velocity greater than approximately 3-fps is required to assure self-cleaning conditions exist and therefore reducing long-term maintenance costs. In addition, a velocity less than approximately 12-fps to minimize possible culvert damage due to scouring and downstream channel erosion.

9-01-09-05 CULVERT SIZING CONSIDERATIONS

The sizing of a culvert is dependent upon two factors, the street classification and the limits of allowable culvert overtopping. Limits for the various street classifications are presented in Table 9.15. The minimum culvert diameter shall be 18 inches. Unless under certain circumstances, the County may allow other sizes.

Table 9.15—Allowable Maximum Culvert Overtopping

Drainage Classification	Minor Drainage System Maximum Depth	Major Drainage System Maximum Depth
Local Industrial, Local Residential and Collector	No Overtopping	12-inches of depth at the gutter flowline (6-inches of depth at street crown for streets without gutters)
Major Arterial and Minor Arterial	No Overtopping	No Overtopping ($H/D \leq 1.5$)
The maximum headwater (H/D) for the 100-year design flows shall be 1.5 times the culvert diameter, or 1.5 times the culvert rise dimension for shapes other than round. Driveway culverts shall be designed using criteria outlined in Tables 9.12, 9.13, and 9.14.		

9-01-09-06 STRUCTURAL DESIGN

At a minimum, all culverts shall be designed to withstand an HS-20 loading (unless designated differently by the County in accordance with the design procedures of AASHTO, “Standard Specifications for Highway Bridges”, and with the pipe manufacturer’s recommendation. Using this loading requirement, calculations shall be submitted to confirm the estimated depth of cover and bearing load on the selected culvert.

9-01-10 BRIDGES

The hydraulic and hydrologic design of bridges within the County shall be in accordance with the Urban Drainage Criteria Manual Volume 2, “Structures, Section 4 - Bridges for this Section, as amended. The Federal Highway Administration “Hydraulics of Bridge Waterways” or other County-approved resources shall also be used to determine the possible impacts on the drainageway (both upstream and downstream), scour potential and mitigation techniques for a proposed bridge structure.

All new and replacement bridges shall comply with the floodplain regulations. Therefore, the engineer is encouraged to communicate with the County prior to proposing the placement of a bridge structure within the County to obtain written approval.

Bridge plans shall require a separate review by a licensed professional engineer that specializes in structural design. The structural consultant will need to have County approval prior to review. The developer/applicant will be responsible for all costs associated with the structural consultant. The County may also mandate inspection services by the structural consultant.

9-01-11 DETENTION

Onsite detention is required for all development or redevelopment projects. Requirements for detention storage of storm runoff shall be based on the location of the development within its major drainage basin as determined by hydrological modeling and surface characteristics. The detention storage facility shall be sized to hold the 5-year and the 100-year runoff, and water quality capture volumes. Refer to Section 9-04 for additional water quality treatment requirements for applicable projects within the County's MS4 Permitted area (urbanized area). Post-development flows from the site cannot be greater than the pre-development flows. Surface water shall not be released from the development at rates greater than provided for in Table 9.16.

Exemptions from flood control detention requirements may be granted by the County based upon the following criteria:

1. The total change in impervious area covers approximately 10,000 square feet or less; or
2. The site for which detention would be required is adjacent to a major drainageway where the ratio of major drainageway basin area to site area is 1000:1 or more; or
3. Rural residential subdivisions that consist of a lot split without the construction of roadways; or
4. Onsite flood control detention requirements for the control of runoff rates may be exempted where regional detention facilities are sized and constructed with the capacity to accommodate 100-year storm event flows from a fully developed basin and are publicly owned and maintained.
5. Public Roads

A flood control detention exemption does not grant a water quality treatment exemption. Water quality treatment must still be provided regardless of the size or location of the lot.

The flood control exemptions listed above may be granted only if:

1. Low impact development techniques are incorporated in the design to reduce a minimum of 50% of the proposed run-off volume.
2. Existing site's water quality facilities are being maintained properly, drainage facility components are upgraded to meet current design standards, and a drainage easement is recorded.

9-01-11-01 VOLUME AND RELEASE RATES

The methods to be used in calculating the required detention volumes and maximum release rates are presented in the following Section. These methods include empirical equations, tables, the CUHP method, or other computer aided models approved by the County. Early communication with the County is encouraged for the determination of the appropriate method and the level of detail required for submission.

9-01-11-01-01 VOLUME ESTIMATES (EMPIRICAL FORMULA METHOD)

The volume available for detention storage for tributary catchments of 90 acres or less shall be based on the following empirical equations that follow. For larger catchments a CUHP hydrograph shall be generated and hydrologic routing shall be used for site detention. The maximum release rates for detention design provided in Table 9.16 shall not be exceeded.

$$V=KA \quad \text{Equation 9.5}$$

For the 100-year:

$$K_{100} = \frac{(1.78I - 0.002I^2 - 3.56)}{910} \quad \text{Equation 9.6}$$

For the 5-year:

$$K_5 = \frac{(0.77I - 2.26)}{1000} \quad \text{Equation 9.7}$$

In which,

- V = Required volume for the 100- or 5-year storm, acre-feet
- A = Tributary catchment area, acres
- I = Developed basin imperviousness, percent (%)

Adams County requires the WQCV be added to the 5-year detention volume. Adams County also requires that 50% of the WQCV be added to the calculated 100-year Volume.

An additional one (1)-foot of depth must be added to the overall volume to accommodate for freeboard. Administrative relief for exemptions or reductions in freeboard requirements may be granted by the County on a case by case basis as supported by sufficient technical justification. These empirical equations were developed as part of the MHFD hydrology research program and were based on a computer modeling study and represent average conditions. It is believed these equations provide consistent and effective approaches to sizing onsite detention facilities. For basins larger than 90 acres, the CUHP computer model may be used to more accurately represent site conditions.

9-01-11-01-02 VOLUME ESTIMATES (COMPUTER AIDED METHOD)

Using a computer aided hydrology/hydraulics model the engineer can develop hydrographs that route flows to and away from the proposed detention facility. The routed or inflow hydrograph will represent the total

volume of runoff from that particular rain event(s) while the outflow hydrograph represents the maximum allowable release rate permitted in Table 9.16. From this volume information plus the required freeboard, the design of the proposed facility may be performed. Using this method, the typical basin and outlet are designed from a detailed comparison of existing and proposed topographic information and downstream conditions. Although the County has helped to fund the UDPOND model for the design of detention and subscribes to its use, it recognizes many different computer models are available for this type of design. It will be the responsibility of the engineer to document and justify their use and the input and output parameters. These parameters and a detailed discussion on the method used for this design will be submitted as part of the Storm Drainage Study. The computer model must be approved by the County prior to review.

9-01-11-02 MAXIMUM ALLOWABLE RELEASE RATE

The maximum allowable release rates for the corresponding storm events (5 and 100-year) are as presented in Table 9.16.

Table 9.16—Allowable Release Rates (CFS/Acre)

Control Frequency	Dominant Soil Group		
	A	B	C & D
5-year	0.07	0.13	0.17
100-year	0.50	0.85	1.00

When using the empirical formula or a composite CUHP method, the predominate soil group for the total basin area contributing runoff to the detention facility will be used in determining the allowable release rate. However, when designing a facility using another type of computer aided model, the engineer shall select the soil group that best represents the surface characteristics of each sub-basin. The selected soil group(s) will be submitted as part of the Storm Drainage Study. In the event that the local drainage system lacks capacity to accommodate the 5-year release rate, a smaller release rate may be required by the County.

9-01-11-03 DETENTION BASIN OUTLET/OUTFALL

Selecting the most appropriate outlet configuration requires a detailed design, which ensures the maximum release rate meets the requirements of the project and includes proper provisions for maintenance and reliability. In addition, care shall be taken as to ensure the designed outlet will not cause downstream erosion or damage during the storm events less than or equal to the major storm. The following lists five typical outlet structures for use in the design of a detention facility depending on the conditions, storage structure design and discharge rates:

1. Circular Culverts
2. Rectangular Culverts
3. Orifices

4. Weirs
5. Orifice Plates

Details of each of these outlet structures are presented in the Urban Drainage Criteria Manual, Volume I, in the Section on "Outlet Structures" as amended. The engineer shall select the preferred outlet structure based on criteria presented in this Section or other references and will present back up information in the Storm Drainage Study.

The Engineer shall maximize the distance between the inlet and the outlet inside the detention basin.

The outlet shall be designed to minimize unauthorized modifications which affect proper function. To assist in this effort, a sign with a minimum area of 0.75 square feet shall be attached to the outlet or posted nearby with the following message:

"WARNING
Unauthorized modification of
this structure is a code violation
and subject to penalties as
provided by law."

9-01-11-03-01

DESIGN STANDARDS FOR DETENTION

The following Section presents additional design standards (depth of freeboard, location planning, grading, and revegetation) for an open space detention facility. The location, size and landscaping should be properly coordinated with the proposed project and surrounding areas.

The planning of a detention facility is very critical in assuring the facility meets the volume requirements for the proposed project and is properly located for long term operations and maintenance. The facility should be constructed in an area that best fits the existing and proposed topography, facilitates the coordination with other regional facilities and where the building of habitat structures downstream is easily prohibited.

As part of the submitted project plans, the engineer shall accurately represent the location of the facility including limits of grading, approximate embankment slopes, and invert elevations for the outlet. In addition, a larger scale or regional map shall be supplied to show where the facility will discharge and how it interacts with existing or proposed regional facilities.

9-01-11-03-01-01

Depth of Freeboard

The minimum required freeboard for open space detention facilities is (1) one-foot above the computed 100-year water surface elevation.

9-01-11-03-01-02

Grading

Detention basin grading shall not be steeper than (4) four horizontal and (1) one vertical for side slopes. Any dam constructed for the purpose of storing water or having a surface area, volume, or dam height as specified in Colorado Revised Statutes 37-87-105, shall require the approval (in writing) of the State Engineer's Office prior to submission to the County.

All detention facility embankments shall be protected from catastrophic failure due to overtopping. Overtopping can occur when the pond outlets become obstructed or when an event larger than 100-year storm occurs. Failure protection for the embankment, downstream of the emergency spillway, shall be provided in the form of a buried heavy riprap layer on the entire downstream face of the embankment or a separate emergency outfall. The emergency spillway, or emergency outfall, shall have a minimum capacity of twice the pond inflow rate for the 100-year storm. The emergency spillway, or emergency outfall, shall be clearly depicted on the plans. It is the Engineer of Record's responsibility to ensure downstream properties are not adversely affected by drainage and the assessment shall be reflected in the drainage study. The proposed flow path for the discharge from the emergency spillway, or emergency outfall shall be directed into public right of way or into major drainageway and shall be clearly depicted on the plans and constructed as approved by the County. Structures shall not be permitted in the path of the emergency spillway or emergency outfall. The invert of the emergency spillway or emergency outfall shall be set equal to or above the 100-year water surface elevation. The minimum required freeboard for open space detention facilities shall be at least (1) one-foot above the computed weir flow water surface elevation at the emergency spillway, or the emergency outfall.

Depending on site conditions and characteristics, the County may grant administrative relief on slope requirements. The Applicant shall submit good and sufficient documentation sealed by a Colorado Registered Professional Engineer describing the site conditions that necessitate the need for relief and that the proposed slopes are stable and not susceptible to erosion in order to be considered for relief.

9-01-11-03-01-03

Trickle Channel

Concrete trickle channels shall be used by the design engineer when appropriate and is preferred. Design of trickle channels shall be in accordance with Volume 1 of the Urban Storm Drainage Criteria Manual, as amended.

9-01-11-03-01-04

Emergency spillway

An overflow section shall be provided for the detention facility that will protect embankments from overflow resulting from a 100-year storm

assuming the detention basin is full and the tributary area is fully developed.

9-01-11-03-01-05

Revegetation

All detention facilities shall be revegetated with irrigated sod, natural dry-land grasses, or equivalent. In addition, erosion control blankets may be required by the County to maintain the slopes prior to vegetation maturation. The engineer shall submit the proposed revegetation plan to the County.

9-01-11-03-01-06

Maintenance Access

Access to the detention basin shall be provided. A minimum 10ft wide designated maintenance access around the perimeter and down into the basin shall be provided. Maintenance access into the bottom of the basin must be constructed of a stabilized, clean, material, 10% slope maximum.

9-01-11-03-01-07

Access and Maintenance Easements

A drainage maintenance easement shall be granted to the County for emergency maintenance and access to keep the detention drainage facility operable.

A separate access easement may be required by the County to ensure access to detention drainage facilities.

9-01-11-03-02

PARKING LOT DETENTION

Parking lot detention is not allowed.

9-01-11-03-03

UNDERGROUND DETENTION

Underground detention is generally discouraged and will only be allowed when all other options have been proven to be insufficient. However, if a property owner must use this technique, the owner will be responsible for long-term maintenance. The facility will be allowed if approval to do so is obtained in advance and the facility is designed according to the criteria outlined in this Section or as specified by the County.

9-01-11-03-03-01

Configuration

Pipe segments shall be sufficient in number, diameter (minimum 36-inches), and length to provide the required minimum storage volume for the 100-year design. As an option, the 5-year design can be stored in the underground pipe segments and the remaining volume of the 100-year storm event stored aboveground in an open space facility.

The pipe segments shall be placed side by side and connected at both ends by elbow tee fittings and across the fitting at the outlet. The pipe segments shall be continuously sloped at a minimum of 0.25% to the outlet. Manholes for maintenance access shall be strategically placed to identify the limits of the underground facility. In addition, maintenance

access shall be provided in the tee fittings and in the straight segments of the pipe, when required.

Structural fill/gravel backfill for underground detention facilities shall be designed with a porosity not to exceed 30%, unless approved by the County.

Permanent buildings or structures shall not be placed directly above the underground detention.

Proposed underground detention facilities that do not utilize storm sewer pipe as a storage facility will be reviewed and, the design allowed to proceed on a case by case basis. The County reserves the right to refuse approval to any underground detention system that does not meet the following criteria:

1. System must be fully inspectable and maintainable.
2. Any system not previously approved in Colorado.
3. Any system that does not provide adequate volume or, does not include one (1) foot of freeboard.
4. Does not meet MHFD criteria.

9-01-11-03-03-02 Materials

The engineer shall design the underground detention facility using the appropriate materials. The required pipe strength shall be determined from the actual depth of cover, true load, and proposed field conditions. Typical design strength calculations for an HS-25 loading condition shall be submitted as part of the Storm Drainage Study.

9-01-11-03-03-03 Maintenance Access

Access to the underground detention facility shall be provided in accordance with this Section. To facilitate cleaning of the pipe segments, 3-foot diameter maintenance access ports shall be placed according to the schedule in Table 9.16. In addition, 18-inch inspection ports are required to facilitate routine inspections or take water samples.

Table 9.16—Underground Detention - Maintenance Access Requirements

Detention Pipe Size	Maximum Spacing	Minimum Frequency
36" to 54"	50'	Every pipe segment
60" to 66"	75'	Every other pipe segment
>66"	100'	One at each end of the battery of pipes

9-01-11-03-03-04 FLOOD HAZARD WARNING

In addition, all underground detention areas shall have a sign posted identifying the underground detention area. The signs shall have a minimum area of 1.5 square feet and contain the following message:

“Warning

There is an underground detention basin in this area.

Caution, digging in this area could cause damage.”

9-01-11-03-03-05 ACCESS AND MAINTENANCE EASEMENTS

A drainage maintenance easement shall be granted to the County for emergency maintenance and access to keep the underground detention facility operable. A separate access easement may be required by the County to ensure access to the underground facility

9-02 STORMWATER QUALITY REGULATIONS - PURPOSE AND INTENT

Protecting the quality of stormwater runoff is a priority to Adams County and is required by Colorado Discharge Permit System (CDPS) Regulations. The Colorado Department of Public Health and Environment (CDPHE), Water Quality Control Division (WQCD), through the Municipal Separate Storm Sewer System (MS4) Phase II permit issued to Adams County, requires Adams County to control and reduce the discharge of pollutants to protect stormwater quality and to satisfy the appropriate water quality requirements of the Colorado Water Quality Control Act (25-8-101 et. seq., C.R.S) and the Colorado Discharge Permit Regulations (Colorado Regulation No. 61). It is the intent of these regulations to implement an effective Construction Site Stormwater Runoff Control Program, Post-construction Stormwater Management Program and Illicit Discharge and Detection Program to establish uniform criteria to minimize stormwater pollution to the maximum extent practicable from certain development and redevelopment sites, to improve flood control, protect the environment, and enhance the health and safety of County residents.

This Section includes:

1. Section 9-03 Construction Stormwater Management
2. Section 9-04 Post-construction Runoff Regulations
3. Section 9-05 Illicit Discharges

9-02-01 AUTHORITY

The Director of the Public Works Department shall administer, implement and enforce the provisions of the Stormwater Quality Regulations, including implementation of enforcement procedures listed under Chapter 1 of the Adams County Development Standards and Regulations.

9-03 CONSTRUCTION STORMWATER MANAGEMENT

9-03-01 GENERAL REQUIREMENTS

Any person who undertakes or causes to be undertaken any construction activity within unincorporated Adams County that involves disturbance of the land surfaces, regardless of the size or location of the construction project, shall ensure that soil erosion, sedimentation, pollutant loads and changes to water flow characteristics resulting from their activities are controlled so as to minimize stormwater pollution and protect receiving waters.

The following are unincorporated Adams County minimum requirements (note that additional requirements apply within the Adams County MS4 Permitted Area):

1. All construction projects disturbing one (1) or more acres, or less than one (1) acre but belonging to a larger common plan of development or sale larger than one (1) acre, shall comply with the Colorado Discharge Permit System (CDPS) Stormwater Discharge Permit for Construction Activities when applying for a County Permit. Compliance with CDPS Stormwater Discharge Permit's term and conditions throughout construction is required.
2. All construction sites, proposing to disturb 3,000 sq ft or more of land, shall submit an Erosion Control (EC) Plan with their applicable County Permit application. The EC Plan, is a civil drawing depicting the project site with the location of all construction Best Management Practices (BMPs), including the associated BMP details, that will be installed and maintained during construction and final stabilization practices.
3. Landowners shall be responsible for ensuring that any temporary and/or permanent construction BMPs installed prior to purchase of a lot, parcel or site from a developer, previous landowner, or builder as part of the implementation of the EC Plan or State's CDPS Stormwater Discharge Permit for Construction Activities are properly maintained and remain in good working order. If not installed prior to individual lot acquisition, all temporary and/or permanent BMPs required by the EC Plan, State's CDPS Stormwater Discharge Permit or other written requirements of the County shall be installed by the landowner immediately and maintained until final stabilization is reached. All temporary BMPs shall be removed after work on the site has been completed, final stabilization has been reached and measures are no longer needed.
4. If the County determines there are non-compliance issues, the County may, in writing, direct the landowner, developer, builder, or Stormwater Quality (SWQ) Permittee, as the case may be, to repair, replace and/or install any stormwater pollution prevention construction BMPs as required by the site's EC Plan, Erosion and Sediment Control Plan (ESCP), Stormwater Management Plan (SWMP); or require additional measures be installed if deemed necessary by the County, in order to minimize said stormwater

pollution. It shall be a violation of these regulations for any landowner, developer, builder or SWQ Permittee to fail to undertake all reasonable and necessary measures to comply with such written directives.

9-03-02 TECHNICAL STANDARDS AND SPECIFICATIONS

All construction stormwater pollution prevention BMPs shall be designed and maintained to meet standards of this Regulation, the Mile High Flood District's Urban Storm Drainage Criteria Manual, Volume 3; or the Colorado Department of Transportation (CDOT) Item Code Book as the same may be amended from time to time. These manuals may be updated and expanded from time to time, at the discretion of the County, based on improvements in engineering, science, monitoring and local maintenance experience.

9-03-03 STORMWATER QUALITY (SWQ) PERMIT APPLICABILITY

The following construction projects shall obtain an Adams County Stormwater Quality (SWQ) Permit, unless excluded under Section 9-03-04:

1. Any construction activity, within unincorporated Adams County MS4 Permitted Area, that disturbs one (1) or more acres of land.
2. Any construction activity within unincorporated Adams County MS4 Permitted Area that disturbs less than one (1) acres of land which is also part of a larger common plan of development or sale that would disturb, or has disturbed since the implementation of the County's MS4 permit construction requirements, at least one (1) or more acres, unless the disturbed areas have been finally stabilized.
3. If a construction project is partially located within the MS4 Permitted Area, then only the area disturbed within the County's MS4 Permitted Area is subject to the SWQ Permit requirements.
4. If there is an applicable construction site overlapping multiple jurisdictions, and a written agreement is in place with a co-regulating jurisdiction holding an MS4 Permit, the BMP requirements may be imposed in accordance with the requirements of the co-regulating jurisdiction pursuant to a written agreement. SWQ permit requirements, review and Adams County Regulatory Inspections may be delegated to the co-regulating jurisdiction.

It shall be unlawful for any person to commence or conduct qualifying construction activities, land disturbance activities or other development without first obtaining a SWQ Permit.

9-03-04 EXEMPTIONS

The Adams County SWQ Permit is not required for the following:

1. Construction projects outside the County's MS4 Permitted Area, regardless of the size of the project. Although a SWQ permit is not required, installation and

maintenance of erosion and sediment control BMP's and stormwater pollution prevention control measures shall be implemented during construction. In addition, sites disturbing one (1) or more acres outside the MS4 Permitted Area must comply with CDPHE Stormwater Discharge Permit requirements.

2. Land zoned for and used for agriculture; including agricultural practices such as tilling, planting, or harvesting. This exemption does not apply to buildings on agriculturally zoned land.
3. Gravel, sand, dirt or topsoil removal as authorized pursuant to approval of the Colorado Mined Land Reclamation Board;
4. Any construction activity waived or exempt of coverage under the State of Colorado CDPS Stormwater Construction Permit (i.e.: R-Factor Waiver);
5. Pavement maintenance of public and private roadways, such as an overlay or pavement patching, that does not disturb the subsurface of the paved street.
6. Emergency situations that pose an imminent risk to life or property, such as hazardous waste cleanup operations, emergency firefighting, or emergency utility repairs provided that applicable projects apply for a SWQ Permit within 14 days of the start of construction activity.
7. Land disturbance of one (1) or more acres for construction of a single family dwelling within Adams County MS4 Permit Growth Area on a large single family residential lot, or agriculturally zoned land, with an area greater than or equal to 2.5 acres, and having a total site impervious area that is equal to or less than 10% imperviousness.
8. Land disturbance of one (1) or more acres for construction of a single family dwelling within Adams County MS4 Permit Growth Area on a large single family residential lot, or agriculturally zoned land, with an area greater than or equal to 2.5 acres, and having a total site impervious area that is equal to or less than 20% imperviousness; only if a study specific to the watershed shows that expected soil and vegetation conditions are suitable for infiltration/filtration of 100% of the Water Quality Control Volume (WQCV) for a typical site has been conducted and approved by the County.
9. Land disturbance of one (1) or more acres for facilities associated with oil and gas exploration, drilling, production, processing, treatment operations, or transmission facilities within Adams County MS4 Permit Growth Area. These facilities are not exempt from CDPS Stormwater Discharge Permit for Construction Activities coverage.

Notwithstanding the foregoing SWQ Permit exemptions in this Section, those operations and construction activities that are exempted from obtaining a SWQ Permit must nevertheless comply with the rules and regulations concerning erosion and sediment control specified in Section 9-03-01 General County Requirements or other applicable provisions of this Regulation, and shall provide adequate stormwater pollution prevention controls.

9-03-05 SWQ PERMIT APPLICATION

The applicant must submit to the County the following documentation to obtain a SWQ Permit:

1. A complete SWQ Permit Application on the form prescribed by the County. The application shall be signed by a person responsible for compliance with the SWQ permit throughout the duration of the permit's validity.
2. An Erosion and Sediment Control Plan (ESCP) that includes the narrative and civil EC Plan, according to Section 9-03-08 ESCP.
3. A copy of the State CDPS Stormwater Construction Permit Certification.
4. Permit fees in accordance with Section 9-03-06 SWQ Permit Fees.
5. The BMP Cost Opinion Worksheet form or equivalent.
6. Financial surety according to Section 9-03-07 SWQ Permit Financial Surety.
7. When applicable:
 - a. Recorded Plat including ownership and long-term responsibilities for the post-construction BMP; or recorded standalone Post-construction BMP drainage access easement.
 - b. Recorded Post-construction BMP Maintenance and Operation Plan.
8. Other materials as deemed appropriate by the County to ensure compliance with this Regulation.

SWQ permits are issued for a period of twelve (12) months, and solely for the specific applicant, scope of work, location and size of the proposed development. Any SWQ permit renewal or modifications to the scope of work, location or size of the permitted area (area within the construction boundary line where land disturbing activities are allowed to take place) must be pre-approved in writing by the County. Amendments to the permit shall be filed by the Permittee with the County on a form prescribed by the County.

SWQ permits will not be approved until construction plans are approved. If there is no construction activity for a period longer than 6 months then any SWQ Permit issued will be automatically terminated. All applicable SWQ permit fees are nonrefundable.

9-03-06 SWQ PERMIT FEES

SWQ Permit fees shall be established from time to time in the annual fee schedule adopted by the Board of County Commissioners. The permit fees shall be paid at the time of submittal of the SWQ Permit application.

9-03-07 SWQ PERMIT FINANCIAL SURETY

Financial surety shall be submitted in the form of check, irrevocable letter-of-credit or bond to the benefit of the County, in the amount determined by the estimated cost of

the work required to ensure compliance with the SWQ Permit requirements. Refer to Appendices for Irrevocable Letter of Credit and Bond template.

The amount shall be sufficient to purchase, install and maintain the construction site's temporary and permanent erosion and sediment control BMP measures as indicated on the ESCP. The amount shall be calculated using the BMP Cost Opinion Worksheet which uses the industry average cost to estimate the probable costs for erosion and sediment control BMPs. The Worksheet may be updated from time to time and is included in the Appendices.

The surety shall remain in place until final stabilization is reached in accordance with Section 9-03-11 Final Construction Site Stabilization.

The County has the authority to reduce the performance surety amount to 20% of the original approved amount, or retain a minimum amount of \$1,500, whichever amount is higher, if construction activities have been completed, temporary and permanent construction BMPs are in place and the site is only waiting for Final Stabilization.

The County may consider release of a performance surety at such time as the development, in whole or in part, is sold by the Permittee, and responsibility for stormwater and erosion and sediment control is transferred to the new owner and acceptable substitute performance surety is provided by the new owner.

The surety, less any deductions in accordance with Section 9-03-20 Penalties, shall be promptly released and returned to the Permittee if all required work has been completed successfully and all other requirements of these Regulations have been met.

9-03-08 EROSION AND SEDIMENT CONTROL PLAN (ESCP)

The Permittee shall develop and implement a site specific Erosion and Sediment Control Plan (ESCP), utilizing Adams County's ESCP Template as outlined in the Appendices, Colorado Department of Transportation current SWMP Template, or equivalent. The ESCP shall comply, at a minimum, with the SWMP requirements established by the State of Colorado CDPS Stormwater Construction Permit, as amended. Additionally, the ESCP shall be prepared in accordance with good engineering and hydrologic pollution control practices by a Professional Engineer, or individual that holds and provides evidence of a current certification in development of Stormwater Management Plans, or Certified Professional in Erosion and Sediment Control.

The ESCP shall be implemented from start of land disturbance until final stabilization and permanent stormwater quality BMPs (if applicable) are effectively in place.

Adams County ESCP review and conditional acceptance process only intends to verify that minimum ESCP requirements set by the CDPS Stormwater Construction Permit, and Adams County Stormwater Quality Regulations are met. The acceptance of the ESCP by the County is granted with the condition that the ESCP is considered a living document and will change due to unforeseen issues or if the submitted plan does not function as intended. Revisions and updates of the ESCP shall be conducted regularly by the Permittee during construction. Additional or revised BMPs will be required should inspections indicate the ESCP is not

adequately controlling erosion, capturing sediment, or preventing contact of stormwater runoff from potential pollutant sources.

The main purpose of the ESCP is to reduce pollutants in stormwater discharges from construction sites. The ESCP describes implementation, maintenance and inspection of construction stormwater pollution prevention BMPs.

The ESCP is a detailed written plan that shall include:

1. Identification of all potential pollutant sources which may reasonably be expected to affect the quality of stormwater discharges associated with the following construction activities:
 - a. Land disturbance and storage of soils.
 - b. Vehicle tracking
 - c. Loading and unloading operations
 - d. Outdoor storage of construction site materials, building materials, fertilizers, and chemicals
 - e. Bulk storage of materials.
 - f. Vehicle and equipment maintenance and fueling
 - g. Significant dust or particulate generating processes
 - h. Routine maintenance activities involving fertilizers, pesticides, detergents, fuels, solvents and oils.
 - i. Concrete truck/equipment washing, including the concrete truck chute and associated fixtures and equipment.
 - j. Dedicated asphalt and concrete batch plants
 - k. Other areas or operations where spills can occur.
 - l. Other non-stormwater discharges, including construction dewatering not covered under the CDPHE Construction Dewatering Discharges general permit and processed water discharges.
2. Description of the construction stormwater pollution prevention BMPs (erosion control, sediment control and waste management control), designed and selected for the potential pollutant sources listed above, which will be installed during each phase of construction (initial, interim and final). These can be temporary or permanent, structural or non-structural construction BMPs.
3. Erosion Control (EC) Plan, which is a site plan(s) including, but not limited to:
 - a. Construction site boundary line or limits of construction,
 - b. All areas of ground surface disturbance,
 - c. Areas of cut and fill,
 - d. Areas used for storage of building materials, equipment, soil or waste,
 - e. Location of dedicated asphalt or concrete batch plants,
 - f. Location of all structural BMPs for each phase of the construction project (initial, interim and final),
 - g. Location of all non-structural BMPs as applicable for each phase of the construction project (initial, interim and final); and

- h. Location of springs, streams, wetlands and other surface waters.
 - i. Any other requirements according to the State of Colorado CDPS Stormwater Construction Permit, as amended.
4. Construction BMP details, which shall include information regarding appropriate uses, design, installation, maintenance and removal information.

9-03-08-01 EROSION CONTROL BMPS

A Permittee must control erosion during construction. Erosion control means reducing the movement of soil by keeping the disturbed ground in place. Five (5) examples of effective erosion controls:

1. Minimize disturbed area and protect natural features and soil.
2. Phase construction activity and seeding.
3. Control stormwater flowing onto and through the project.
4. Stabilize soils promptly.
5. Protect slopes.

9-03-08-02 SEDIMENT CONTROL BMPS

A Permittee must control the transportation of sediment during construction. To control the transportation of sediment is to control eroded sediment from leaving the disturbed area, i.e. the second line of defense. Four (4) examples of effective sediment control BMPS:

1. Protect storm drain inlets.
2. Establish perimeter controls.
3. Retain sediment on-site.
4. Establish stabilized construction entrances/exits.

9-03-08-03 WASTE MANAGEMENT CONTROLS

Waste management controls shall be included in the Erosion and Sediment Control Plan (ESCP) for solid and liquid waste, sanitary waste, chemical waste, contaminated groundwater or soils, etc. Waste management controls include, stockpile management, spill prevention, good housekeeping, proper vehicle maintenance, fueling and storage areas, adequate use of pesticides, herbicides and fertilizers, regular street sweeping, concrete/grout/paint washout area, and storm sewer system cleaning/vacuum and jetting.

Waste materials, such as discarded building materials and solid waste from construction activities, shall be contained and disposed of properly in a timely manner and removed from the construction site.

Waste materials shall not be buried, dumped or left at the permitted construction site. Waste materials shall not be temporarily placed or stored in the street, alley, or other public right-of-way with the exception of construction located within the public right-of-way.

All materials stored on-site shall be stored in a neat and orderly manner, in their original containers, with original manufacturer's labels. Materials shall not be stored in a location where they may be carried by stormwater runoff into the County's MS4 or State Waters.

9-03-08-04 ESCP FIELD CHANGES

The ESCP shall be kept at the construction site and shall be updated by the Permittee as construction progresses and field conditions change.

If major changes to the ESCP are needed related to hydrology, then the ESCP must be resubmitted to the County.

Minor changes such as BMP substitutions needed after initial submittal to the County, can be made directly at the site by the Permittee. Documentation of the changes must be available to the County upon request.

The ESCP shall be revised as soon as practicable, following the BMP installation or implementation and according to the SWMP requirements of the State of Colorado CDPS Stormwater Construction Permit, as amended. A notation shall be included in the ESCP with the initials and date of the change(s). If the ESCP is not up to date, or the Permittee fails to conduct a mandated stormwater inspection, it shall be deemed inadequate resulting in a SWQ permit violation.

**9-03-09 SELECTION, INSTALLATION AND MAINTENANCE OF CONSTRUCTION
BMPS**

Adequate construction BMPs must be installed prior to the start of construction activity. BMPs must control potential pollutants (such as sediment, construction site waste, trash, concrete truck washout, chemicals, sanitary waste and contaminated soils) during each phase of construction, and must be maintained until final stabilization is reached. The Permittee must ensure that all BMPs are appropriate for the selected application, installed and maintained according to the conditionally accepted ESCP and BMP detail drawings and in effective working condition to function as designed.

9-03-09-01 PROPRIETARY AND ALTERNATIVE CONSTRUCTION BMPS

The technology of construction stormwater pollution prevention BMPs is constantly changing. New innovations are developed and existing technologies are refined to be more effective. The BMPs included in these Regulations are not meant to be comprehensive. Should the owner or engineer desire to use other BMPs, it will be necessary to provide documentation that adequately demonstrates an alternative BMP option can effectively control stormwater runoff quality. Proprietary or alternative BMP options will be reviewed on a case-by-case basis by the County.

9-03-10 STORMWATER INSPECTION FREQUENCY

The Permittee shall perform and document site stormwater inspections following the inspection frequency requirements of the State CDPS Stormwater Construction Permit, as amended.

The Permittee must inspect for evidence of, or the potential for pollutants leaving the construction site permit boundaries, entering into the MS4, or discharging into State Waters. All erosion and sediment control BMPs identified in the ESCP shall be evaluated to ensure they are installed, maintained and operating correctly.

9-03-10-01 STORMWATER INSPECTION REPORT

The Permittee shall keep a record of all required stormwater site inspection reports, as well as all Adams County Regulatory Inspection reports. Records must be available on-site upon request. The Permittee must comply with the retention of record requirement set by the State CDPS Stormwater Construction Permit, as amended. Stormwater inspection reports must identify any incidents of non-compliance with the terms and conditions of the SWQ Permit.

At a minimum, the stormwater inspection report must contain and comply with the requirements set by the State CDPS Stormwater Construction Permit, and shall include the following information:

1. Inspection date;
2. Names(s) and titles(s) of personnel performing the inspection;
3. Locations(s) of any discharges of pollutants outside the SWQ Permit boundary;
4. Location(s) of BMPs that need to be maintained;
5. Location(s) of BMPs that failed to operate as designed or proved inadequate for a particular location;
6. Location(s) where additional BMPs are needed that were not in place at the time of inspection;
7. Description of all BMP corrective actions and the date corrected;
8. Document when the BMPs are no longer necessary and are removed; and
9. Certification Statement signed by the Permittee or his/her designee stating that the inspection information is true and accurate.

9-03-11 FINAL CONSTRUCTION SITE STABILIZATION

Final Construction Site Stabilization occurs when all ground disturbing activities are complete, and all disturbed areas have either been built on, paved over or a uniform vegetative cover has been established per conditionally accepted ESCP.

Prior to SWQ Permit closeout, all items listed below must be completed in order for the construction site to be considered to have final stabilization:

1. The site has a uniform vegetative cover with a density of at least seventy percent (70%) compared to the original undisturbed site. Vegetative cover shall be established with the approved seed mix, sod or a combination thereof.
2. If applicable, proper installation and maintenance of all approved permanent post-construction stormwater quality BMPs.
3. Removal of all stockpiles of soil, construction material/debris, construction equipment, etc. from the construction site.
4. Streets, parking lots and other surrounding paved surfaces are clean and free of any sediment or debris.
5. Removal of sediment and debris within the private or adjacent public storm drainage system.
6. Restoration and stabilization of any damaged public infrastructure caused by the Permittee's construction activities.

Any acceptance of installed vegetative cover shall not be construed to relieve the property owner of the duty to warrant and maintain the installed vegetative measures as aforementioned.

9-03-12 PERMIT CLOSEOUT

In order to close out the SWQ Permit, the Permittee must complete the following:

9-03-12-01 PERMIT CLOSEOUT NOTIFICATION

The Permittee must contact the County to set up a Closeout Inspection.

The purpose of the Closeout Inspection is to verify the site is adequately stabilized and/or covered with pavement or structures, per the County accepted plans.

If the County needs to conduct more than one Closeout Inspection, an inspection fee may be assessed for each additional closeout inspection, as approved by Adams County Annual Fee Schedule adopted by the Board of County Commissioners.

9-03-12-02 REMOVAL OF TEMPORARY BMPS

Once the site has met the final stabilization conditions, as specified in Section 9-03-11 Final Construction Site Stabilization, the remaining temporary BMPs such as perimeter controls, inlet protection, silt fence, etc. shall be removed and disposed of properly.

9-03-13 RELEASE OF FINANCIAL SURETY

Once all conditions as specified in Section 9-03-12 Permit Closeout, have been met, the Permittee may request the release of the financial surety to the County.

9-03-14 ADAMS COUNTY REGULATORY INSPECTIONS

All Adams County SWQ Permits may be inspected regularly during construction by the County to ensure compliance with the County's Stormwater Quality Regulations, SWQ Permit and/or ESCP.

Adams County reserves the right to request, at any time, submittals of documents associated with the SWQ Permit, including; the Permittee's stormwater site inspection logs, the current ESCP, etc. The County will identify a time frame that specifies the date the Permittee must submit the requested documentation. If the Permittee fails to provide the requested documentation, a violation will be assessed. Adams County Regulatory Inspections shall not be used in place of the Permittee's stormwater inspections as required under the SWQ Permit.

9-03-15 RIGHT OF ENTRY

Refer to Chapter 1 of these standards and regulations for the authority to enter onto private property within unincorporated Adams County for inspection purposes.

Additionally, the landowner, developer, builder, or SWQ Permittee must allow County staff the right-of-entry for the following:

1. To enter upon the construction project premises where a regulated facility or activity is located or in which records are required to be kept under the terms and conditions of the Adams County Stormwater Quality Regulations or Adams County SWQ Permit.
2. To have access to the construction project premises to request copies of any records, stormwater inspection reports, plans or documentation required to be kept under the terms and conditions of the Adams County Stormwater Quality Regulations.
3. To enter upon the construction project premises to investigate, within reason, any actual, suspected, or potential source of water pollution, or violation of these regulations. The investigation may include, but is not limited to, the following: sampling of any discharge or process waters, the taking of photographs, interviewing associated personnel on alleged violations, and access to any and all facilities or areas within the project premises that may have any effect on the discharge, permit, or alleged violations.

9-03-16 ULTIMATE RESPONSIBILITY

Adams County Stormwater Quality Regulations are to be interpreted as minimum standards and regulations. These regulations may not be adequate to comply with the requirements of the State CDPS Stormwater Discharge Permit for Construction Activities.

The Permittee is ultimately responsible for ensuring compliance with the State CDPS Stormwater Discharge Permit for Construction Activities.

These Regulations do not intend or imply compliance by any person will ensure there will be no contamination, pollution or unauthorized discharge of pollutants. These Regulations shall not be construed as implying County liability for any non-compliance by a Permittee or any other person, nor for any damage or injury to third persons.

9-03-17 AUTHORITY

Enforcement of the Adams County Stormwater Quality Regulations and the County SWQ Permit are the responsibility of the Department of Public Works.

The Department of Public Works is hereby authorized to issue the SWQ Permit and sign-off (or withhold the approval) of associated County permits (e.g. Building, Right-of-Way, Infrastructure, etc.) with a stormwater signature line once all SWQ Permit conditions have been.

The Department of Public Works is also hereby authorized to sign off on the Certificate of Occupancy (C.O.) for buildings holding a SWQ Permit. In order for the Department of Public Works to sign off on a C.O., the associated overall site shall be in compliance with the SWQ Permit. Sites that are under an enforcement action may not receive a sign off by the Department of Public Works.

9-03-18 ENFORCEMENT POLICIES

It is the policy of Adams County to encourage compliance with the Stormwater Quality Regulations by working with the landowner, developer, builder, or SWQ Permittee during construction.

The County may allow the landowner, developer, builder, or SWQ Permittee a reasonable amount of time to re-inspect the site to ensure necessary measures have been completed to bring a construction site into compliance prior to formal enforcement.

The County considers the owner of the land the ultimate responsible party for all construction activities. It is ultimately the responsibility of the landowner to take all necessary measures to ensure the site is in compliance with County, State and Federal statutes, regulations, ordinances and permits.

The County has, to the maximum extent practicable, made its Stormwater Quality Regulations consistent with the requirements of the State CDPS Stormwater Discharge Permit for Construction Activities. In the event of conflicting requirements, the most stringent or restrictive shall govern.

9-03-19 CONSTRUCTION STORMWATER VIOLATIONS

The following items are considered, but not limited to, a violation of the Stormwater Regulations and/or Stormwater Quality (SWQ) Permit:

1. Conducting a permit covered activity without a County SWQ Permit.
2. Failure to prepare an Erosion and Sediment Control Plan (ESCP).
3. Failure to prepare an Erosion Control (EC) Plan.
4. Conducting a permit covered activity without Adams County review and conditional acceptance of the ESCP.
5. Conducting activity without a State CDPS Stormwater Discharge Permit for Construction Activities (when applicable).
6. Failure to renew the SWQ Permit.
7. Failure to renew the SWQ Permit's financial surety.
8. Deficient ESCP.
9. Failure to implement the ESCP or EC Plan.
10. Failure to update the ESCP adequately to reflect current site conditions.
11. Failure to install, maintain or properly select Best Management Practices (BMP).
12. Failure to correct findings from previous Adams County Regulatory Inspections.
13. Failure to perform stormwater inspections of the permitted construction site.
14. Failure to submit requested documentation.
15. Failure to adequately respond to the County's written directives.
16. Failure to install permanent post-construction water quality treatment facilities (if applicable).
17. Lack of good housekeeping practices.
18. Pollution, contamination or degradation of stormwater quality.
19. An illicit discharge into the County's Municipal Separate Storm Sewer System.

9-03-20 PENALTIES

In addition to penalties listed under Chapter 1 of these standards and regulations, the following penalties may apply to any person, landowner, developer, builder, or SWQ Permittee if such person fails to adequately comply with the measures required by the ESCP, EC Plan, SWQ Permit, Stormwater Quality Regulations or other written requirements by the County. The remedies listed below are not exclusive of any other remedies available under any applicable federal, state or local law, and it is within the discretion of the County to seek alternative and/or cumulative remedies.

Verbal or Written Warning: Advice of non-compliance given by the County to the Permittee that indicates the Permittee is in violation with County Regulations and directing immediate resolution.

Notice of Violation: As define in Chapter 1 of these standards and regulations. Additionally, the NOV shall include re-inspection dates in which the County returns to the site to ensure completion of corrective and preventative measures. Possible measures may include, but are not limited to; vacuum and jetting storm sewer structures, attending educational training, submitting standard operating procedures, posting signage, reimbursing the County for any additional inspection cost and/or spill material provided by the County, etc. When clean-up and repairs are not feasible, then alternative equivalent activities may be directed such as, but not limited to, storm drain stenciling, attendance to compliance workshops, and trash cleanup.

Suspension or Revocation of Permits: As define in Chapter 1 of these standards and regulations. All fees for re-issuance of a new permit must be paid prior to re-issuance of the permit.

Permit Fee Increase: As established in the Annual Fee Schedule adopted by the Board of County Commissioners.

Certificate of Occupancy (C.O.) Withhold: As define in Chapter 1 of these standards and regulations. In Addition, the County may withhold the Certificate of Occupancy (C.O.) sign off if the associated overall site is not in compliance with the Stormwater Quality Regulations or SWQ Permit requirements. Sites that are under an enforcement action will not receive a sign off by Public Works Department.

Cease and Desist Order: As define in Chapter 1 of these standards and regulations.

Payment of additional Inspections: A person or landowner may be charged inspection fees for more than one regular follow-up regulatory inspection or any inspection triggered by a Notice of Violation as established in the Annual Fee Schedule adopted by the Board of County Commissioners.

Stringent Stormwater Inspection Frequency: Permittees may be required to conduct stormwater inspections on a more stringent frequency if the Permittee is non-responsive after two NOV, or systematic/chronic violator.

Financial Surety Withdrawal: The County may, after notifying the SWQ Permittee of the required maintenance and/or BMP removal, and such person's failure to perform such maintenance and/or BMP removal within ten (10) business days thereafter, enter upon the property and perform or cause to be performed the required work and assess the reasonable costs and expenses of such work against such person. At such time, as any assessment for work performed by the County has not been paid by the SWQ Permittee, the County shall withdraw from the SWQ Permit Financial Surety;

Civil/Criminal Action: As define in Chapter 1 of these standards and regulations.

9-04 POST-CONSTRUCTION RUNOFF REGULATIONS

The purpose and intent of this Section is to establish minimum post-construction stormwater management requirements and controls to protect and enhance the water quality of receiving waters and to provide for the health, safety and general welfare of the residents of unincorporated Adams County.

The objectives are:

1. To require the implementation of post-construction practices and promote Low-Impact Development (LID) techniques to control stormwater runoff from development and redevelopment sites in order to prevent flooding, erosion and stormwater pollution;
2. To protect surface water resources from degradation by guiding the development of the community away from sensitive areas;
3. To preserve the natural infiltration of groundwater and to protect the quantity and quality of groundwater resources;
4. To ensure adequate long-term operation and maintenance of post-construction stormwater management practices; and
5. To enable the County to comply with the State of Colorado MS4 Permit and other applicable federal and state regulations.

9-04-01 APPLICABILITY

The following construction projects shall comply with Post-construction Run-off Regulation requirements, unless excluded under Section 9-04-02:

1. All development or redevelopment construction sites located within unincorporated Adams County's MS4 Permitted Area that disturb an area of one (1) acre or greater.
2. All development or redevelopment construction sites located within unincorporated Adams County's MS4 Permitted Area that disturb less than one (1) acre, which are part of a larger common plan of development disturbing (1) or more acres of land even though multiple, separate and distinct development activities may take place at different times on different schedules.
3. Any post-construction water quality treatment facility constructed outside Adams County MS4 Permitted Area, which were installed to fulfill the requirement of this Section for parcels that do not have sufficient space to install the post-construction BMP within the MS4 Permitted Area boundary.

In the case where an applicable post-construction BMP is part of future phasing, the temporary measure must meet one of the Minimum Design Standards in Section 9-04-04.

9-04-02 EXEMPTIONS

The following exemptions apply:

1. Any new development or redevelopment site, regardless of the size of the project, located outside Adams County MS4 Permitted Area, provided this exemption does not exclude long-term maintenance responsibilities of drainage structures as set under Section 9-04-13 Operations and Maintenance of Water Quality Treatment Facilities.
2. Any development or redevelopment, regardless of the size or location (inside or outside the MS4 Permitted Area), approved by the County prior to the initial effective date of the implementation of the County's MS4 Permit Post-Construction Run-off Program requirements, provided this exemption does not exclude long-term maintenance responsibilities of existing drainage structures as set under Section 9-04-13 Operations and Maintenance of Water Quality Treatment Facilities.
3. Activities that are exclusively for agricultural land use, regardless of the size or location (in or outside the MS4 Permitted Area).
4. Routine maintenance and repair to any post-construction BMP, regardless of the size or location (inside or outside the MS4 Permitted Area), deemed necessary to maintain original grade, hydraulic capacity or original purpose of drainage structures.
5. Pavement management sites or portions of sites, for the rehabilitation, maintenance, and reconstruction of roadway pavement, which includes roadway re-surfacing, mill and overlay, white topping, black topping, curb and gutter replacement, concrete panel replacement, and pothole repair. The purpose of the site must be to provide additional years of service life and optimize service and safety. The site must also be limited to the repair and replacement of pavement in a manner that does not result in an increased impervious area nor the infrastructure substantially change. The types of sites covered under this exclusion include day-to-day maintenance activities, rehabilitation, and reconstruction of pavement. Roadways include roads and bridges that are improved, designed or ordinarily used for vehicular travel and contiguous areas improved, designed or ordinarily used for pedestrian or bicycle traffic, drainage for the roadway, and/or parking along the roadway. Areas primarily used for parking or access to parking are not roadways.

6. Excluded roadway redevelopment sites for existing roadways, when one of the following criteria is met:
 - a. The site adds less than 1 acre of paved area per mile of roadway to an existing roadway, or
 - b. The site does not add more than 8.25 feet of paved width at any location to the existing roadway.
7. Redevelopment site exclusion of only the area of the existing roadway when the site does not increase the width by two (2) times or more, on average, of the original roadways area. The entire site is not excluded from being considered an applicable development site for this exclusion, the area of the site that is part of the added new roadway area is still an applicable development site.
8. Activities for installation or maintenance of aboveground and underground utilities or infrastructure that do not permanently alter the terrain, ground cover, or drainage patterns from those present prior to the construction activity. This exclusion includes, but is not limited to, activities to install, replace or maintain utilities under roadways or other paved areas that return the surface to the same condition.
9. Single-family residential lot, or agriculturally zoned lands, greater than or equal to 2.5 acres in size per dwelling and having a total lot impervious area of less than ten percent (10%). A total lot imperviousness greater than ten percent (10%) is allowed when a study specific to the watershed and/or MS4 shows expected soil and vegetation conditions are suitable for infiltration/filtration of the WQCV for a typical site, and the County accepts such study as applicable within its MS4 boundaries. The maximum total lot impervious covered under this exclusion shall be twenty percent (20%).
10. Non-residential and non-commercial sites for which post-development surface conditions do not result in concentrated stormwater flow during the 80th percentile stormwater runoff event, as defined in Chapter 11 under the WQCV term. In addition, post-development surface conditions must not be projected to result in a surface water discharge from the 80th percentile stormwater runoff events. Specifically, the 80th percentile event must be infiltrated and not discharged as concentrated flow. For this exclusion to apply, a study specific to the site, watershed and/or MS4 must be conducted. The study must show rainfall and soil conditions present within the applicable site; and the County must accept such study as Applicable within its MS4 boundaries. This exclusion does not apply to residential or commercial sites.

11. Sites with land disturbance to undeveloped land that will remain undeveloped (land with no human-made structures such as buildings or pavement).
12. Stream stabilization sites.
13. Pedestrian or bike trails detached from roadway projects. Bike lanes for roadways are not included in this exclusion, unless attached to a roadway that qualifies under another exclusion in this Section.
14. Facilities associated with oil and gas exploration, production, processing, or treatment operations, or transmission facilities, including activities necessary to prepare a site for drilling and for the movement and placement of drilling equipment, whether or not such field activities or operations may be considered to be an applicable construction activity.
15. In the event the project is located within Adams County Growth Area according to Adams County's MS4 Permit, as amended, the following is excluded:
 - a. Agricultural facilities and structures on agriculturally zoned lands (e.g., barn, stables).
 - b. Residential development site or larger common plans of development for which associated construction activities result in a land disturbance of less than or equal to 10 acres and have a proposed density of less than 1,000 people per square mile.
 - c. Commercial or industrial development site or larger common plans of development for which associated construction activities results in a land disturbance of less than or equal to 10 acres.

9-04-03 GENERAL REQUIREMENT

All applicable development or redevelopment projects shall incorporate in the design permanent water quality treatment and source control BMPs to control and prevent illicit discharges into the storm sewer system. Requirements must be met prior to receiving approval from the County to proceed with construction of the development or redevelopment.

Water Quality Treatment shall:

1. Be designed considering existing site conditions, site operations and potential pollution sources.
2. Be designed to minimize regular maintenance, facilitate the performance of required maintenance and repair tasks, ensure proper functioning and reduce the potential for extensive, difficult and costly remedial or emergency maintenance efforts.
3. Be strong, durable and corrosion-resistant.

4. Incorporate safety measures.
5. Include design features to prevent accumulation or discharge of trash and debris in drainage systems.
6. Include source control BMPs to prevent and/or contain spills at industrial or commercial developments.
7. Avoid adverse effects on water quality and quantity, or harm or damage to persons and property.

9-04-04 MINIMUM WATER QUALITY TREATMENT DESIGN STANDARDS

Post-construction water quality treatment BMPs or facilities for applicable development and redevelopment sites shall meet one of the following base water quality design standards listed below within the County's MS4 Permitted Area:

1. Water Quality Capture Volume (WQCV) Standard: The post-construction BMP shall be designed to provide treatment and/or infiltration of the WQCV and:
 - a. 100% of the applicable development site is captured, except the County may exclude up to 20%, not to exceed one (1) acre, of the applicable development site area when the Developer has determined that it is not practicable to capture runoff from portions of the proposed site that will not drain towards drainage facilities. In addition, the Developer must also determine the implementation of a separate post-construction BMP for the portion of the site that is not practicable. (for example: driveway access that drains directly to the street)
 - b. Evaluation of the minimum drain time shall be based on the pollutant removal mechanism and functionality of the post-construction BMP implemented. Consideration of drain time shall include maintaining vegetation necessary for operation of the post-construction BMP (for example: wetland vegetation)
2. Pollutant Removal Standard: The post-construction BMP is designed to treat at a minimum the 80th percentile storm event. The post-construction BMP(s) shall be designed to treat stormwater runoff in a manner expected to reduce the event mean concentration of total suspended solids (TSS) to a median value of 30 mg/l or less.
 - a. 100% of the applicable development site is captured, except the County may exclude up to 20 percent not to exceed one (1) acre of the applicable site area when the Developer has determined that it is not practicable to capture runoff from portions of the site that will not drain towards a post-construction BMP. In addition, the Developer must also determine the implementation of a separate post-construction BMP for that portion of the site is not practicable (for example: driveway access that drains directly to street).
3. Runoff Reduction Standard: The post-construction BMP(s) is designed to infiltrate into the ground where site geology permits, evaporate, or

evapotranspire a quantity of water equal to 60% of what the calculated WQCV would be if all impervious area of the applicable site discharged without infiltration. This base design standard can be met through practices such as green infrastructure. Green infrastructure generally refers to control measures that use vegetation, soils, and natural processes to mimic natural processes to manage stormwater. Green infrastructure can be used in place of or in addition to Low Impact Development (LID) principles.

4. Applicable Site Draining to a Regional WQCV Control Measure: The regional WQCV control measure must be designed to accept the drainage from the applicable site. Stormwater from the site must not discharge to a water of the state before being discharged to the regional WQCV control measure. The regional WQCV control measure must meet the requirements of Section 9-04-04.1) Minimum Design Standard - WQCV Standard.
5. Applicable Site Draining to a Regional WQCV Facility: The regional WQCV facility is designed to accept drainage from the applicable site. Stormwater from the site may discharge to a water of the state before being discharged to the regional WQCV facility. Before discharging to a water of the state, at least 20 percent of the upstream imperviousness of the applicable site must be disconnected from the storm drainage system and drain through a receiving pervious area control measure comprising a footprint of at least 10 percent of the upstream disconnected impervious area of the applicable site. The control measure must be designed in accordance with Mile High Flood District's Urban Storm Drainage Criteria Manual, Volume 3 as amended and/or equivalent criteria. In addition, the stream channel between the discharge point of the applicable site and the regional WQCV facility must be stabilized. The regional WQCV facility must meet the following requirements:
 - a. The regional WQCV facility must be implemented, functional and maintained following good engineering practices, hydrologic and pollution control practices.
 - b. The regional WQCV facility must be designed and maintained for 100% WQCV for its entire drainage area.
 - c. The regional WQCV facility must have a capacity to accommodate the drainage from the applicable development site.
 - d. The regional WQCV facility must be designed and built to comply with all assumptions for the development activities planned by the County within its drainage area.
 - e. Evaluation of the minimum drain time shall be based on the pollutant removal mechanism and functionality of the facility. Consideration of drain time shall include maintaining vegetation necessary for operation of the facility (for example: wetland vegetation).
 - f. The regional WQCV facility must meet the requirements under Section 9-04-09 Site Plan Review and Section 9-04-12 Inspections.

- g. The regional WQCV facility must be subject to the County's regulatory authority, or ownership.
- h. Regional WQCV facilities must be designed and implemented with flood control or water quality as the primary use. Recreational ponds and reservoirs may not be considered regional facilities for the purpose of this Section. Water bodies listed by name in surface water quality classifications and standards regulations (5 CCR 1002-32 through 5CCR 1002-38) may not be considered regional facilities.

**9-04-05 MINIMUM WATER QUALITY TREATMENT DESIGN STANDARD FOR
CONSTRAINED REDEVELOPMENT SITES**

This Section applies to applicable redevelopment sites that meet the following criteria:

- 1. The applicable redevelopment site is for a site that is greater than 75% impervious area, and
- 2. The Developer has determined it is not practicable to meet any of the minimum design standards listed under Section 9-04-04. The Developer's determination shall include an evaluation of the applicable redevelopment site's ability to install a post-construction BMP without reducing surface area covered with the structures.

Post-construction water quality treatment BMP shall be designed to meet one (1) of the following:

- 1. Provide treatment of the WQCV for the area captured. The captured area shall be 50% or more of the impervious area of the applicable redevelopment site. Evaluation of the minimum drain time shall be based on the pollutant removal mechanism and functionality of the post-construction BMP implemented; or
- 2. The post-construction BMP is designed to provide for treatment of the 80th percentile storm event. The post-construction BMP shall be designed to treat stormwater runoff in a manner expected to reduce the event mean concentration of total suspended solids (TSS) to a median value of 30 mg/l or less. A minimum of 50% of the applicable redevelopment area including 50% or more of the impervious area of the applicable redevelopment area shall drain to the post-construction BMP. This standard does not require that 100% of the applicable redevelopment site area be directed to the post-construction BMP(s) as long as the overall removal goal is met or exceeded (for example: providing increased removal for a smaller area); or
- 3. Infiltrate, evaporate, or evapotranspirate, through practices such as green infrastructure, a quantity of water equal to 30% of what the calculated WQCV would be if all impervious area for the applicable redevelopment site discharged without infiltration.

**9-04-06 ACCEPTABLE POST-CONSTRUCTION WATER QUALITY TREATMENT
BMPS**

All permanent post-construction water quality treatment BMPs or facilities within unincorporated Adams County shall be designed and maintained to meet erosion control, groundwater recharge and stormwater runoff quantity and quality standards of these Regulations; the Mile High Flood District's Urban Storm Drainage Criteria Manual, Volume 3 as amended; and/or equivalent criteria.

The County allows, but is not limited to, the following types of stormwater quality permanent Best Management Practices (BMPs):

1. Bioretention/Rain Garden
2. Sand Filter
3. Extended Detention Basin
4. Permeable Pavements
5. Other stormwater quality drainage facilities will be considered on a case by case basis. Refer to Section 9-04-07 Proprietary or Alternative Post-construction Water Quality Treatment Facilities.

**9-04-07 PROPRIETARY OR ALTERNATIVE POST-CONSTRUCTION WATER
QUALITY TREATMENT FACILITIES**

The technology of post-construction water quality treatment facilities is constantly changing. New innovations are developed and existing technologies are refined to be more effective. The acceptable drainage facilities listed in Section 9-04-06 are not meant to be comprehensive. Should the owner or engineer desire to use other post-construction water quality treatment BMPs, it will be necessary to provide documentation that adequately demonstrates an alternative post-construction BMP option can effectively control stormwater runoff quality. Proprietary or alternative post-construction BMP options will be reviewed on a case-by-case basis.

**9-04-08 PERMANENT POST-CONSTRUCTION WATER QUALITY TREATMENT
BMP CONSTRUCTED OUTSIDE UNINCORPORATED ADAMS COUNTY**

When the location of the permanent post-construction BMP of an applicable site is designed and constructed to meet the requirements of these Regulations outside of the jurisdictional control of Adams County, the Developer needs to request to the adjacent local jurisdiction a written letter stating the permanent post-construction BMP is accepted by the local jurisdiction as part of their Post-Construction Program to ensure said permanent post-construction BMP is design, constructed and accepted by the local jurisdiction to ensure long-term maintenance of said infrastructure.

9-04-09 SITE PLAN REVIEW

Applicable sites shall submit to the County the following information for review and approval prior to development or redevelopment of the site:

1. Site plan including design details for all structural water quality treatment facilities.
2. Drainage Report including a narrative for all non-structural BMPs for the site including measures to prevent or reduce pollutants being introduced to stormwater, or that prevent or reduce the generation of runoff (such as LID techniques) or illicit discharges according to Section 9-04-10 Source Control BMPs
3. Operation and Maintenance Plan describing procedures to ensure long-term function and integrity of the stormwater drainage facilities.
4. Recorded Easement or other legal means to allow the County's access to the post-construction BMP
5. Drainage Report including documentation and confirmation the post-construction water quality treatment BMP was designed according to Section 9-04-04 Minimum Design Standards.
6. If any modification is proposed to the approved Site Plan, the Site Plan must be re-submitted for approval prior to construction or modification of the proposed changes.

9-04-10 SOURCE CONTROL BMPS

Applicable sites shall be required to provide on-site structural and/or non-structural source controls to reduce the potential for illicit discharges into the storm drainage system from the normal operation of the constructed site. Examples of normal site activities which have the potential for pollutants to be discharged and carried off in stormwater runoff include, but are not limited to:

1. Outside material storage
2. Vehicle washing
3. Vehicle maintenance
4. Outside manufacturing
5. Painting operations
6. Above ground storage tanks
7. Loading and unloading areas
8. Fueling
9. Power washing

9-04-10-01 STRUCTURAL SOURCE CONTROLS

Applicable sites that propose outdoor uses and activities that are deemed by the County to have the potential to create illicit discharges shall be required to provide special source control Best Management Practices (BMPs). The source

control BMPs shall be designed to prevent the contamination of stormwater runoff from the site. Source control BMPs can include, but are not limited to:

1. Permanent covering of outdoor storage areas
2. Spill containment and control (secondary containment, curbing, diking, etc.)
3. Proper sanitary sewer connections
4. Provision of designated storage and material handling areas
5. Provision of proper waste receptacles
6. Run-on diversion

9-04-10-02 NON-STRUCTURAL CONTROLS

Non-structural Best Management Practices (BMPs) reduce or prevent contamination of stormwater runoff by decreasing pollutant generation through changes in behavior. Non-structural controls are extremely effective, as they typically prevent or eliminate the entry of pollutants into stormwater at their source. The County encourages all development and redevelopment to require and implement non-structural controls throughout their site and within their facility operational practices. Non-structural BMPs, which may provide a significant benefit to water quality, include:

1. General good housekeeping practices
2. Preventative maintenance
3. Recycling programs
4. Spill prevention and response
5. Employee "awareness" education and training

9-04-11 OWNERSHIP

Permanent post-construction water quality treatment BMPs, as well as detention drainage facilities, located on private property shall be operated, repaired, maintained and replaced as necessary by the landowner of the property on which the drainage facility is located within unincorporated Adams County, unless a written Operation and Maintenance Manual or recorded document exists stating that a person other than the landowner shall be responsible for the operation, repair, maintenance and replacement of such facility.

Prior to the approval of the development or redevelopment, the County may require the landowner to create an association to be responsible for the operation, repair, maintenance and replacement of the drainage facility. The bylaws, covenants and restrictions of the association shall include the legal responsibility to operate, repair, maintain and replace the drainage facility installed in the development, as well as legal authority to levy an assessment on each property owner to pay for the operation,

repair, maintenance and replacement of the drainage facility, and provisions for a lien on an owner's property for failure to pay the assessment.

9-04-12 INSPECTIONS

The landowner or person responsible for any applicable drainage facility shall perform regular inspections in accordance with the adopted criteria manuals or as specified in the Operation and Maintenance (O&M) Plan. Inspection records shall be retained for at least five (5) years and shall be readily available to the County upon request.

9-04-13 OPERATION AND MAINTENANCE OF WATER QUALITY TREATMENT FACILITIES

An important part of water quality management is the continued maintenance of permanent post-construction water quality treatment BMP facilities to ensure they function as designed.

Repair, maintenance and replacement of drainage facilities include routine and non-routine operations. Routine maintenance may include inspections, lawn mowing and care, debris and litter removal, minor erosion mitigation, mechanical repairs, mosquito control, and sediment removal. Non-routine procedures may include removal of large amounts of accumulated sediments, dredging the bottom of a pond, restoration of large eroded areas, fence repair or replacement, restoration of vegetation and structural repairs.

The owner of the property located within unincorporated Adams County is responsible for the maintenance in perpetuity of privately owned drainage facilities including storm inlets, storm pipes, culverts, channels, ditches, hydraulic structures, emergency spillways, detention basins or bioretention basins, etc. located on private land unless modified by the Subdivision Improvement Agreement (SIA), recorded Plat, approved and recorded Operation and Maintenance Manual or other acceptable recorded document. Preventative and corrective maintenance and replacement shall be performed to maintain the function and integrity of the stormwater post-construction BMP and other drainage facilities.

9-04-13-01 MAINTENANCE REQUIREMENT

The County requires maintenance of the private storm sewer systems, including permanent post-construction water quality treatment BMPs. The obligation to maintain drainage facilities and the County's legal right to enforce that obligation is a requirement of this Section. It may also be memorialized on the Subdivision Plat, Annexation Map, Subdivision Improvement Agreement, recorded Operation and Maintenance Manual or other instrument in a form acceptable to the County.

When recording a Plat, the maintenance requirement shall be clearly stated within the plat notes. Refer to the Appendices for Drainage Maintenance and Access Easement language, or equivalent statement, that must be included in applicable Plats or standalone Warranty Deeds. The documents shall be filed in the office of Adams County Clerk and Recorder, and the terms thereof shall run with the land and be binding on all subsequent owners of the property, the person responsible for operation, repair, maintenance and replacement of the drainage facility or his or her successors and assigns, to ensure structural drainage facilities function as designed and non-structural post-construction BMP are preserved and not altered.

9-04-13-02 MAINTENANCE ACCESS AND DRAINAGE EASEMENT

Adams County requires maintenance access be provided to private storm drainage facilities to assure continuous operational capability of the system.

The property owner shall designate a maintenance access around the perimeter of storm drainage facilities, provide a stabilized maintenance access to the bottom of the storm drainage facility; and ensure all necessary manholes and inlets are located properly and accessible for maintenance.

The property owner shall designate a Maintenance Access and Drainage Easement sufficient to ensure access to all drainage facilities on a permanent basis for the purpose of inspection, operation, repair, maintenance and replacement. Such easement shall be recorded in the office of the Adams County Clerk and Recorder and the easements shall run with the land. Should the property owner fail to adequately maintain said facilities, the County shall have the right to enter said land for the purposes of repair or maintenance as described in Section 9-04-16 Penalties.

9-04-13-03 OPERATION AND MAINTENANCE PLAN

In addition to the Easement, the property owner is responsible for recording an Operation and Maintenance (O&M) Plan once the drainage facility is constructed. The O&M Plan shall include:

1. Indicate person responsible for inspecting and performing long-term operation, repair, maintenance and replacement, emergency repairs, of all post-construction BMPs (Property Owner, HOA or County);
2. Description and identification of all stormwater drainage facilities, structural and nonstructural;
3. Description of specific preventative maintenance tasks and maintenance frequency for all drainage facilities;
4. Description of inspection procedures and frequency for all drainage facilities;

5. Designation of Maintenance Access and Drainage Easements on the property sufficient to ensure access to all drainage facilities;
6. Operational standards from the manufacturer of any manufactured BMPs structure or device;
7. Other information or provisions as required by the County.

Refer to the Development Standards & Regulations Appendices for O&M Plan template.

9-04-14 RIGHT OF ENTRY

Refer to Chapter 1 of these standards and regulations for authority to enter onto private property within unincorporated Adams County for inspection purposes. The inspection may include, but is not limited to, the following: sampling of any discharge and/or process waters; taking of photographs; interviewing staff on alleged violations; and access to any and all facilities or areas within the premises that may have any effect on the discharge.

9-04-15 POST-CONSTRUCTION VIOLATIONS

The following items are considered, but not limited to, a violation of the Adams County Standards and Regulations:

1. Failure to maintain drainage facilities.
2. Failure to perform regular post-construction inspections.
3. Failure to submit requested documentation.
4. Failure to adequately respond to the County's written directives.
5. An illicit discharge into the County's MS4.

If operation standards for drainage facilities are not being met; or repairs, maintenance or replacement of the post-construction BMP is required, the County may, in writing, direct the landowner and/or the person responsible therefore, or their agents or representatives, to correct operational failures, repair, maintain, replace and/or install any post-construction BMP in order to keep the post-construction BMP in acceptable working condition.

9-04-16 PENALTIES

In addition to the penalties listed under Chapter 1 of these standards and regulations, the following penalties may apply to any person or landowner within unincorporated Adams County, if such person fails to adequately comply with the measures required under Section 9-04 Post-construction Run-off Regulations, Stormwater Quality Regulations or other written requirements of the County.

The remedies listed in this regulation are not exclusive of any other remedies available under any applicable federal, state or local law, and it is within the discretion of the County to seek alternative and/or cumulative remedies

Verbal or Written Warning: advice of non-compliance given by the County to the Permittee that indicates the Permittee is in violation with County Regulations and directing immediate resolution.

Notice of Violation: As define in Chapter 1 of these standards and regulations. Additionally the NOV shall include re-inspection dates on which the County returns to the site to ensure completion of such measures were completed. Possible remediation measures may include vacuum and jetting storm sewer structures, attending educational training, submitting standard operation procedures, posting signage, reimbursing the County for any additional inspection cost and/or spill material provided by the County, etc. When clean-up and repairs are not feasible, alternative equivalent activities may be directed such as, but not limited to, storm drain stenciling, attendance to compliance workshops, and trash cleanup.

Cease and Desist Order: As define in Chapter 1 of these standards and regulations.

Payment of additional Inspections: A person or landowner may be charged inspection fees for any inspection triggered by a Notice of Violation as established in the Annual Fee Schedule adopted by the Board of County Commissioners.

Stormwater Inspection Frequency: The landowner or responsible person may be required to conduct inspections on a more stringent frequency if the person or landowner is non-responsive after two NOV or a systematic/chronic violator.

Mandatory Inspection: Upon written notification by the County, the person or landowner responsible for any post-construction BMP shall, at his or her own cost and within a reasonable time period determined by the County, have an inspection of the post-construction BMP conducted by a qualified professional; file with the County a copy of the written report of inspection prepared by the professional; and, within the time period specified by the County, complete any repair, maintenance or replacement work recommended in the report to the satisfaction of the County.

Civil/Criminal Action: As define in Chapter 1 of these standards and regulations.

9-05 ILLICIT DISCHARGES

No person shall cause, allow, or contribute to the discharge of pollutants into the storm drainage system within unincorporated Adams County.

Penalties and enforcement shall be applied according to Chapter 1 of these standards and regulations.

9-05-01 PROHIBITION OF ILLICIT DISCHARGES

1. No person shall discharge or cause to be discharged into the storm drainage system or watercourses any pollutants or waters containing any pollutants that cause or contribute to a violation of applicable water quality standards, or any state established TMDL, other than stormwater.
2. It shall be a violation of these Regulations to cause pollutants to be deposited in such a manner or location as to constitute a threatened illicit discharge into the storm drainage system or Waters of the State.

9-05-02 PROHIBITION OF ILLICIT CONNECTIONS

1. The construction, use, maintenance or continued existence of illicit connections to the storm drainage system is prohibited.
2. The prohibition expressly includes illicit connections made prior the effective date of this Chapter, regardless of whether the connection was permissible under law or practices applicable or prevailing at the time of connection.

9-05-03 EXEMPTIONS

The commencement, conduct or continuance of any illicit discharge to the storm drainage system is prohibited except as described as follows:

1. The following non-stormwater discharges are exempt from the discharge prohibitions established by this Section when managed according to County regulations:
 - a. Discharges from potable water sources, including waterline flushing, in accordance with CDPHE Water Quality Control Division's Low Risk Policy Discharge Guidance for Portable Water as amended. Potable water shall not be used in any other additional process such as, but not limited to, any type of washing, heat exchange, manufacturing, or hydrostatic testing of pipelines not associated with treated water distribution systems;
 - b. Uncontaminated pumped groundwater, not including construction dewatering systems);
 - c. Landscape irrigation and lawn watering;
 - d. Irrigation return flow;

- e. Springs;
 - f. Rising groundwater;
 - g. Air conditioning condensation;
 - h. Uncontaminated water from crawl space pumps;
 - i. Individual residential car washing;
 - j. Foundation drains;
 - k. Roof drains;
 - l. Footing drains;
 - m. Dechlorinated swimming pool discharges in accordance with CDPHE Water Quality Control Division's Low Risk Discharge Guidance: Swimming Pools;
 - n. Diverted stream flows;
 - o. Dye testing, in accordance with the manufacturer's recommendations and that notification is provided to the County prior to the test;
 - p. Flow from natural riparian habitats and wetlands;
 - q. Uncontaminated groundwater infiltration (not including construction dewatering systems);
 - r. Water incidental to street sweeping (including associated sidewalks and medians) not associated with construction;
 - s. Discharges resulting from emergency firefighting activities;
 - t. Stormwater runoff with incidental pollutants; and
 - u. Discharges that are in accordance with the CDPHE Water Quality Control Division's Low Risk Policy guidance documents or other policies and guidance documents where the Division has stated that it will not pursue permit coverage or enforcement for specified point source discharges.
2. Agricultural stormwater run-off.
 3. Permitted discharges with an NPDES or CDPS permit, waiver or waste discharge order issued to the discharger and administered under the authority of the Environmental Protection Agency or Colorado Department of Public Health and Environment as being necessary to protect public health and safety, provided the discharger is in full compliance with all requirements of the permit, waiver or order and other applicable laws and regulations, and provided written approval has been granted for any discharge to the storm drainage system.

9-05-04 WATERCOURSE PROTECTION

Dumping or disposal of debris such as yard waste, shopping carts, brush, fill, etc. on natural channels, streams or watercourses is prohibited to avoid flood hazards. Debris can clog culverts, divert flows, and reduce the conveyance capacity of channels, streams and watercourses.

Adams County may remove or cause to be removed any obstruction to any natural channel, stream or watercourse which causes a flood hazard, and for such purpose shall

have the right of access to any such natural stream, which access shall be accomplished through existing gates and lanes, when possible.

Every person owning, leasing or otherwise occupying property through which a natural channel, stream or watercourse passes shall keep and maintain that part of the watercourse within the property free of trash, debris, excessive vegetation, animal waste (excluding agricultural practices specifically exempted in Section 9-05-03) and other obstacles that would pollute, contaminate, or significantly retard the flow of water through the watercourse. In addition, the owner, lessee or tenant shall maintain existing privately owned approved structures within or adjacent to a watercourse, so that such structures will not become a hazard to the use, function, or physical integrity of the watercourse.