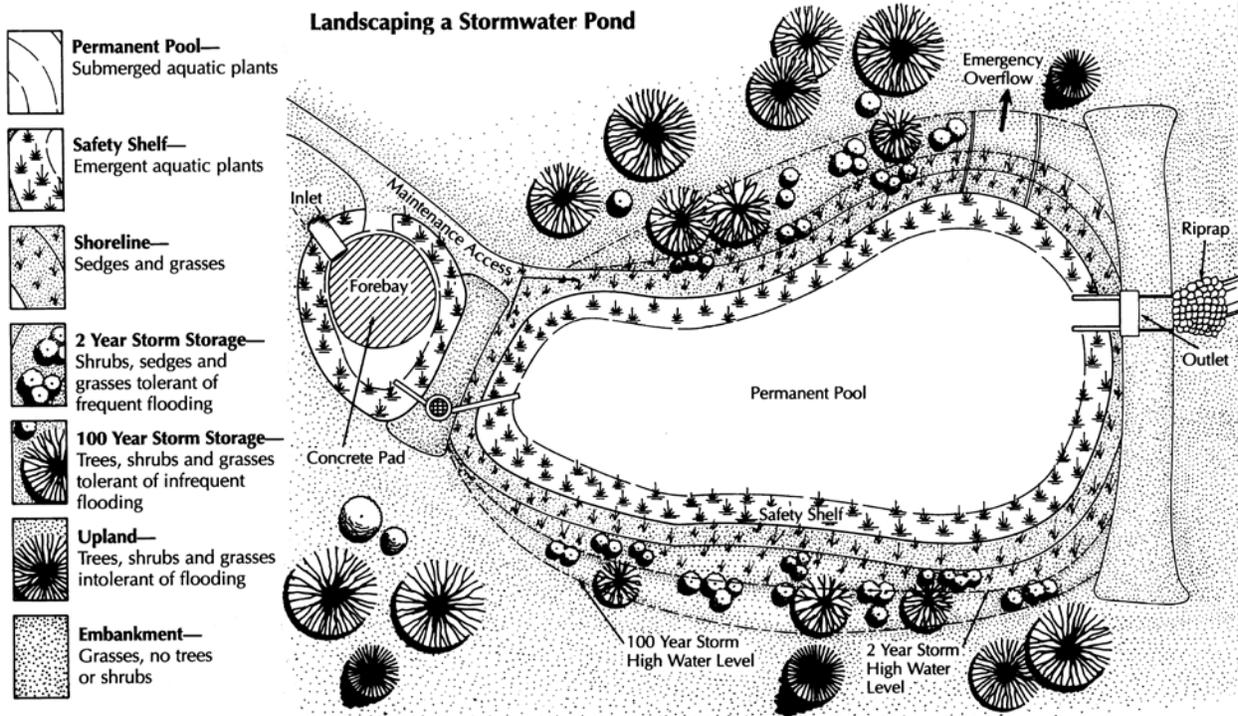


# STORMWATER DESIGN MANUAL



NOVEMBER, 2016

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## **APPENDICES**

**Appendix "A" Sedgwick County, KS Rainfall Intensity Table**

**Appendix "B" Manning's "n" Values for Pipes**

## **1.0 Introduction**

The City of City of Park City Municipal Separate Storm Sewer System (MS4) Operator as required by the City of City of Park City Stormwater Management Ordinance is providing the Stormwater Design Manual to provide guidelines for the engineering and design of stormwater systems and erosion control practices in City of Park City. This manual applies to all areas under the jurisdiction of the City of Park City.

## **2.0 Required Submittals**

Any person or landowner who develops or engages in development activities on land or a development site subject to the provisions contained herein must first obtain a Stormwater Management Plan Approval (SWMPA) from the City. A Stormwater Management Plan (SWMP) must be submitted to the City before plan approval can be granted. The plan shall include the following:

### **2.1 Plans**

2.1.0 A complete set of plans signed and stamped by a registered engineer. The plan sheets shall be provided with a 1"=20', 1"=30', 1"=40', 1"=50' scale only and include at a minimum:

2.1.1 A title sheet with the project name and address, location map and a vicinity map clearly indicating the project location, the name, address and phone number of the developer/ owner and design engineering firm, and the name of City of Park City, Kansas.

2.1.2 A plan sheet with the existing topography at no greater than a 2 foot contour interval, 1 foot being preferred; and providing a USGS datum benchmark. Single family structures, public streets may be exempted from this requirement;

2.1.3 A plan sheet or sheets with the proposed development layout and grading. The topography should be at no greater than a 2-foot contour interval, 1 foot being preferred. All grade breaks should be defined and labeled with spot elevations. The grading plan shall also include the 100-year base flood elevation (BFE) as required in Section 4.5 with notation as to the source of the BFE (e.g. The Flood Insurance Rate Study, date). All appropriate floodplains shall also be delineated and the source noted;

2.1.4 A plan and profile of the proposed storm sewer system for all projects. Easement lines and right-of-way limits shall be included and clearly labeled on the plan view;

2.1.5 A separate erosion and sediment control plan showing the location of all erosion control BMPs and including details of the installation methods shall be provided;

2.1.6 A detail sheet with installation and dimensional details for all proposed storm conveyances. Please refer to Appendix VIII for standard details of conveyances accepted;

2.1.7 A certified survey showing residential, roadway and drainage easements and right-of-way.

2.1.8 A table which summarizes the post-developed condition of the development in square feet (roof tops, sidewalks, drives, parking lots, retention/detention areas, natural areas, etc.)

2.1.9 Number of storm drain inlets with capacities.

## **2.2 Drainage Report**

The drainage report for platting purposes shall include the following:

2.2.1 A drainage narrative. This narrative shall include a description of: the existing and proposed runoff patterns; the downstream receiving facilities; summary of all calculations; all assumptions used in the calculations;

2.2.2 Basin maps shall be submitted for the pre- and post-developed project and correspond to the calculations/computer models. These basin maps shall include all off-site basins, detention design basins, and pipe inlet / catch basin areas. Basin areas should be clearly labeled on the maps with respect to the basin labels used in the computer modeling;

2.2.3 Computer model input and output reports. The computer reports shall include all input parameters (time-of-concentration, basin areas, curve numbers, rainfall depths, rainfall distributions, etc.) and copies of the corresponding calculations. A node diagram shall be provided that summarizes the computer model routing. Summary reports showing all the inputs. Detailed hydrographs are optional and may be requested as required by the City of Park City;

2.2.4 A written narrative is required with the submittal stating that the drainage plans are in compliance with the provisions of this City of Park City, Kansas Stormwater Design Manual.

2.2.5 The drainage report shall be signed, dated and stamped by a registered professional.

Plan sheets for drainage plans can be either 24"x36" or 36"x48".

The City may require such additional information to be included in a drainage plan that is necessary to evaluate and determine the adequacy of the proposed drainage and water quality facilities. For all Residential subdivisions the developer shall produce a four corner lot grading plan for each residential lot, and provide a copy to the City in pdf format with at least one hard copy.

At such time as the City determines that all requirements of this manual are met, a formal notice of approval shall be issued by the City.

If any construction project is determined to be inconsistent with plans previously approved by the City may be subject to the articles of Section 12 of this manual (Enforcement). Any changes to already approved plans by the City of Park City must be submitted to the City of Park City and re-approved as a revision. Additional hourly review fees may be applicable to this revision review.

Lot Grading Plan shall include a copy of the plat with existing contours along with four corner final elevations for each lot, and finish floor or top of foundation for the primary structure. Both a paper and a digital copy seal by the engineer shall be submitted to the City.

### **3.0 Hydrology – Runoff Estimation**

The most critical parameter in stormwater engineering is estimating the amount and rate runoff will occur for rainfall events. This estimation first provides the basis for determining if detention is required and then the quantity of storage necessary. Two methods shall be considered acceptable by the City of Park City; the rational method, for development areas with a total watershed less than or equal to 5 acres, and hydrograph generating / routing techniques for developments with a total watershed greater than 5 acres. The same methodology must be used to determine the pre- and post-developed runoff rates.

#### **3.1 Rational Method**

The rational method is based on the equation,

$$Q = C i A$$

Where Q = is the peak runoff rate, cubic feet per second (cfs)

C = the runoff coefficient (Table 3.1.1)

i = the rainfall intensity (in/hr)

A = area of the drainage basin in acres.

The rainfall intensity is chosen corresponding to the time-of-concentration. The time-of-concentration shall be calculated as described in 3.2 below.

The following steps summarize the procedure:

- Determine the watershed area;
- Estimate from Table 3.1.1 the runoff coefficient C or the composite area runoff coefficient;
- Calculate the time-of-concentration (per Section 3.2);
- Determine the rainfall intensity using Sedgwick County, Kansas Rainfall Intensity Table.

**Table 3.1.1**

<b>TYPE OF SURFACE</b>	<b>RUNOFF COEFFICIENT</b>
<b>Non-Urban Areas</b>	
Bare Earth	0.55
Steep Grassed Areas (slope 2:1)	0.60
Turf Meadows	0.25
Forested Areas	0.20
Cultivated Fields	0.30
<b>Urban Areas</b>	
All Watertight Roof Surfaces	0.90
Pavement (concrete, asphalt)	0.85
Gravel	0.85
Impervious Soils (Heavy)	0.55
Impervious Soils (with turf)	0.45
Slightly Pervious Soil	0.25
Slightly Pervious Soil (with turf)	0.20
Moderately Pervious Soil	0.15
Moderately Pervious Soil (with turf)	0.10
Business, Commercial & Industrial	0.85
Apartments & Townhouses	0.70
Schools & Churches	0.55
Single Family Lots < 10,000 ft <sup>2</sup>	0.45
Lots < 12,000 ft <sup>2</sup>	0.45
Lots < 17,000 ft <sup>2</sup>	0.40
Lots > 1/2 Acre	0.35
Park, Cemetery or Unimproved Area	0.30

### **3.2 Time-of-Concentration (T<sub>c</sub>)**

The time-of-concentration shall be determined using the Time of Concentration or Travel Time Worksheet in Technical Release 55 (TR-55). This method addresses the time-of-concentration in three parts, sheet flow, shallow concentrated flow and channel flow. A table of Manning's roughness coefficients for sheet flow (Table 3.1.2), and the graph for determining the average velocity for shallow concentrated flow (Figure 3.3.1). A minimum time-of-concentration of 5 minutes shall be used for all calculations. In addition, only a 5 minute time-of-concentration may be assumed for calculations. All other times-of-concentration must be supported with calculations.

### **3.3 Rainfall**

#### **3.4.1 Intensities – Rational Method**

The rainfall intensities for use in the rational method can be determined using Appendix "A", Sedgwick County, Kansas Rainfall Intensity Table.

### **3.5 Downstream Analysis**

Downstream analysis may be used, upon approval of the City of Park City, to demonstrate that a proposed development's runoff will not increase the peak runoff in the receiving watercourse if no detention is provided. The proposed development area must be 10% or less of the watershed area at the discharge location.

Downstream analysis shall be performed by creating an existing conditions hydrograph for the watershed without the development area and an existing hydrograph for the proposed development. These two hydrographs are to be added together to determine the peak existing conditions flow. A third hydrograph of the proposed development conditions shall then be generated and added to the existing upstream watershed hydrograph to determine the developed peak flow. If there is no increase, then detention may be waived.

Downstream analysis may be performed for open channel areas only. Areas with significant pipe systems upstream or downstream of the subject site may not use downstream analysis. In addition the City of Park City reserves the right to require detention in lieu of downstream analysis as appropriate.

Downstream analysis submissions shall include basin maps, curve number documentation, and all hydrograph inputs and outputs, etc.

Detention shall be required for all proposed developments where the runoff rate from the proposed post-developed conditions shall increase when compared to the pre-developed conditions. In addition, detention may be required for any development in areas where downstream flooding has been identified by the City of Park City. The pre- and post-developed runoff rates shall be determined using methodologies below.

All detention ponds shall meet the minimum requirements of detaining the post-developed 100-year storm and releasing the runoff at the pre-developed 100-year peak storm release rate. Likewise, the post-developed 10-year peak storm shall be detained and released at the pre-developed 10-year peak storm release rate. There shall be no increase in the runoff rate from the pre-developed conditions to the post-developed conditions for all storms at all discharge points along the property line. An adequate downstream receiving facility shall be identified on the plans. There shall be no increase in erosion potential on the adjoining properties. Earthen embankments, dams and/or berms designed and constructed to detain or impound shall be designed using criteria specified in this manual.

***(Remainder of Page left blank on purpose)***

Table 3.1.2

<b>TYPE OF SURFACE</b>	<b>COEFFICIENT</b>
Smooth Surfaces (concrete, asphalt, gravel, bare soil)	0.011
Fallow (no residue)	0.05
Cultivated Soils:	
Residue cover $\leq$ 20%	0.06
Residue cover $>$ 20%	0.17
Grass:	
Short Grass Praire	0.15
Dense Grass	0.24
Bermuda Grass	0.41
Range (natural)	0.13
Woods:	
Light Underbrush	0.40
Dense Underbrush	0.80

210-VI-TR-55, Second Edition, June 1986

## **4.0 Hydraulics-Detention**

### **4.1.1 Rational Method**

The rational method may be used for detention design on developments less than or equal to 5 acres contributing area. The allowable release rate shall be calculated using a runoff coefficient of 0.10.

### **4.1.2 Hydrograph Methods**

Detention ponds collecting watersheds greater than 5 acres and facilities not designed using the rational method shall be designed by hydrograph routing techniques. The 0.5-, 1-, 2-, 3-, 6-, 12-, and 24-hour duration storms shall be routed to determine the peak release rates, maximum pond elevation and required peak volumes. The peak elevation shall be shown on the grading plan.

### **4.1.3 In-Line Detention**

In-line detention should be avoided to the extent practicable. However, when in-line detention is proposed, the pond shall be designed using the characteristics of the site only as required in Section 4.1.2. A weir or other discharge structure shall be installed at the peak elevation as determined in Section 4.1.2 to accommodate the off-site or flow-through runoff.

## **4.2 Pipe Design**

The minimum pipe diameter shall be 12 inches and the minimum full flow velocity shall be 2.0 fps for all pipes. Orifice plates shall be used when smaller openings are required to restrict flow. All pipes must have a minimum of 1.5 feet of cover and trash racks shall be provided for pipe inlets and outlets as well to prevent entry by wildlife or children.

Pipes must be designed to accommodate the 10-yr flow with the Hydraulic Grade Line (HGL) below the crown of the pipe. An overflow route to the detention facility shall be provided for flows greater than the 10-yr storm. If an overflow route is unavailable, then the pipes should be designed to accommodate the 100- yr HGL below the top of casting elevations or within an easement.

Pipes may be designed using the Manning's equation. When the total design flow reaches 90% of the Manning's pipe capacity, hydraulic gradeline calculations shall be submitted to document the 10-year flow is below the crown of the pipe.

#### **4.2.1 Manning's Equation**

Manning's equation should be used for the design of all stormwater pipes. See Appendix "B" for table.

#### **4.2.2 Tailwater**

The Manning's equation addresses only the flow conditions of the pipes and assumes a free outfall. When proposed pipe outfalls are submerged or may be subject to submergence, the starting depth of water (tailwater) shall be included in the analysis and sizing of the pipes. Pipes subject to submergence shall use, as a minimum, a starting tailwater condition equivalent to the 10-year elevation of the receiving facility. All tailwater analysis methods must be approved by the City of Park City.

#### **4.2.3 Culverts**

Culverts under roadways designated as thoroughfares, arterials or that providing the only means of ingress and egress to developments, shall accommodate the 100-year flow to the culvert without over-topping the roadway.

Culverts under collector roadways (those roadways connected to designated thoroughfares and arterials) shall accommodate the 50-year flow to the culvert without overtopping the roadway.

All other roadway culverts shall accommodate the 25-year flow to the culvert without overtopping the roadway.

Driveway culverts shall accommodate the 10-year flow to the culvert without overtopping the driveway.

#### **4.2.4 Lift Stations**

Lift stations shall not be designed as part of a storm water conveyance system. Proposed storm water lift stations will only be reviewed if complete documentation of no other reasonable option is provided. Storm water lift stations will be approved on a case-by-case basis.

#### **4.2.5 Perimeter Drain Collection**

All residential development regulated by this Ordinance shall indicate on their plans an appropriately sized, common collection swale, ditch or subsurface pipe structure that provides a positive discharge, collects and effectively conveys perimeter drain discharge to an appropriate offsite outlet.

#### **4.2.6 Sump Pumps**

Sump pumps shall be connected to the MS4 and not the City's sanitary storm sewer system

#### **4.2.7 Roof Down Spouts**

Down spouts shall not be connected to the City's MS4 or the City's sanitary sewer system.

### **4.3 Inlet Capacity and Gutter Spread 4.3.1 Inlet Capacity**

Inlets shall be designed to properly convey the 10-yr storm event. Grate castings shall provide a sufficient grate opening to collect the 10-yr storm event with a maximum depth above the casting of 7" and shall not affect the surrounding structures. Emergency overflow routing should be provided for storm events greater than the 10-yr storm. Multi-lane roadways shall maintain one clear driving lane in both directions.

#### **4.3.2 Gutter Spread**

Inlets within all roadway gutter lines shall be spaced to provide a minimum open lane width of 12'. Inlets within multi-lane roadways (3 or more lanes) shall keep a minimum of one (1) 12' wide lane open in each direction. The gutter spread should be determined using the 10-yr storm event.

Once the peak gutter flow is determined, the maximum drainage area can be calculated using the rational method and the basin characteristics. For a basin consisting only of the roadway itself, the maximum area can be calculated by using a fixed width of the roadway from the crown to the curb and determining the total length required to achieve the maximum flow.

### **4.4 Open Channel Ditch or Swale Design**

#### **4.4.1 Capacity**

Open channels (swales and ditches) shall be designed using the Manning's equation as outlined above in Section 4.2.1 and using Table 4.1.3. The channels should be designed to convey the 10-yr storm event within the banks. The 100-yr storm event should remain within the easement of the ditch. The side slopes on all drainage ditches shall be no steeper than 3 (horizontal) to 1 (vertical). The minimum slope for all grass-lined non-public swales shall be 0.5%. Slopes less than 0.5% will be accepted for public swales and road ditches with appropriate invert treatment. Invert

treatment may consist of concrete paved channel, or a sub-surface under drain. A slope less than 0.25% concrete, 0.30% asphalt will not be accepted for swales.

**Table 4.1.3**  
**Open Channel Surface Material** **n**

Concrete		0.012
Gravel Bottom with sides	- Concrete	0.020
	- Mortared Stone -	0.023
	- Rip Rap	0.033
Natural Stream Channels:		
Clean, Straight Stream		0.030
Clean, Winding Stream		0.040
Winding with weeds and pools		0.050
With Heavy Brush and Timbers		0.100
Flood Plains:		
Pasture		0.035
Field Crops		0.040
Light Brush and Weeds		0.050
Dense Brush		0.070
Dense Trees		0.100

Chow, 1959

#### 4.4.2 Lining

All channels shall be lined with material capable of withstanding the shear stress from the proposed design velocity. Channels that convey runoff with velocity greater than 5 fps will be required to have invert treatment. A table of channel linings and maximum velocities is provided in Table 4.1.4.

**Table 4.1.4**

**Typical Maximum Velocities for Open Channel Linings**

<b>Open Channel Lining Material</b>	<b>Desirable Maximum Velocity (ft/s)</b>
Concrete, Trowel Finish	15
Concrete, Broom or Float Finish	15
Rip-Rap	10
Gabions	10
New Earth (Uniform, Sodded, Clay)	3-5
Existing Earth (Fairly Uniform, With Some Weeds)	3-5
Dense Weeds	3-5
Swale with Grass	3-5

**4.5 Flood Control**

4.5.1 FEMA Studied Waterways: FEMA Floodway Floodplain Delineation All plans submitted shall have the floodway (FW) and floodplain (FP) delineated on the grading plan(s) as scaled from the FEMA Flood Insurance Rate Maps. A reference to the panel number and date of the map shall also be included. Where no FW is delineated, the entire floodplain shall be assumed to be the FW.

4.5.2 100-year Base Flood Elevation (BFE) – The 100-year BFE shall be noted on the grading plan(s). This BFE shall be determined using the Flood Insurance Study (FIS) and the appropriate plate. A note referencing the plate number and date shall be included on the plans.

4.5.3 Basins Less Than 1 Square Mile in Area: Floodplain delineation – All waterways with drainage basins less than one (1) square mile and greater than 25 acres shall have the 100-yr BFE determined by methods outlined in the City of City of Park City Stormwater Design Manual and delineated on the plans. Complete documentation of this determination shall be included with the submission.

No structures shall be located in a FEMA designated floodway. No structures shall be located within the floodplain of drainage basins less than one (1) square mile unless a floodway determination is conducted.

The lowest finished floor of all Structures located within a flood plain shall have a two (2) foot flood protection grade (FPG) with respect to the lowest floor of the structure.

4.5.4 Flood Modeling - The base flood elevation (BFE) shall be provided for all structures on properties adjoining a waterway draining 25 acres or more. The BFE from the Flood Insurance Rate Study (FIS) should be provided for stream locations that are in the study. The DNR BFE should be provide for FEMA unstudied areas with watersheds greater than 1.0 square miles. For watersheds less than 1.0 square miles and greater than 50 acres, the submitting engineer must determine the BFE. The US Army Corps of Engineers HEC-2 or HEC-RAS programs shall be acceptable methods. Any other methods must be approved by the City of Park City.

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## **5.0 Detention Design Requirements**

### **5.1 Bypass Flow**

Detention facilities bypassing off-site flow shall provide adequate capacity for the design flow. The proposed bypass shall provide erosion protection, such as riprap over the entire bank for pond overflow weirs designed to bypass off-site runoff.

### **5.2 Emergency Spillway**

An emergency spillway and/or emergency overflow route will be required on all detention facilities. The emergency spillway shall be designed to accommodate the 100-year peak storm inflow to the structure with 1 foot of freeboard above the maximum anticipated flow through the spillway. Where off-site flow is bypassed over the same structure, the spillway shall accommodate both the peak combined on-site 100-year flow and the off-site 100-year flow and maintain the 1 foot of freeboard above the maximum anticipated flow through the spillway.

### **5.3 Dry Pond Requirements**

Dry detention ponds shall have:

- A minimum 1% bottom slope within the pond must be maintained to the outlet, or;
- Acceptable invert treatment (paved invert, underdrains, etc.) must be installed when a minimum 1% slope is unable to be maintained;
- In no case shall the bottom slope of the dry detention be less than 0.5%; A bank

slope of 4:1 or shallower for grass side slopes;

#### **5.4 Wet Pond Requirements**

Wet ponds shall include:

- A minimum depth of 8 feet from the normal pool elevation to the bottom of the pond;
- 25% of the pond must have a minimum depth of 8' from the normal pool elevation.
- A safety ledge a minimum of 6' in width and 18" to 30" below normal pool elevation.
- A maximum vegetative bank slope of 4:1 above the normal pool level and continuing 10' into the pond below the normal pool level; A maximum side slope below the normal pool of 2:1;

#### **5.5 Dams and Embankment Requirements**

Dams and Embankments shall:

- Demonstrate suitable foundation materials and or contain a suitable cutoff to prevent excessive seepage;
- Be designed with an appropriate core fill and an anti seep collar;
- Have a suitable top width and finished side slopes;
- Have a minimum acceptable freeboard and appropriately sized emergency spillway.

#### **5.6 Parking Lot Detention Requirements**

Parking Lot Detention Facilities:

- May not accept runoff from off-site drainage basins;
- May not pond to a depth greater than 7";
- Have an appropriate emergency overflow route;

#### **5.7 Underground Detention Requirements**

Underground Detention Facilities:

- May not accept runoff from off-site drainage basins;
- Must include emergency overflow facilities including a flow path.

Appropriate details of each pond design must be included on the plans. The appropriate normal pool elevation, 2-yr, 10-yr, and 100-yr water surface elevations must also be indicated on the grading plan.

## **6.0 Emergency Access Easements**

Emergency access easements (easement) shall be provided for all stormwater conveyances and facilities to be maintained by City of Park City. In addition, easements shall be provided (around the 100 year flood elevation) for all conveyances, including ponds, carrying runoff from off-site drainage basins and for any pond serving greater than 5 acres,. This emergency access easement shall include all release control devices. The minimum emergency access easement requirements for detention structures is designated in the table 6.0 below.

Regulated Drains (proposed and existing) may have additional easement requirements to ensure the provisions of this Manual and the City of City of Park City Stormwater Management Ordinance are met. The City of Park City shall be contacted to determine any special requirements prior to design. All stormwater conveyances must be centered within the required easement. An emergency access easement shall be provided for all conveyance systems that will be accepted by the City and/or be located adjacent to public or private roads or ways or lead to public conveyance systems located adjacent to public or private roads or ways, maintained by a homeowners association or receive off-site runoff. The minimum emergency access easement requirements for conveyance systems is designated in table 6.0 below.

The owner of the property shall be responsible for maintenance of the property's drainage facilities. The granting of an emergency access to City of City of Park City does not alter the property owner's duty to maintain the property's drainage facilities.

Stormwater BMP's used for the water quality requirements must maintain easements as well. Stormwater ponds shall maintain the same easement as required for a detention facility. Off-line manufactured BMP's structures should maintain an easement that includes the connecting manholes and the weir structure. All easements should be clearly included on the plans. Water quality easements should be included in the O&M manual as outlined in Table 6.0. On a case-by-case basis the City of Park City may determine additional easement requirements. The City of Park City may require such additional easement requirements as are necessary to ensure the provisions of this Manual and the City of City of Park City Stormwater Management Ordinance are met. The following table summarizes the easement widths required

**Table 6.0**

<b>Stormwater Facility Description</b>	<b>Minimum Easement (ft)</b>
Detention Pond/Facility (Serving > 5.0 ac) (including all stormwater pond BMP's)	20 horizontally from the 100-year elevation of the pond – Detention facilities shall not be constructed within the public right-of-way.
Storm Sewer Pipe and structures (< 3 feet diameter)	20 (10' from center of pipe/structure)
Storm Sewer Pipe and structures (> or = 3 feet diameter)	25 (12.5' from center of pipe/structure)
Drainage Ditch	30 (above 100 year elevation of ditch)
Drainage Swale	20 (flowline of swale, not less than 5" from edge of easement)
Structural and Manufactured BMP's	20 from the outside of BMP – Manufactured BMP units must maintain 20 from the center of the unit or 10 from the outside of the unit (whichever is greater) and include the connecting manholes when in an off-line configuration

## 7.0 Materials

### 7.1 Storm Sewer Pipe Materials

Storm sewers shall be defined as a network of pipe conduits and concrete manholes and/or inlet structures, which collect and convey stormwater (surface or Sub-surface water) from one facility to another facility.

Sub-surface drainage tiles, under drains, roof downspouts and drains, building drains, and foundation drains are not considered as part of the requirements for storm sewers.

The following is a table that outlines pipe materials and the appropriate type of facility that each material may be used. Public facilities are classified as any stormwater facility located within the public right-of-way or drainage easement maintained by the City of Park City or any state, town or city departments. Private facilities include all privately owned and maintained stormwater facilities outside of the public right-of-way or drainage easement.

**Table 7.1**

<b>MATERIALS</b>	<b>PUBLIC FACILITIES</b>	<b>PRIVATE FACILITIES</b>
Reinforced Concrete Pipe (RCP) – All pipe sizes (ASTM C 76)	YES	YES
Elliptical RCP – All pipe sizes (ASTM C 507)	YES	YES
Pre-cast RCP Box Culverts Sections– All sizes (ASTM C 789)	YES	YES
Bituminous Coated Corrugated Metal Pipe (CMP) – All sizes	*NO	YES
Arch CMP – All pipe sizes	*NO	YES
Galvanized CMP – All pipe sizes (ASTM A 444, A 760)	*NO	YES
High Density Polyethylene Pipe (HDPE) – 12” – 24”	*NO	YES
High Density Polyethylene Pipe (HDPE) – 27” – 48”	NO	YES
Polyvinyl Chloride (PVC) – 12” – 24”	NO	YES
Polyvinyl Chloride (PVC) – 27” – 36”	NO	YES
Other	PER City Approval	PER City Approval

\* May be used if replacing an existing pipe. Check with City for approval of location.

## **7.2 Sub-surface Drainage Tiles**

Sub-surface tiles (all under drains, roof downspouts and drains, building drains, and foundation drains) shall not accept any surface water flows. Any system

designed to collect surface runoff shall be designed to the minimum pipe standards in Section 7.1 above. Sub-surface systems shall provide a cleanout at a minimum interval of 350'. Connections to the main storm sewer system must be at an approved structure. Sub-surface drain connections to other Sub-surface drains may utilize approved wye and/or tee connections.

It shall be illegal for down spouts to outlet directly to the street or into the right-of-way of the street, or to be connected to the sanitary sewer or the storm sewer.

Sump pumps shall be connected to the subsurface drainage system. All sump pump connections to the storm sewer shall be inspected by the City of Park City or other City staff. All sump pump connections to the storm sewer require an inspection prior to approval. Inspection fees are \$10 per inspection.

Accepted pipe materials to be used for Sub-surface tiles are outlined in the table below:

**Table 7.2**

MATERIALS	ASTM
Corrugated Polyethylene tubing and fittings – up to 10"	F 405 & F 667
Corrugated Polyvinyl Chloride (PVC) tubing and fittings – up to 10"	F 800
PVC corrugated pipe with smooth interior walls and fittings – up to 10"	F 949

The minimum cover above Sub-surface tiles shall be 24" and must be properly bedded with #8 stone. See standard detail in Appendix VIII for additional bedding requirements.

**7.3 Manhole and Box Inlet Materials**

A storm sewer manhole or concrete box inlet structure must be installed; at all changes in material, grade, size, and alignment of the storm sewer pipe; at all pipe connections; and at a maximum interval of 400'.

Wyes, tees, and elbows may be used for underground detention facilities as allowed by the City of Park City. Underground detention facilities must include appropriate risers to provide for maintenance access to the detention facility. In addition, manufactured yard inlets may be used for private stormwater facilities per the discretion of the City of Park City.

Outlet structures must consist of a concrete box inlet or manhole with appropriate weir or orifice cut-outs. In no case shall a vertical standpipe be used in place of a manhole or inlet.

Bench walls shall be shaped and formed within each manhole and inlet to provide a smooth conveyance of flows through the structure. The bench walls shall form a clearly defined channel, to a minimum height of 50% of the diameter of the pipe, and constructed at a minimum 1/2" per foot slope to the manhole wall. A standard bench wall detail is provided in Appendix VIII.

All manhole and box inlets must be placed on a minimum 6" stone bedding to provide a stable base.

## **8.0 Details**

Details for manholes, inlets, pipe bedding swales and other common stormwater conveyances shall be submitted for approval of the City.

## **9.0 Water Quality**

Unless judged by the City of Park City for a project to be exempt, the following criteria shall be addressed for stormwater management at all sites:

Water quality considerations shall be incorporated in the submitted SWMPs. The plan sheets shall specify stormwater best management practices (BMPs) (stormwater quality treatment systems) to be implemented, operated and maintained to meet water quality requirements. Because water quality requirements vary depending on the uses of the water bodies in the watershed, a framework methodology is provided here.

### **9.1 Treatment Objective**

The City of City of Park City has adopted a policy that the control of stormwater runoff quality city-wide will be based on the management of total suspended solids (TSS). It should also be noted that control of sediment is required for construction site runoff city-wide. As state requirements increase more specific control measures will be added to comply with permit requirements added by the state.

For new development areas that "disturb" one (1) or more acres of land, or disturbs less than one (1) acre of land, but are part of a larger common plan of development or sale (if the larger common plan will ultimately disturb one (1) or more acres of land), or for new development that disturb more than 0.5 acres, structural BMPs shall be designed to comply with this manual. It is presumed that a BMP complies with this

standard if it is: sized to capture the prescribed water quality volume (WQ<sub>v</sub>) or water quality treatment rate,

- constructed properly, and
- maintained regularly.

The following requirements shall be fulfilled:

- (1) All stormwater runoff generated from land development and land use conversion activities shall not discharge untreated stormwater runoff directly into a jurisdictional wetland or local water body without adequate treatment. Where such discharges are proposed, the impact of the proposal on the wetland shall be assessed using a method acceptable to the City of Park City. In no case shall the impact be any less than allowed by the Army Corp of Engineers (ACOE) or IDEM.
- (2) Infiltration practices shall not be allowed where stormwater is generated from highly contaminated source areas as recognized by the EPA, IDEM or the City of Park City; where stormwater is carried in a conveyance system that also carries contaminated, non-stormwater discharges; where stormwater is being managed in a designated groundwater recharge area; and under certain geologic conditions (e.g., karst) that prohibit the proper pretreatment of stormwater.
- (3) Land development projects shall comply with the water quality performance-based criteria in accordance with the following:

A BMP shall be located, designed, and maintained to achieve the target pollutant removal efficiencies to effectively reduce the pollutant load to the required level.
- (4) Stormwater discharges to critical areas with sensitive resources (i.e., cold water fisheries, shellfish beds, swimming beaches, recharge areas, water supply reservoirs) may be subject to additional criteria, or may need to utilize or restrict certain stormwater management practices at the discretion of the City of Park City.
- (5) Industrial sites which are listed under the Standard Industrial Code are required to prepare and implement a stormwater pollution prevention plan, and shall file a notice of intent (NOI) under the provisions of the National Pollutant Discharge Elimination System (NPDES) general permit. The stormwater pollution prevention plan requirement applies to both existing and new industrial sites.
- (6) Stormwater discharges from land uses or activities with higher potential pollutant loadings may require the use of specific structural BMPs and

pollution prevention practices at the discretion of the City of Park City.

- (7) Prior to design, applicants are required to consult with the City of Park City to determine if they are subject to additional stormwater design requirements.
- (8) Discharges will not be allowed directly into sinkholes or fractured bedrock, without treatment that results in discharge meeting Kansas ground water quality standards.
- (9) Any stormwater practice that is a Class V injection well must ensure that the discharge from such practices meets Kansas ground water quality standards.
- (10) New retail gasoline outlets, new municipal, state, federal, or institutional refueling areas, or outlets and refueling areas that replace existing tank systems shall be required to design and install appropriate practices to reduce lead, copper, zinc, and polyaromatic hydrocarbons in stormwater runoff.
- (11) Storm water infiltration practices, or practices having an infiltration component are prohibited, even with pretreatment, in the following circumstances:
  1. Where storm water is generated from highly contaminated source areas as identified by the IDEM, USEPA or the CITY OF PARK CITY.
  2. Where storm water is carried in a conveyance system that also carries contaminated, non-storm water discharges.
  3. Where storm water is being managed in a designated groundwater recharge or well head protection area.
  4. Under certain geologic conditions (e.g., karst) that prohibit the proper pretreatment of storm water.

## 9.2 Plan Requirements

Pursuant to the Ordinance all Stormwater Management Plans must include the following:

- (1) Location, dimensions, detailed specification, and construction details of all post construction stormwater quality treatment BMPs.
- (2) A description of those measures (BMPs) that that will be installed to treat stormwater discharges that will occur after construction activities completed.
- (3) A sequence describing when each post construction stormwater quality

- treatment BMP will be installed.
- (4) Stormwater quality treatment BMPs that will remove or minimize pollutants from stormwater run-off.
  - (5) Stormwater quality treatment BMPs that will be implemented to prevent or minimize adverse impacts to stream and riparian habitat.
  - (6) An Operation and Maintenance Manual for all BMPs. 9.3

#### Operations and Maintenance Manual

Each BMP on a site must have an operations and maintenance (O&M) manual. The O&M manual must be submitted with the Stormwater Management Plan. The approved O&M manual must be signed by and provided to the BMP owner and the City of Park City. The O&M manual will include the following:

- (1) BMP owner name and contact person, address, and contact information, i.e. business phone, fax, email, pager, cell phone, etc. as appropriate;
- (2) Site drawings clearly indicating the location of the BMP and including plan and cross-sectional details, showing the BMP and applicable features. Dimensions, easements (as previously defined in this manual), outlet works, forebays, signage, connecting structures, weirs, invert elevations, etc. should be clearly indicated on the plans and details;
- (3) Guidance on both owner-required periodic inspections and inspections to be performed by the City of Park City;
- (4) Guidance on routine maintenance, including mowing, litter removal, woody growth removal, etc.;
- (5) Guidance on remedial maintenance, such as inlet replacement, outlet work, etc.;
- (6) Guidance on sediment removal, both narrative and graphical, describing when sediment removal shall occur in order to insure that the BMP remains effective as a water quality and/or quantity control device;
- (7) A statement that the City of Park City has the right to enter the property to inspect the BMP;
- (8) A tabular schedule showing inspections and maintenance requirements; and
- (9) Identification of the property/BMP owner as the party responsible for maintenance, including cost.

(10) A text or graphic narrative of the easement around the BMP.

Completed inspection forms must be maintained by the BMP owner and produced upon request by the City of Park City. The City of Park City must be notified of any changes in BMP ownership, major repairs or BMP failure in writing within 30 days of the change. The letter should be addressed to:

City of Park City  
6110 N. Hydraulic St.  
Park City, Kansas 67219

In the event that the City of Park City finds a BMP in need of maintenance or repair, the City of Park City will notify the BMP owner of the necessary maintenance or repairs and give the landowner a timeframe for completing the maintenance or repairs. If the maintenance or repairs are not completed within the designated timeframe, the City of Park City shall perform the repairs or maintenance and bill the landowner for the actual costs for the work.

#### 9.4 Water Quality Volume / Rate Calculations

In order to protect and maintain water quality, a portion of the stormwater runoff created by the development project must be treated. BMPs may be designed to treat on a volumetric basis or flow rate basis. The runoff volume to be treated or the peak flow rate to be treated by a BMP shall be determined by the following methods.

##### 9.4.1 Water Quality Volume

The volume of stormwater runoff to be captured, stored and treated is called the Water Quality Volume ("WQv").

a. The formula for determining WQv is:

$$\text{WQv} = \underline{(P)} \underline{(Rv)} \underline{(A)}$$

12

where:

WQv = water quality volume (acre-feet)

P = rainfall depth (inches); the volume of rainfall for 90% of the storm events which produce runoff in the watershed annually (e.g., 1.0 inches)

A = project area (acres)

$R_v$  = volumetric runoff coefficient;  $[0.05 + 0.009(I)]$ , where  $I$  is the percent impervious cover on the site as defined by the area that does not have permanent vegetative or permeable cover.

#### 9.4.2 Water Quality Treatment Rates

The peak water quality treatment rate shall be determined using hydrograph generation methods. The hydrograph shall use the Huff 1<sup>st</sup> Quartile, 50% distribution with a 0.5 inch rainfall and a one hour storm duration. The peak rate of this hydrograph shall be used as the minimum water quality treatment rate.

Documentation for all proposed manufactured BMPs shall be provided clearly demonstrating the BMP will remove 80% of the particles listed below at this peak flow rate.

**Table 9.1 Runoff Particle Distribution**

Particle Size (.m)	% of TSS
250	20
125	40
75	40

#### 9.5 Pre-Treatment

Several practices that are not capable of providing water quality treatment can nonetheless function in a pretreatment role or as a supplemental practice. These practices can often be incorporated into the Stormwater Management Plan design as pretreatment devices, to treat a small portion of a site, or in retrofit or redevelopment applications. Some of these practices, including dry ponds and underground storage vaults, can be used to meet water quantity goals such as channel protection and flood control requirements. In addition, some of these practices may be helpful to reduce the total volume of runoff from a site or to disconnect impervious surfaces. Some practices not currently deemed effective for stand-alone water quality treatment include:

.Catch basin inserts

- Dry ponds
- Underground vaults (designed for flood control)
- Oil/grit separators
- Filter strips

- Grass channels (includes ditches designed primarily for conveyance as well as modified practices that can achieve some pollutant removal)
- Deep sump catch basins
- On-line storage in the storm drain network
- Porous pavement

## **9.6 Primary Treatment**

Effective management is often achieved from a management systems approach. A combination of BMPs can be used to meet the water quality treatment requirements.

## **9.7 Specific Practices**

Table 9.2 identifies structural BMPs pre-approved to comply with the City's stormwater quality requirements in their MS4 permit. Table 9.3 identifies the criteria designers should consider when choosing stormwater quality BMPs. A list of pre-approved, manufactured BMPs (e.g. Aqua-Swirl, Stormceptor, Vortechs, etc.) is available within the City Engineer's Office.

**Table 9.2 Pre-Approved structural BMPs (non-manufactured)**

BMP Type	Description	Quantity Control	WQv and 80% TSS Removal
Stormwater Ponds <ul style="list-style-type: none"> <li>• Wet pond</li> <li>• Wet extended detention pond</li> <li>• Micropool extended detention pond</li> </ul>	Stormwater ponds are constructed stormwater retention basins with a permanent pool (or micropool) of water. Runoff from each rain event is captured and treated in the pool	Yes	Yes
Stormwater Wetlands <ul style="list-style-type: none"> <li>• Shallow wetland</li> <li>• Extended detention wetland</li> <li>• Pond/wetland systems</li> <li>• Pocket wetland</li> </ul>	Stormwater wetlands are constructed, artificial wetland systems used for stormwater management. They consist of a combination of shallow marsh areas, open water and semi-wet areas above the permanent pool	Yes	Yes
Bioretention Areas	Bioretention areas are shallow stormwater basins or landscaped areas that utilize engineered soils and vegetation to capture and treat stormwater runoff.	No	Yes
Sand Filters <ul style="list-style-type: none"> <li>• Surface sand filter</li> <li>• Perimeter sand filter</li> </ul>	Sand filters are multi-chamber structures designed to treat stormwater runoff through filtration, using a sand bed as its primary filter media.	No	Yes
Water Quality Swales <ul style="list-style-type: none"> <li>• Dry swale</li> </ul>	Water quality swales are vegetated open channels that are designed and constructed to capture and treat stormwater runoff within dry cells	No	Yes
Biofilters <ul style="list-style-type: none"> <li>• Filter strip</li> <li>• Grass channel</li> </ul>	While bio filters provide some filtering of stormwater runoff, by themselves they cannot meet the 80% TSS removal performance goal. These measures can only be used as pre-treatment measures or as part of a treatment train.	No	No

**Table 9.3 BMP Selection Criteria**

<b>Current Use</b>	<b>Planned Use</b>	<b>Approved BMPs</b>
Open Land	Commercial strip, light industrial, institutional (individual lots)	Bio retention, wet pond, artificial wetland, sand filters, biofilter, water quality swale
Open Land	Commercial or industrial subdivision	Wet pond, wetland
Open Land	Residential	Bio retention, wet pond, artificial wetland, biofilter, water quality swale
Commercial building or strip (medium imperviousness)	Commercial building or strip	Bio retention, Sand filter, wet pond, wetland
Commercial building or strip (small lot, high imperviousness)	Commercial building or strip	Bio retention, Sand filter
Transportation Infrastructure	Increased/expanded transportation infrastructure	Water quality swales, wet ponds, artificial wetlands

### **9.8 Regional Stormwater Management Plans**

Applicants are directed to communicate with City of Park City prior to submitting an application for stormwater management plan approval to determine if a Regional Stormwater Management Plan has been developed for the applicable watershed. If such a plan is in existence, the applicant must provide stormwater management water quality treatment on-site in accordance with the provisions of the regional plan, and other management provisions as specified by the City of Park City.

### **10.0 Soil Erosion and Sedimentation Control**

The purpose of this section is to control soil erosion, sediment damages, and related environmental damage by requiring adequate provisions for surface water retention and drainage and for the protection of exposed soil surfaces in order to promote the safety, public health, convenience, and general welfare of the citizens of the City of Park City.

The volume and rate of any stormwater discharges allowed under this Manual must be managed to prevent the physical degradation of receiving waters, such as by stream bank scour

and erosion. The following requirements are necessary for soil erosion and sedimentation control:

- (1) All persons who cause, in whole or in part, any earth change to occur shall provide soil erosion and sedimentation control so as to adequately prevent soils from being eroded and discharged or deposited onto adjacent properties or into a stormwater drainage system, a public street or right of way, wetland, creek, stream, water body, or floodplain.
- (2) All development shall be in accordance with all applicable federal, state and local ordinances, rules and regulations.
- (3) During any earth change, which exposes soil to an increased risk of erosion or sediment track-out, the property owner and other persons causing or participating in the earth change shall do the following:
  - (a) Comply with the stormwater management standards of this Manual.
  - (b) Obtain and comply with the terms of a soil erosion and sedimentation control permit if required by law.
  - (c) Prevent damage to any public utilities or services within the limits of grading and within any routes of travel or areas of work of construction equipment.
  - (d) Prevent damage to or impairment of any water body on or near the location of the earth change or affected thereby.
  - (e) Prevent damage to adjacent or nearby land.
  - (f) Apply for all required approvals or permits prior to the commencement of work.
  - (g) Proceed with the proposed work only in accordance with the approved plans and in compliance with this manual.
  - (h) Maintain all required soil erosion and sedimentation control measures, including but not limited to, measures required for compliance with the terms of this manual.
  - (i) Promptly remove all soil, sediment, debris, or other materials applied, dumped, tracked, or otherwise deposited on any lands, public streets, sidewalks, or other public ways or facilities, including catch basins, storm sewers, ditches, drainage swales, or water bodies. Removal of all such soil, sediment, debris or other materials within twenty-four (24) hours shall be considered prima facie compliance with this requirement, unless such materials present an immediate hazard to public health and safety.

- (j) Refrain from grading lands at locations near or adjoining lands, public streets, sidewalks, alleys, or other public or private property without providing adequate support or other measures so as to protect such other lands, streets, sidewalks or other property from settling, cracking or sustaining other damage.
  - (k) Request and obtain inspection of soil erosion and sedimentation control facilities, by the City of Park City or their designee. Qualified personnel provided by the owner or Operator shall inspect construction sites for which the City of Park City or their designee will not perform inspections. The qualified person shall inspect all disturbed areas which are not finally stabilized, storage areas of possible polluting agents such as paints, solvents, fuels, fertilizers and pesticides that are exposed to precipitation, structural control measures and locations of vehicle entrance and exit at least once every seven (7) calendar days and, for sites which disturb greater than five (5) acres, within 24 hours of the end of a storm that is 0.5 inches or greater. Inspections will continue until all disturbed areas are stabilized, structural controls are removed or converted to stormwater management facilities, and stored materials are removed from exposure. Corrective action will be taken for all noted deficiencies. Such actions will be initiated within 24 hours of inspection notification.
  - (l) Follow the minimum design standards of this manual to protect properties and receiving waterways downstream of any land development project from erosion and damage due to increases in volume, velocity and frequency of peak flow rate of stormwater runoff.
- (4) Land alterations, including re-grading, which strip the land of vegetations, shall be accomplished in a manner, which minimizes erosion or the addition of sediments to natural and manmade drainage ways. This will reduce the impact on adjacent properties and water quality of receiving waters. Whenever feasible, natural vegetation shall be retained, protected and supplemented.
  - (5) Cut and fill operations shall be kept to a minimum to ensure conformity with existing topography to reduce the potential erosion
  - (6) Sediment controls shall be installed whenever runoff from disturbed portions of the parcel will leave the parcel. Sediment controls may include vegetative buffer strips, filter barriers, sediment basins, debris basins or silt traps. Vegetative buffer strips shall only be used where runoff is dispersed and exits the parcel as sheet flow. Filter barriers shall not be used in areas of concentrated flow. Synthetic filter fences are more effective than straw bales and shall be used in series. Straw bales shall also be anchored with stakes and grounded to reduce unfiltered underflow by burying the lower 3 inches of each bale.
  - (7) Any flow from a disturbed parcel shall pass through a vegetative filter barrier or sediment basin before entering a storm drain inlet. Existing inlets or those being constructed in a

disturbed area shall have all flow diverted away from them, be plugged or protected by a filter. Downstream development parcels shall be protected from increases in volume, velocity, and sediment load or peak flow rates.

- (8) The duration of time, which an area remains exposed, shall be kept to a practical minimum and the area stabilized as quickly as possible. Temporary vegetation or mulch shall be used to protect exposed areas during development. For areas subject to daily disturbance, a weighted cover of impermeable material may be used, if approved by the City of Park City.
- (9) Stockpiles shall be located outside of drainage ways and the 100-year floodplain if possible. It may be necessary to divert drainage around a stockpile that must be located in a drainage way.
- (10) Soil stabilization shall be maintained in an effective condition throughout construction until permanent vegetation stabilization is achieved.
- (11) Permanent vegetation or structural erosion control devices shall be installed as soon as practical after as-built topographic conditions are finalized.
- (12) Permanent stabilization requires permanent structures, pavement or vegetation sufficiently mature to withstand annual climate cycle or permanent mulch.
- (13) During all construction activities on the development site, the City of Park City or their representative may inspect the development site to ensure compliance with the approved construction site runoff controls.

### **10.1 Plan Requirements**

If the owner or Operator is required to prepare an erosion and sedimentation control plan and comply with, all applicable state and federal permits or notices for land disturbing activities shall be obtained or filed prior to commencement of land disturbing activities. All applicable state or federal standards shall be adhered to when conducting land-disturbing activities. For land disturbances within the MS4 area that are greater than or equal to one (1) acre, or disturbances of less than one (1) acre of land that are part of a larger common plan of development or sale if the larger common plan will ultimately disturb one (1) or more acres of land, copies of all applications, letters of intent submittals, plans and other erosion and sediment control related information shall be submitted to the City of Park City. The construction project site owner shall also submit a copy of the application directly to the IDEM.

The Developer must include the SWMPA as verification of plan approval with the Notice of Intent (NOI) sent to KDHE with a copy to the City of Park City at least forty-eight (48) hours prior to land-disturbing activities.

If an ESCP (Soil Erosion and Sedimentation Control) is prepared, it shall be prepared under the supervision of, and certified by a registered professional.

## **10.2 General Criteria for Erosion and Sediment Control Practices**

- (1) Perimeter Control and Sediment Trapping – Perimeter control and other sediment trapping measures shall be installed as specified on the approved plan, including: construction access drives, straw bale dams and fabric fencing, temporary sediment traps, sediment basins, and diversions. Also storm drain system inlet shall be protected from sedimentation.
- (2) Vegetative Control – Disturbed areas, which are at finish grade, shall be permanently seeded within seven (7) days. At the discretion of the City of Park City, barren areas to be rough graded and left undisturbed for more than thirty (30) days shall be established with temporary vegetation; and dormant seeding will be required during seasonal periods (October through February) for those barren areas to be left undisturbed for one-hundred and twenty (120) days or longer.
- (3) Slope Protection – Slope protection shall be provided by use of temporary and permanent diversion dikes, vegetative cover, and slope drains. Concentrated stormwater flows shall not be allowed to flow down cut or fill slopes without proper slope stabilization.
- (4) Protection of Outlet Channel – Concentrated stormwater runoff leaving a development site shall be outlet to an open channel, storm sewer pipe inlet or culvert, which is capable of receiving this discharge. Runoff velocities shall be controlled during all storm events, up to the 100-year return interval storm, so that the peak runoff velocity during and after the completion of the land alteration approximates existing conditions.
- (5) Waste, Debris, and Pollution Elimination – Appropriate measures shall be taken to minimize or eliminate wastes and unused building materials and all pollutants from being carried from the site by runoff. Proper storage, handling and use of all potentially polluting substances shall be employed.
- (6) Roadways and Streets – Public and private roadways and streets shall be kept clear of accumulated sediment daily or as needed. Bulk clearing of accumulated sediment shall not include flushing the area with water.

## **11.0 Deviation from Approved Plans**

Any significant deviation or change in the detailed plans and specifications after granting of the Stormwater Management Plan Approval (SWMPA) shall be filed in duplicate with and approved by the City of Park City prior to the time land alteration involving the change occurs. Copies thereof, if approved, shall be attached to the original plans and specifications.

## 12.0 Enforcement

In the case of non-compliance with this Ordinance or the Stormwater Design Manual, the City of Park City has the right to issue abatement orders, stop work orders, injunctions, and revoke permits.

If work for which the Stormwater Management Plan Approval (SWMPA) is required is commenced by the applicant without compliance with the provisions of the City of City of Park City Stormwater Management Ordinance, the review fee shall be increased to \$500.00. If work for which the SWMPA is required is completed or substantially completed by the applicant without compliance with the provisions of the City of City of Park City Stormwater Management Ordinance, the review fee shall be increased to \$2,500.00.

The City of Park City may revoke a SWMPA where the application, plans, or other supporting documents reflect either:

- A false statement or misrepresentation as to material fact; or
- Failure to comply with the requirements of this manual

Whenever the City of Park City discovers the existence of any of the circumstances listed below, they are empowered to issue an order requiring the suspension of the land alteration. The stop-work order shall be in writing and shall state to what land alteration it is applicable and the reason for its issuance. One (1) copy of the stop-work order shall be posted on the property in a conspicuous place and one (1) copy shall be delivered to the permit applicant, and if conveniently possible to the person doing the land alteration and to the owner of the property or his agent. The stop work order shall state the conditions under which land alteration may be resumed. A stop-work order shall be issued if:

- Land alteration is occurring in violation of a drainage requirement and in such manner that if land alteration is allowed to proceed, there is a probability that it will be substantially difficult to correct the violation; or
- Land alteration has been accomplished in violation of a drainage requirement and fifteen (15) calendar days has elapsed since written notice of the violation or noncompliance was either posted on the property in a conspicuous place or given to the person doing the land alteration, without the violation or noncompliance being corrected; or
- Land alteration for which a SWMPA is required is proceeding without a SWMPA being in force. In such an instance the stop-work order shall indicate that the effect of the order terminates when the required SWMPA is obtained.

# **APPENDIX “A”**

**Sedgwick County, KS Rainfall Intensity Table (Duration 5 min - 120 min)**

Return Periods 25-yr through 1000-yr based on Point Precipitation Frequency Estimates (Annual Maximum Series). Data values used in the regression analysis were obtained from the NOAA Precipitation Frequency Data Server for Wichita-Mid Continent weather station location.

DURATION in hours	DURATION in	Return Period																		
		1-yr	1	2-yr	1	5-yr	1	10-yr	25-yr	1	50-yr	100-yr	1	200-yr	1	500-yr	1000-yr			
0.0833	5	5.07		5.43		6.79		7.82		9.14		10.16		11.17		12.16		13.45		14.44
0.1000		4.75		5.08		6.35		7.30		8.53		9.46		10.38		11.28		12.45		13.32
0.1167	7	4.47		4.78		5.97		6.87		8.02		8.88		9.73		10.56		11.64		12.44
0.1333	8	4.22		4.52		5.65		6.49		7.58		8.39		9.18		9.96		10.97		11.71
0.1500	9	4.01		4.29		5.36		6.16		7.19		7.96		8.71		9.44		10.40		11.10
0.1667	10	3.82		4.09		5.11		5.87		6.86		7.59		8.30		9.00		9.91		10.57
0.1833	11	3.65		3.90		4.88		5.62		6.56		7.26		7.94		8.61		9.48		10.12
0.2000	12	3.50		3.74		4.68		5.38		6.29		6.96		7.62		8.26		9.10		9.72
0.2167	13	3.36		3.59		4.50		5.18		6.05		6.70		7.33		7.95		8.76		9.36
0.2333	14	3.23		3.46		4.33		4.99		5.83		6.46		7.07		7.67		8.46		9.04
0.2500	15	3.12		3.34		4.18		4.81		5.63		6.24		6.83		7.42		8.19		8.75
0.2667	16	3.01		3.22		4.04		4.66		5.45		6.04		6.62		7.19		7.94		8.49
0.2833	17	2.92		3.12		3.92		4.51		5.28		5.86		6.42		6.98		7.71		8.25
0.3000	18	2.83		3.02		3.80		4.37		5.13		5.69		6.24		6.78		7.50		8.03
0.3167	19	2.74		2.93		3.69		4.25		4.99		5.53		6.07		6.60		7.31		7.83
0.3333	20	2.67		2.85		3.58		4.13		4.85		5.38		5.91		6.43		7.13		7.64
0.3500	21	2.59		2.77		3.49		4.02		4.73		5.25		5.76		6.28		6.96		7.46
0.3667	22	2.52		2.70		3.40		3.92		4.61		5.12		5.63		6.13		6.80		7.30
0.3833	23	2.46		2.63		3.32		3.83		4.50		5.00		5.50		6.00		6.65		7.14
0.4000	24	2.40		2.57		3.24		3.74		4.40		4.89		5.38		5.87		6.52		7.00
0.4167	25	2.34		2.51		3.16		3.65		4.30		4.78		5.27		5.75		6.39		6.87
0.4333	26	2.29		2.45		3.09		3.57		4.21		4.68		5.16		5.63		6.26		6.74
0.4500	27	2.24		2.40		3.02		3.50		4.12		4.59		5.06		5.53		6.15		6.62
0.4667	28	2.19		2.34		2.96		3.42		4.04		4.50		4.96		5.42		6.04		6.50
0.4833	29	2.15		2.30		2.90		3.35		3.96		4.42		4.87		5.33		5.94		6.39
0.5000	30	2.10		2.25		2.84		3.29		3.89		4.33		4.78		5.24		5.84		6.29
0.5167	31	2.06		2.20		2.79		3.23		3.82		4.26		4.70		5.15		5.74		6.19
0.5333	32	2.02		2.16		2.74		3.17		3.75		4.18		4.62		5.06		5.65		6.10
0.5500	33	1.98		2.12		2.69		3.11		3.68		4.11		4.55		4.98		5.57		6.01
0.5667	34	1.95		2.08		2.64		3.06		3.62		4.05		4.48		4.91		5.48		5.92
0.5833	35	1.91		2.05		2.59		3.01		3.56		3.98		4.41		4.83		5.40		5.84
0.6000	36	1.88		2.01		2.55		2.96		3.50		3.92		4.34		4.76		5.33		5.76
0.6167	37	1.85		1.98		2.51		2.91		3.45		3.86		4.28		4.70		5.26		5.69
0.6333	38	1.82		1.94		2.47		2.86		3.40		3.80		4.22		4.63		5.19		5.61
0.6500	39	1.79		1.91		2.43		2.82		3.35		3.75		4.16		4.57		5.12		5.54
0.6667	40	1.76		1.88		2.39		2.78		3.30		3.70		4.10		4.51		5.06		5.48
0.6833	41	1.73		1.85		2.36		2.74		3.25		3.65		4.05		4.45		4.99		5.41
0.7000	4	1.71		1.83		2.32		2.70		3.21		3.60		3.99		4.39		4.93		5.35
0.7167	43	1.68		1.80		2.29		2.66		3.16		3.55		3.94		4.34		4.88		5.29
0.7333	44	1.66		1.77		2.26		2.62		3.12		3.51		3.89		4.29		4.82		5.23
0.7500	45	1.63		1.75		2.22		2.59		3.08		3.46		3.85		4.24		4.76		5.17
0.7667	46	1.61		1.72		2.19		2.55		3.04		3.42		3.80		4.19		4.71		5.12
0.7833	47	1.55		1.70		2.17		2.52		3.00		3.38		3.76		4.14		4.66		5.07
0.8000	48	1.57		1.68		2.14		2.49		2.97		3.34		3.71		4.10		4.61		5.01
0.8167	49	1.55		1.66		2.11		2.46		2.93		3.30		3.67		4.05		4.56		4.96
0.8333	50	1.53		1.63		2.08		2.43		2.90		3.26		3.63		4.01		4.52		4.91
0.8500	51	1.51		1.61		2.06		2.40		2.86		3.22		3.59		3.97		4.47		4.86
0.8667	52	1.49		1.59		2.03		2.37		2.83		3.19		3.56		3.93		4.43		4.82
0.8833	53	1.47		1.57		2.01		2.34		2.80		3.16		3.52		3.89		4.39		4.78
0.9000	54	1.45		1.56		1.99		2.32		2.77		3.12		3.48		3.85		4.35		4.74
0.9167	55	1.43		1.54		1.96		2.29		2.74		3.09		3.45		3.81		4.31		4.69
0.9333	56	1.42		1.52		1.94		2.27		2.71		3.06		3.41		3.78		4.27		4.65
0.9500	57	1.40		1.50		1.92		2.24		2.68		3.03		3.38		3.74		4.23		4.61
0.9667	58	1.39		1.49		1.90		2.22		2.65		3.00		3.35		3.71		4.19		4.57
0.9833	59	1.37		1.47		1.88		2.19		2.63		2.97		3.32		3.67		4.16		4.54

# APPENDIX “B”

<b>Pipe Material</b>	<b>Manning's n</b>
Concrete Pipe	0.012
Concrete Boxes	0.012
Corrugated Metal Pipe or Pipe Arch	
2 2/3" x 1/2" Helical Corrugation	0.022
2 2/3" x 1/2" Annular Corrugation	0.022
15" to 36"	0.025
42" to 96"	0.024
3" x 1" Corrugation	0.027
5" x 1" Corrugation	0.025
Structural Plate Pipe or Pipe Arch	
6" x 2" Corrugation	0.033
9" x 2 1/2" Corrugation	0.035
Spiral Ribbed Corrugated Metal Pipe	0.013
Smooth High Density Polyethylene (HDPE)	0.012
Smooth Lined Interior Polyvinyl Chloride (PVC)	0.012
Smooth Interior Corrugated HDPE	0.012
Ductile Iron Pipe	0.012

**Manning's "n" Values for Pipes**