DIVISION 5

STORM DRAINAGE CRITERIA

Section 5.01 GENERAL

The following storm drainage design criteria shall apply to all storm drainage designs in the City. Additional design criteria are specified in the Standard Drawings. The minimum allowed pipe size and material inside the City right-of-way is fifteen-inch (15") diameter reinforced concrete.

Section 5.02 INLET BOXES AND MANHOLES

Sub-Section A. Storm Water Inlets:

Curb face inlets (or an acceptable alternative) must be constructed at all low lying areas. Curb face inlet boxes will serve tributary piping and shall not be used as junction boxes or manholes. If multiple piping is required in a structure using a curb face inlet, a combination box shall be constructed which must include a manhole for access. No inlets shall be allowed at the bottom of an ADA ramp structure or in a designated pedestrian path. Inlets at drive cuts are discouraged and may only be used with approval of the City Engineer.

Sub-Section B. Manholes:

Minimum manhole interior diameter is four (4) foot for manholes with one inlet and one outlet pipe. Manholes with two or more inlet pipes and one outlet pipe shall be a minimum of five (5) foot in diameter.

Spacing between manholes shall be no more than four hundred (400) feet unless special approval is granted by the City Engineer.

Sub-Section C. Storm Water Treatment:

All new land development will require provisions for storm water treatment before the water is allowed to discharge into the existing City system. A design that will separate oils and particulates from the discharged water will have to be approved by the City Engineer. The treatment facility must be easily accessible and maintainable without unreasonable effort.

Section 5.03 MULTIPLE-LOT STORM DRAINAGE CALCULATIONS

The following information shall be included in the storm drainage calculations for multiple-lot development.

Sub-Section A. Hydrologic (Flow) Calculations:

1) A map showing drainage sub-basins and the piping system.
2) Cumulative peak flow calculations for each sub-basin (submit all input data, calculations and results).

Sub-Section B. Hydraulic (Inlet and Pipe) Calculations:

1) Capacity calculations for each segment of the pipe system.
2) Calculations demonstrating that flow rates in streets do not exceed maximums before being caught in storm drain inlets. "Section 5.07, Sub-Section C: Inlet Spacing" dictates the criteria required for allowable water spread.
3) Calculations demonstrating that inlets are sufficiently long to capture peak design flows.
4) Slopes shall be designed to have a two (2) foot pre second velocity. Minimum slopes for different size pipes are as follows:

MINIMUM STORM DRAIN MAIN SLOPES

Pipe Size	Min Slope (ft/ft)
15”	.0015
18”	.0012
21”	.00095
24”	.00078
30”	.00058
36”	.00046

Sub-Section C. Detention Calculations:

1) Detention volume requirement which includes an analysis that identifies the storm whose duration creates the greatest detention volume requirement, given storm duration and stage storage curve and outlet discharge curve.
2) Orifice calculations illustrating that the maximum release rate is not exceeded.

Section 5.04 COMMERCIAL SITE STORM DRAINAGE CALCULATIONS

The following information shall be included in the storm drainage calculations for commercial site property development.

Sub-Section A. Hydrologic (Flow) Calculations:

1) Peak flow calculations for the site (submit all input data, calculations and results).

Sub-Section B. Hydraulic (Inlet and Pipe) Calculations:

1) Capacity calculations for each segment of the pipe system.

Sub-Section C. Detention Calculations:

1) Detention volume requirement-an analysis that identifies the storm whose duration creates the greatest detention volume requirement, given storm duration and stage storage curve and outlet discharge curve.
2) Stage storage curve - generally required only on large detention basins.
3) Outlet discharge curve - generally required only on large detention basins.
4) Orifice calculations illustrating that the maximum release rate is not exceeded.

Section 5.05 LANDSCAPED STORM DETENTION BASIN REQUIREMENTS

Storm water must be detained such that the peak flow rate released from the site does not exceed 0.15 cubic feet per second per acre of development (cfs/acre). Detention basins must have vehicular access for maintenance and will not be allowed in the backyards of single family residences. The following limitations apply to detention basins:

a) The side slopes of the basin may not be steeper than 3:1 unless special circumstances warrant a change. Any change must be approved by the City Engineer. The bottom of the detention basin must slope toward the drain.
b) Within 10 feet of the outlet, the slope of the basin bottom must not be flatter than 5% unless a concrete apron is constructed around the outlet.
c) Excluding areas within 10 feet of the outlet, the maximum allowable depth of water in the basin is 3 feet. An additional one (1) foot of freeboard must be constructed on all basins.

d) Storm drain pipes are to be continuous through detention areas to allow low flows to proceed through the storm drainage system without having to come to the surface. These flows must still pass through the outlet restriction that limits runoff rates.
e) Basins are to be designed such that water does not run into them after storm water reaches a maximum depth (unless a free flowing overflow is provided)—this can usually be controlled by the elevation of an inlet box in the street adjacent to the basin.
f) Basins are to be designed such that when runoff exceeds design values or when restrictions plug, excess storm water will be directed to the street system or bypass the restriction by entering the piped system via a free flowing overflow.
g) A basin may be designed for dual use, but uses other than the detention of storm water must be approved by the City Engineer.
h) In cases where the basin detains water from, and is part of a project controlled by, a "Home Owners Association" (HOA), the HOA will be responsible to maintain the operation, landscaping and irrigation sprinkling of the basin.

Section 5.06 HARD SURFACE STORM DETENTION STORAGE REQUIREMENTS

Storm water ***may not*** be detained above ground on hard surface areas. If property is not available for a landscaped detention basin, storm water may be detained underground in an approved underground system. Storm water must be detained such that the peak flow rate released from the site does not exceed 0.15 cubic feet per second per acre of development (cfs/acre). Underground storage designs should be discussed with the City Engineer before submittal and will be approved on a case by case basis. The following limitations apply to underground detention storage:

a) Basins are to be designed such that when runoff exceeds design values or when restrictions plug, excess storm water will be directed to the street system or bypass the restriction by entering the piped system via a free flowing overflow.
b) The private property owner benefiting from the underground detention storage will be responsible to maintain the operation of the system.

Section 5.07 STORM WATER QUANTITY CRITERIA AND DESIGN GUDELINES

The following storm drainage criteria and design guidelines apply to all storm drainage plans in Springville and shall be used in storm drainage calculations. The City Engineer has authority to modify the criteria and guidelines as needed to meet changing or unusual needs or conditions.

Sub-Section A. Design Storm:

1) Frequency
   i. Design the piping system for a 10-year storm
   ii. Design detention for a 25-year storm with a 0.15 cfs/acre release rate.
   iii. Control the point of discharge and the flooding hazard of a 100-year storm
2) Intensity—per the following table:

Rainfall Intensities (inches/hour)			
Duration	**10 Year**	**25 Year**	**100 Year**
5 min	3.12	3.84	4.68
10 min	2.40	2.94	3.66
15 min	2.04	2.48	3.12
30 min	1.40	1.72	2.14
60 min	0.89	1.09	1.36

2 hours	0.52	0.62	0.77
3 hours	0.40	0.45	0.56
6 hours	0.23	0.26	0.33
12 hours	0.14	0.16	0.20
24 hours	0.08	0.10	0.12

Sub-Section B. Runoff Coefficients:

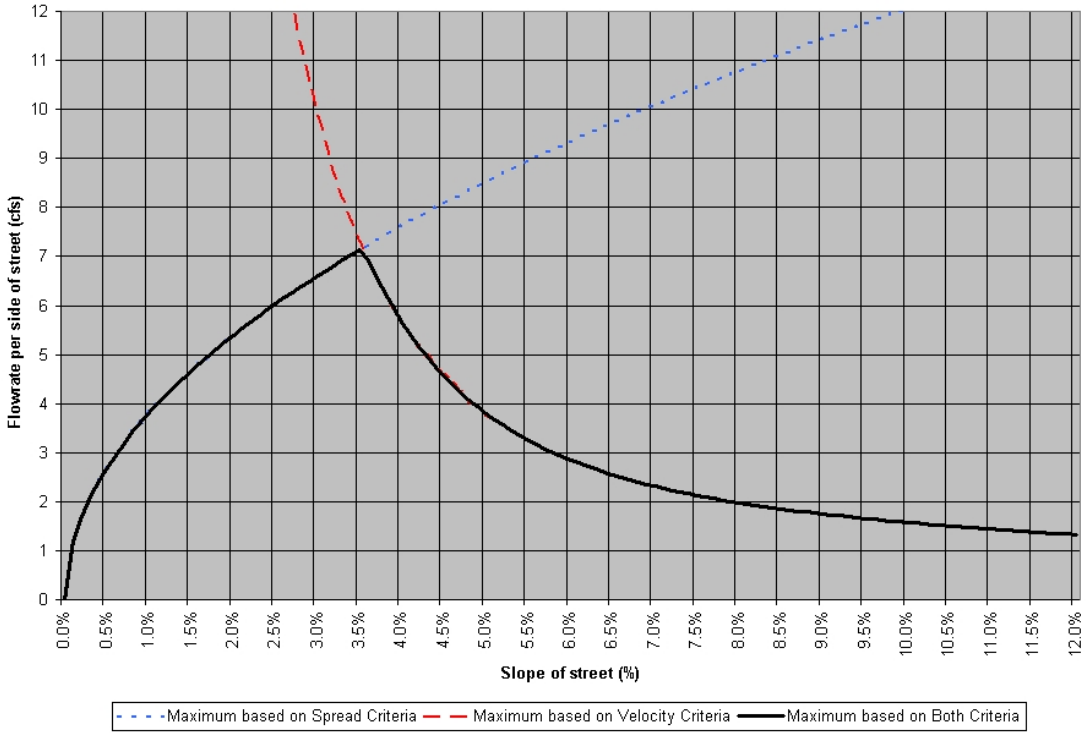
Springville City requires the design engineer to calculate a composite runoff coefficient based on surface type and associated runoff coefficient, weighted by the area of each surface type.

Sub-Section C. Inlet Spacing:

Two criteria must be met.

1) Spread of water in the street:
   Storm water must be delivered from the street into an underground piped system when the spread of water in the street covers the outside 8 feet of asphalt. This will leave one 12-foot traffic lane in local streets (that have 28 feet of asphalt), two 10-foot lanes in minor collector streets (that have 36 feet of asphalt) and three 12-foot lanes in major collector streets (that have 52 feet of asphalt) that are not submerged.
2) Gutter velocity:
   Water must be delivered from the street into an underground piped system when the velocity of water in the deepest part of the gutter reaches 10 feet per second (as a safety consideration).

Both of these requirements are a function of street slope and storm water flow rate. Storm water must be delivered from the street to storm drains when flows reach amounts shown in the following graph. This means that for a given longitudinal street slope, flows on the street surface must be delivered into the underground piped system when they reach the amount indicated on the graph by the solid line.



Note: The spread of water in the street is calculated using the Manning equation in the form developed by Izzard, with a roughness coefficient of 0.013 and the standard street cross section. The velocity criteria is based on the velocity at the deepest part of the gutter with the Manning Equation, with a roughness coefficient of 0.013, and using a depth at a point six inches from the face of the curb as the hydraulic radius.

Sub-Section D. Inlet Capacity:

The designer is to assume 50% blockage of inlets when considering storm drain inlet capacity.

SPRINGVILLE STORM WATER STORAGE FACILITY POLICY

This policy has been prepared to provide design standards and regulations for evaluating and designing storm drain and flood control facilities in the City of Springville (City). The objective of this policy is to ensure that storm water facility planning and design for small areas and local developments within the City are consistent with the City's Storm Drain Master Plan.

All storm water facilities shall conform to requirements in this Storm Water Facility Policy, the City's Storm Drain Master Plan, and shall be approved by City Engineer.

STORM WATER DETENTION FACILITY DESIGN CRITERIA

All storm water detention facilities shall be designed according to the following criteria:

1. The maximum side slope of the basin shall be 3H:1V. The maximum side slope for any basin designed or intended for multiple use shall be 4H:1V.

2. Basins adjacent to pedestrian walk ways must be set back a min. of 8 feet from the back of walk before the basin side slope begins.

3. A basin may be designed for dual use, but uses other than the detention of storm water must be approved by the City Engineer.

4. Storm water storage facility must be sized such that the peak flow rate released from the site does not exceed 0.15 cubic feet per second per acre of development (cfs/acre). The amount of storm water may be further restricted by the capacity of the existing storm drains or drainage facilities as determined by the City Engineer. In the event such additional restrictions are necessary, the developer shall provide additional detention storage of a capacity designated by the City Engineer.

5. Low flow pipes or channels will not be allowed in detention facilities unless suitable pre-treatment is provided.

6. The minimum area of the discharge orifice shall be six (6) square inches.

7. The volume requirements shall not be reduced based on evaporation or infiltration due to percolation.

8. The basin maximum depth shall be approved by the City Engineer. Prior to the design of the storm water facility (above or below ground) the maximum groundwater level, including irrigation induced water level, shall be identified on the site. The maximum ground water table shall be determined by one or more of the following methods:

a. Direct visual observation of the maximum ground water table in a soil exploration pit during the anticipated time period of maximum ground water table, including irrigation induced water table.

b. Regular monitoring of the "ground water table" or "ground water table, perched" in an observation well for a period of six months, or for the period of anticipated maximum ground water table, including irrigation induced water table.

c. Observation of soil in a soil exploration pit for evidence of crystals of salt left by the maximum ground water table; or chemically reduced iron in the soil, reflected by a mottled coloring.

The maximum ground water level is to be documented in the soils report by a professional geotechnical engineer or geologist licensed in the state of Utah. A City representative shall be present on site at time the high water elevation is determined. The invert or lowest point in the pond shall be not less than 12-inches above the existing or historical groundwater levels (whichever is higher).

The maximum depth of the basin shall be three feet; a maximum water depth of three (feet) below the emergency overflow. Additionally one (1) foot of freeboard above the emergency overflow shall be provided. All other basins require special design, approval, and permitting including safety precautions on a case by case situation.

9. The bottom of the basin shall be sloped at a minimum two percent (2%) slope toward the outlet.

10. Provide a plan for long-term maintenance and monitoring of the facility.

11. Provide vehicular access to all drainage control and pre-treatment structures.

12. Provide an emergency overflow spillway to safely discharge runoff from the facility in the event that the outlet is inoperable or the inflow exceeds the outlet capacity. The overflow shall be designed such that water will escape from the facility before reaching finished floor elevations on site or escaping onto neighboring properties.

13. Each detention basin shall have an outlet to the City storm drain system. A trash rack shall be installed at the outlet(s) to prevent debris from entering the storm drain system

14. Storm water may be detained underground in an approved underground system. Underground storage system designs shall be discussed with the City Engineer before submittal and will be approved on a case by case basis. The following limitations apply to underground detention storage:

a. Basins are to be designed such that when runoff exceeds design values or when restrictions plug, excess storm water will be directed to the street system or bypass the restriction by entering the piped system via a free flowing overflow to pass the 100 year event.

b. The private property owner benefiting from the underground detention storage will be responsible to maintain the operation of the system.

c. Underground systems shall provide adequate access points for cleaning and maintenance.

d. Emergency overflows and the flow path of the overflows shall be mapped for purpose of flooding and flood insurance requirements.

15. All facilities shall be landscaped in accordance with City Standards. Approved landscaping for storm water storage facilities based on zoning/use is as follows:

Residential	**Non-Residential**	**Regional**
Turf Grass [A]	Turf Grass [A]	Turf Grass [A]
	Rock mulch with plants [B]	Rock mulch with plants [B]
		Native Grasses [C]

NOTE :

A) Grass lined basins will be required to install a underground sprinkler system to adequately water the basin to keep the grass alive.

B) The rock in rock lined basin shall be ¾" to 3" washed rock. Mirafi fabric shall be laid prior to the placement of the rock to act as a weed barrier. Underground irrigation (sprinkler or drip) shall be provided to adequately water all plants/trees. Plants in the basin may be optional for sites that have already met the landscape requirements as established by City Code.

C) Native grass mix must be approved by the City.

16. Detention basins may be constructed in the required landscape for commercial/industrial properties. Storm water may **NOT** be detained above ground in parking/hard surface areas.

17. The City Engineer shall have authority to modify the criteria as needed to meet changing or unusual needs or conditions.

TEMPORARY STORM WATER STORAGE FACILITIES

The City Engineer may approve temporary drainage facilities for on-site detention that will allow development to continue pending completion of the permanent (i.e. regional) storm drainage improvements as outlined in the City's Storm Water Master Plan.

Temporary facilities shall meet the storm water design criteria listed above and provide the same level of flood protection at all times that will be provided by the completed permanent system. All costs of temporary facilities shall be paid for by the developer in addition to the other costs and fees.

STORM WATER RETENTION FACILITY DESIGN CRITERIA

Retention facilities (basins, sumps, or underground infiltration systems) **will not be allowed** without prior written approval of the City Engineer. Sumps shall not be located in areas with a constant or seasonally high groundwater table (including irrigation induced water levels), or shallow bedrock. Identification of the high groundwater level will be accomplished in the same procedure outlined for detention facilities above. **No sumps or retention facilities will be allowed west of 400 West**. If sumps are allowed they shall be designed according to the following criteria:

1. The bottom of the sump shall be at least 10 feet above the seasonal high water table, and at least 3 feet above bedrock.

2. Sumps shall provide adequate water quality treatment to prevent contamination of the ground water aquifer.

3. All basins/sumps shall drain within 3 days (72 hours) from the end of the storm event. This is to be documented with a certified percolation test and documented in the soils report. The percolation test must be performed at or below the bottom elevation of the proposed retention structure. The percolation test must be performed by professional geotechnical engineer licensed in the state of Utah. Percolation rates must be 20 min per inch or higher. The regulatory authority shall have the option of inspecting the open soil exploration pits and monitoring the percolation test procedure.

4. All sumps must be designed for the 25-year storm. All design data including soil log, percolation tests, etc., must be submitted with the drainage plans.

5. Underground retention shall conform to the design requirements for underground detention systems listed above.

6. Basins are to be designed such that when runoff exceeds design values or when restrictions plug, excess storm water will be directed to the street system or bypass the restriction by entering the piped system via a free flowing overflow to pass the 100 year event.

7. Emergency overflows and the flow path of the overflows shall be mapped for purpose of flooding and flood insurance requirements.