PEOPLE'S ORDINANCE NO. 18

SERIES 1987

AN ORDINANCE ADOPTING THE BRECKENRIDGE STORM DRAINAGE STANDARDS FOR THE TOWN OF BRECKENRIDGE, COLORADO

WHEREAS, it is desirable to control runoff from storms and snowmelt in order to minimize damage to public and private property and prevent personal injury or loss of life; and

WHEREAS, development of properties within the Town of Breckenridge can alter drainage patterns, increase runoff, and increase the potential for flooding; and

WHEREAS, the control of storm runoff and its safe conveyance by an adequately sized drainage system is necessary and desirable to promote the health, welfare and safety of the citizens of Breckenridge.

NOW, THEREFORE BE IT ORDAINED BY THE TOWN COUNCIL OF THE TOWN OF BRECKENRIDGE, COLORADO:

10-2-1 TITLE:

This chapter is entitled, and may be cited as, the "Breckenridge Storm Drainage Ordinance."

10-2-2 PURPOSE:

The purpose of these standards is to set forth certain rules and regulations so that there is reasonable degree of assurance that the health, safety, welfare and property of the Town and citizens may be safeguarded and protected through the proper control and drainage of storm and surface waters; and, further, to assure that there will be a certain uniformity in performance with respect to design and construction of drainage facilities. Additionally, criteria have been developed to complement the Water Quality and Sediment Transport Control Ordinance through reduction in erosion caused by runoff of storm waters.

10-2-3 GENERAL:

The design criteria as presented in "Appendix to Breckenridge Storm Drainage Ordinance" are intended to aid in preparation of plans and specifications for the Town of Breckenridge, including minimum standards where required. As with any design criteria, occasions may arise where the minimum standards are either inappropriate or cannot be practically implemented. In these cases a variance to these criteria shall be considered. Written request for each variance should be directed to the Town Engineer.

10-2-4 DEFINITIONS:

Acre Foot: A measurement of water volume. An acre foot equals the amount of water necessary to cover an acre at a depth of one foot (43,560 cubic feet).

Area of Special Flood Hazard: The land in the flood plain within a community subject to one percent (1%) chance or greater of flooding in any given year.

Basin: Is an area of land, so defined by a physical boundary that when rain falls upon this area all the resulting storm water runoff will drain by gravity toward a common watercourse (natural stream, reach, river, or nanmade channel, ditch, gutter, etc.) and ultimately exits the area at the specific point (known as the outfall).

Contour Interval: A contour is a line drawn on a map through points of equal elevation. A contour interval is the difference in elevation between contour lines.

Cross Street Flow: Flow across the traffic lanes of a street from external sources, as distinguished from sheet flow of water falling on the pavement surface.

Culvert: A covered channel or pipe that takes a watercourse under a road, through the downstream dike of a detention facility or simply below ground.

Detention Facility: Is designed for the storage of storm runoff water for controlled release during or immediately following a storm. A typical facility consists of a detention pond with an embankment on the downstream side, and a pipe or concrete box outlet. The size of the pond is based on a specific design storm and the amount of water that can be discharged through the outlet. Design features may be incorporated in detention facilities so that they also function as sediment ponds.

Drainageway: A route or course along which water moves or may move to drain an area. A "natural" drainageway refers to the route or course in an area prior to the construction of any urban improvements.

Drainage Easement: A grant to the Town of the right to control development of a drainage right of way or an area subject to periodic flooding.

Freeboard: The elevation difference between the normal maximum level of the water surface and the top of the confining structure, which is provided so debris may more readily pass through the structure without creating blockage and waves and other movements of the water will not overtop such confining structures.

Grade: The inclination or slope of a channel, canal, conduit, etc., or natural ground surface, usually expressed in terms of the percentage or number of units of vertical rise (or fall) per unit of horizontal distance.

100-Year Storm & 2-Year Storm: These terms refer to the recurrence intervals of various intensities of storms. A recurrence interval is a statistically determined average period of time within which a given intensity of rainfall will be equalled or exceeded only once. For example, the 100-year storm refers to the intensity of rainfall which, on the average, will be equaled or exceeded once during a 100 year period. The larger the recurrence interval being considered, the higher the intensity. In other words, the 100-year storm will have a higher intensity than the 2-year storm.

100-Year Flood: A peak discharge that can be expected to be equaled or exceeded once during every hundred year period. This event bas a one percent chance of occurring during any given year. Discharge rates for the Blue River and its major tributaries are provided in the Breckenridge Drainage Master Plan.

Impervious Surface: The area of a site which allows only minimal infiltration and percolation, such as a constructed or natural surface which will allow surface runoff approximately equal to 100% of the applied water.

Initial Storm: See Minor Storm

Inlet: (1) An opening into a storm sewer system for the entrance of surface storm runoff; (2) a structure at the diversion end of a conduit; or (3) the upstream connection between the surface of the ground and a drain or sewer for the admission of surface or storm water.

Minor Storm and Major Storm: These terms refer to the recurrence intervals of storms or design storms. The minor storm (also called the "initial storm") is considered to be the two- to ten-year storm with the exact return period dependent on the land use. The storm runoff from the minor storm is called "nuisance flows." The major storm is the 100-year storm and the uncontrolled runoff from this storm could possibly cause major property damage or even loss of life.

Open Channel: An open channel or open drainageway is a watercourse which carries the storm runoff water collected by the drainage basin to the outfall of the basin. It has definite bed and banks which serve to confine the water, though it has no cover (hence "open").

Stable Channel/Ditch: A streambed, drainageway or ditch in which sediment transport conditions are in balance, neither leaving significant deposits of sediments nor experiencing significant erosion.

Storm Runoff: The water from precipitation running off from the surface of a drainage area during and immediately following a period of rain.

Storm Sewer: A system of inlets, manholes, and conduits to convey runoff to drainageways and natural channels. Storm sewers are necessary whenever the street capacity to carry the design storm runoff is exceeded for either the minor or the major storm.

Street Flow: The total flow of storm runoff in a street, usually being the sum of the gutter flows on each side of the street.

Substantial Completion: The work has progressed to the point where it is sufficiently complete so that it (or a specified part) can be utilized for the purposes whlch it is intended.

Surcharged: A condition in a storm sewer where the hydraulic grade line rises above the elevation of an inlet.

10-2-5 POLICY SUMMARY:

A. General

The statements in this Section are the basis for all storm-water management within the Town of Breckenridge and are to be used as guidelines in the design and evaluation of all storm drainage facilities.

B. Master Plan

The Town shall prepare a Master Plan for drainage within the Town. New development within the Master Plan boundary shall be required to incorporate flows as specified in the Master Plan or by the Town Engineer until such plan is completed. Additionally, the Town Engineer may require recommendations for drainage improvements contained in the Master Plan to be implemented by the developer.

C. Design Standards

The policy of the Town will be to evaluate designs of drainage improvements submitted to the Town based on the standards set forth in the Town of Breckenridge Storm Drainage Ordinance. This ordinance generally follows criteria as set forth in "URBAN STORM DRAINAGE CRITERIA MANUAL" for the Denver Regional Council of Governments. Specific criteria for the Town of Breckenridge have been added.

D. Major and Minor Drainage Systems

For all land uses, design of facilities within the major drainage system shall be based on the 100-year storm runoff unless the Town Engineer specifies a different level of protection. Design of facilities for the minor drainage system shall be based on the level of protection required for various land uses. The design storm associated with the minor drainage system is referred to as the minor storm.

E. Natural Drainageways

The policy of the Town shall be to direct runoff from new developments into historic and natural drainageways and to promote the recreational use and enhance the aesthetic value of such drainageways wherever possible. Runoff shall not be diverted into drainageways so as to increase erosion in the receiving drainageways. Nor shall runoff from a development be allowed to increase flooding problems in the receiving drainageway.

F. Open Channels/Drainageways

The policy of the Town shall be to maintain the stability of all open channels in order to prevent erosion and the contribution of additional sediments to the Blue River and its tributaries. All open channels which are part of the major drainage system shall have sufficient capacity to convey the 100-year storm runoff unless the Town Engineer specifies a different level of protection.

G. Detention

The policy of the Town shall be to require detention storage of stormwater runoff to limit peak discharges from newly developed areas to historical rates. Exemptions to detention requirements may be allowed in cases where the increase in historic runoff is not significant and will not aggravate flooding or erosion problems.

H. Private Property Damage

All systems designed to pump and/or drain water from private property to the Town Rights of Way shall be approved by the Town Engineer prior to construction.

I. Water Quality

It is the policy of the Town that drainage shall be controlled so as not to degrade the quality of surface and groundwater. Specifically, the Town has adopted a "Water Quality and Sediment Transport Control Ordinance" to prevent the contribution from new developments of additional sediments and phosphorus to Lake Dillon and protect the quality of water in the Blue River and its tributaries. All drainage from new developments shall be designed and constructed to comply with the "Water Quality and Sediment Transport Control Ordinance" as well as the "Storm Drainage Ordinance".

J. Flood Plain Management

The Town of Breckenridge has adopted flood hazard mapping for the major streams within its corporate limits. The Town is part of the national flood insurance program administered by the Federal Emergency Management Agency (FEMA). As part of this program, the Town has adopted the "Breckenridge Flood Damage Prevention Ordinance". All drainage plans must show compliance with regulations contained in the "Flood Damage Prevention Ordinance".

K. Preparation by Professional Engineer

All drainage plans shall be prepared by or under the direct supervision of a professional engineer registered in the State of Colorado. The engineer preparing or supervising the preparation of the plan shall verify that the proposed drainage facilities will meet the standards and criteria of the ordinance and related regulations including integration with other project features such as water quality and sediment transport control measures, existing flood plain management, grading, roads, parking and landscaping.

L. Administrative Procedures

In order to implement the provisions of this ordinance, the Town Manager shall adopt "Administrative Procedures and Design Guidelines for Storm Drainage Plans" for the content of drainage plan submittals and guidelines for performing the designs necessary for implementation of the intent of this ordinance. The Town Manager may modify the procedures and guidelines from time to time to incorporate new analysis and design methods or to improve the administrative procedures.

10-2-6 DRAINAGE PLAN REQUIREMENTS AND DESIGN GUIDELINES:

A. Preliminary Drainage Plan

Prior to the submission deadline for the second preliminary Planning Commission hearing of any development, a preliminary drainage plan shall be submitted to the Town Engineer for review. Content requirements are detailed in the Administrative Procedures. Requirements for preliminary engineering submittals for projects not requiring two preliminary hearings shall be determined by the Town Engineer.

B. Final Drainage Plan

Prior to the submission deadline for the final Planning Commission hearing of and development, a final drainage plan shall be submitted to the Town Engineer for review. Content requirements are detailed in the Administrative Procedures.

C. Final Drainage Construction Drawings

Final drainage construction drawings shall be submitted to the Town Engineer and accepted prior to issuance of a building permit or recording of a subdivision agreement. All drawings and specifications shall be dated and stamped "Approved for Construction". Content requirements for the drawings are detailed in the Administrative Procedures.

D. Record Drawings

Record drawings are to be submitted to and accepted by the Town Engineer prior to final acceptance of the improvements. Requirements for the record drawing submittal are detailed in the Administrative Procedures.

10-2-7 FEES AND DEPOSITS:

The following amounts shall be posted for development permits prior to any construction occurring.

A. Performance Guarantees

A letter of credit, cash deposit or other acceptable security in an amount determined by the Town Engineer and in a form approved by the Town Attorney shall be deposited with the Town to guarantee construction and performance for a period of two years following issuance of a certificate of substantial completion. The deposit shall be made prior to recording of a

final plat or issuance of a building permit. Performance guarantee amounts may be reduced after one year. Determination of the amount of guarantee after one year shall be by the Town Engineer.

Construction Costs	Performance & Payment	24 mo. guarantees
$0 - $25,000	125%	25%-100% Cash or letter of credit only
Over $25,000	125%	25%- 50% Cash, letter of credit or bond

Other methods of performance, payment, and 24-month guarantees may be acceptable. Determination of acceptability shall be by the Town Attorney.

10-2-8 GENERAL DESIGN CRITERIA

These standards set forth general criteria to be followed in designing drainage facilities in the Town of Breckenridge. Specific requirements as to drainage plan content and guidelines concerning suggested methodologies to carry out the analysis and design of facilities are provided in the Town "Administrative Procedures and Design Guidelines for Storm Drainage".

The planning and design of the drainage system shall not be such as to transfer the problem from one location to another or create a more hazardous condition downstream. Although improvements may not have to be made upstream or downstream of a development, provisions shall be made in all cases where significant flow is concentrated in the form of a drainage easement or drainageway for the 100-year storm to pass through the development. Natural drainageways are to be used whenever feasible. Alterations to natural drainage patterns may be approved if a thorough investigation and analysis submitted by the engineer shows no hazard or liability. Streets shall not be used as primary conveyances for major storm runoff. The amount of runoff in streets shall not exceed the limits established in the "Appendix to Breckenridge Storm Drainage Ordinance". The drainage plan must indicate the route the flow will take from the site to either a natural drainageway or Town storm drainage facility.

In cases when the development of a property results in the alteration of drainage patterns or the concentration of flow, documentation must be provided that demonstrates existing drainage systems (either natural or manmade) have sufficient capacity to convey the altered flows without causing increased damage due to flooding. In addition, the concentration of flow or alteration of drainage patterns must not result in increased erosion to downstream properties.

All drainage improvements shall be as natural in appearance as possible to be aesthetically pleasing. Maintenance access shall be provided for all drainage and flood control facilities.

Where the Town's Drainage Master Plan or subsequent site specific master plans identify recommendations or criteria for drainage improvements, proposed drainage systems shall conform to that plan. In areas where master plan information is not available, major drainageways and easements shall be located in order to provide continuity with existing drainage conditions. These drainageways and easements shall be shown on all drainage plans and final plats. All flood plain boundaries for the larger drainages are available from the Town Engineer and shall be shown on all drainage plans.

All drainage plans, in addition to design storms, shall consider the runoff created by snowmelt. Considerations shall include design features that will allow snowmelt to runoff from the site

without causing icing problems on the surface, in inlets, in culverts or in storm drains. In addition, the design shall recognize the problems that can be created by snowmelt due to the large volume of water released.

10-2-9 ADDITIONAL REQUIREMENTS AND VARIANCES:

The Town of Breckenridge reserves the right, in the Town's best interest, to issue and enforce more stringent criteria should adverse conditions exist. Also, occasions may arise where the minimum standards are inappropriate. All applications for designs varying from the criteria shall obtain written approval of the variance from the Town Engineer prior to final approval of the plans. The engineer preparing the plans must certify that the variance does not result in a hazard or increase the likelihood of damage to adjacent and downstream properties.

10-2-10 APPENDIX TO BRECKENRIDGE STORM DRAINAGE ORDINANCE:

"Appendix to Breckenridge Storm Drainage Ordinance" is hereby adopted by reference.

10-2-11 VIOLATIONS AND PENALTIES:

A. It is unlawful to erect, construct, reconstruct, alter, or use any structure or to use any land in violation of this ordinance.

B. Any person, firm, or corporation violating any portion of these regulations is guilty of a misdemeanor, and upon receiving conviction thereof, shall be punished by a fine of not more than three hundred dollars ($300.00) and/or imprisonment for a term not to exceed ninety (90) days for each offense. Each day during which such illegal construction, reconstruction, alteration, maintenance, or use continues shall be deemed a separate offense.

C. In addition or as an alternative to such fine and/or imprisonment, the Town may seek other remedies provided in law or equity including but not limited to injunction, mandamus, or abatement.

INTRODUCED, READ ON FIRST READING, APPROVED AND ORDERED PUBLISHED IN FULL ONLY this 9th day of June, 1987. A Public Hearing shall be held at the regular meeting of the Town Council of the Town of Breckenridge, Colorado on the 23rd day of June, 1987, at 7:30 p.m. or as soon thereafter as possible in the Municipal Building of the Town.

ATTEST:

Rosemary Ahern, CMC, Town Clerk

TOWN OF BRECKENRIDGE

Stephen C. West, Mayor

READ, ADOPTED ON SECOND READING AND ORDERED PUBLISHED BY TITLE ONLY this 23rd day of June, 1987.

A copy of this ordinance is available for inspection in the office of the Town Clerk.

ATTEST:

Rosemary Ahern, CMC, Town Clerk

TOWN OF BRECKENRIDGE

Stephen C. West, Mayor

APPENDIX TO BRECKENRIDGE STORM DRAINAGE ORDINANCE

TOWN OF BRECKENRIDGE

I. INTRODUCTION

This document is known as the "Appendix to Breckenridge Storm Drainage Ordinance". The Appendix has been ordained by the Town Council of Breckenridge as part of the "Breckenridge Storm Drainage Ordinance". Contained in this appendix are specific requirements for the design, implementation and performance of storm drainage systems in the Town of Breckenridge.

II. HYDROLOGIC DESIGN CRITERIA

A. General

The hydrologic analysis for a particular area shall be based on the proposed land use for that area. Contributing runoff from upstream areas shall be based on existing land use and topography. For purposes of designing detention storage facilities, calculation of historic rates of runoff shall be based on undeveloped watershed conditions unless other criteria are specified by the Town Engineer in writing. Flows specified in the Flood Insurance Study, Town of Breckenridge (1979) and the Drainage Master Plan shall be incorporated in the analysis where applicable.

Two separate and distinct storms shall be considered in the design of the drainage system. The first is the initial storm which occurs at fairly regular intervals, based on the two- to ten-year storm, depending on land use. The runoff from this type of storm is considered "nuisance flow". The second is the major storm which is defined as the 100-year storm. In some instances the major storm routing will not be the same as the initial storm. In this case, a complete set of drainage plans shall be submitted for each storm system.

B. Design Storms

The following paragraphs specify design storms for both the initial and major storm runoff based on land use. In some instances a land use requiring a higher return period storm may be located above a proposed project. In such cases, in order to maintain a consistent and orderly storm drainage network, the Town Engineer may require the downstream system to be designed to the return periods applicable to the upstream area.

1. Initial Storm Provisions

The initial storm shall be based on the two- to ten-year storm. The objectives of such drainage system planning are to minimize inconvenience, to protect against recurring minor damage and to reduce maintenance costs in order to create an orderly drainage system at a reasonable cost. The initial storm drainage system may include such facilities as curb and gutter, roadside ditches, storm sewers, open drainageways, and/or detention facilities. Design storm frequencies for the initial storm are based on level of land use and are specified in Table 2.1.

2. Major Storm Provisions

The major storm shall be considered the 100-year storm. Objectives of major storm planning are to eliminate substantial property damage or loss of life. Major drainage systems may include storm sewers, open drainageways, and detention facilities. The correlation between the initial and major storm system shall be analyzed to insure a well coordinated drainage system.

Table 2.1
DESIGN STORM FREQUENCIES

Land Use	Design Storm Return Period (Initial Storm)	(Major Storm)
-Residential up to 4 units per acre	2-year	100-year
-Residential greater than 4 per acre	10-year	100-year
-Service Commercial	10-year	100-year
-Retail Commercial	10-year	100-year
-Recreational/Open Space	2-year	100-year
-Open Channels & Drainageways	--	100-year
-Detention Facilities	--	100-year

III. DRAINAGE CRITERIA FOR STREETS

The criteria, specifications, and procedures found in this section have been established with the idea that the primary function of a street is to carry traffic. Street runoff from both the initial and major storms shall be analyzed and checked for compliance with these specifications. Such runoff calculations shall be submitted for approval. The classification of streets as referred to in this section shall meet the criteria set forth by the "Breckenridge Street Standards Ordinance".

A. Grade

The minimum sustained concrete or paved gutter grade shall be 0.6%. The minimum sustained earthen ditch grade shall be 1.0%. Maximum grades in earthen ditches shall be such that erosive velocities are not generated for storm runoff equal to or less than the initial storm. In some situations it may be impractical to keep grades below values that would result in the production of erosive velocities. If this is the case, means to limit the erosion such as check dams or ditch lining shall be implemented.

B. Initial Storm

The determination of the street runoff capacity shall be based on the following procedure:

-- Compute the theoretical flow conditions for pavement encroachment.

-- Apply a reduction factor to the theoretical flow rate to take into account field conditions.

The encroachment of gutter flow on the street for the initial storm runoff shall not exceed the specifications set forth in Table 3.1. Where earthen ditches are utilized to convey flow they shall have sufficient capacity to pass the initial storm without flow encroaching on the shoulder of the road or adjacent property. In all cases, ditch dimensions shall not be less than the minimums set forth in the "Appendix to Town of Breckenridge Street Standards Ordinance". A storm drainage system shall begin where the encroachment reaches the limits found in Table 3.1.

TABLE 3.1
INITIAL STORM STREET RUNOFF ENCROACHMENT

Street Classification	Maximum Encroachment
Local (includes places, alleys, marginal access)	-No curb-topping -Flow may spread to crown of street
Collector (Major and Minor)	-No curb-topping -Flow spread must leave at least one lane width free of water
Arterial	-No curb-topping -Flow spread must leave at least 1/2 of roadway width free of water in each dir.

C. Major Storms

The determination of the allowable street flow due to the major storm shall be based on the theoretical capacity under the allowable depth and inundated area. For all classification of streets the maximum encroachment shall be such that residential dwellings, public, commercial and industrial buildings shall not be inundated at the ground line unless buildings are flood proofed. The depth of water over the crown shall not exceed six (6) inches. Any parking shall be controlled by the same criteria. A storm drainage system shall begin where the encroachment exceeds the amounts specified in this paragraph.

D. Cross Street Flow

For all classifications of streets, flow in cross pans shall not exceed a maximum depth of six inches during the initial storm runoff. During the major storm runoff cross flow shall not exceed a depth of one foot above the crown of local and collector streets. In the case of major arterials, cross flow during the major storm runoff shall not exceed a depth of six inches above the crown.

IV. STORM SEWERS

A storm sewer system shall be deemed necessary whenever street capacities to carry design storm runoff, as defined by Section III, are exceeded. This includes both the initial storm and major storm runoff. When the planned storm sewer connects into existing storm sewer lines, analysis must be provided that indicates the additional flow from the proposed project does not result in the excedence of the existing storm sewer capacity.

The placement of storm inlets shall be determined by a thorough analysis of the drainage area and streets involved. These inlets shall be located where carrying capacities exceed those specified in Section III. Inlets shall also be located in all areas where sump (low spot) conditions exist. However, due to freezing problems at inlets and the associated hazards, sump conditions will only be allowed if no practical alternatives for grading and drainage exist. To lessen the likelihood of inlet blockage due to ice build up in sump areas, the inlet shall be sized to have twice the capacity as would be otherwise required by this Section.

Storm sewers with pressure flows shall be designed to withstand the forces of such pressure. When pressure flow occurs, pressures that create surcharged conditions at storm inlets are not allowed.

A. Frequency of Design Runoff

When conditions warrant the installation of a storm sewer system, and the street runoff carrying capacity does not govern the design, the

storm sewer shall be designed for the storm frequencies for the specific land uses listed in Table 4.1. Creation of a storm drainage system does not relieve the developer from the requirement to provide, in the case where significant flow is concentrated, a drainage easement or drainageway for the major (100-year) storm runoff to pass through the development.

Table 4.1

STORM DRAINAGE SYSTEM DESIGN STORM FREQUENCIES

Land Use	Initial Design Storm Return Period Frequency
-Residential up to 4 units per acre	2-year
-Residential greater than 4 units per acre	10-year
-Commercial/Business	10-year
-Recreational/Open Space	2-year

B. Storm Sewer Pipe

The minimum allowable pipe diameter shall be 24 inches for main trunks and laterals. The minimum inside dimension shall be no less then 16 inches for elliptical and arch pipe. In areas where debris, sediment deposition or freezing are potential problems, the Town Engineer may require additional over sizing of the pipe. All pipe shall be of sufficient strength to withstand AASHTO HS-20-44 loading.

If there is reason to believe that pipe corrosion may be a problem, the Town Engineer may request that a soils report addressing potential corrosive properties of the soils and groundwater in the area of storm sewer installation be performed. Additionally, an analysis of the stormwater may be required.

When located beneath areas where regular snow removal is performed, storm sewers shall be installed with a minimum of 5 feet of cover over the pipe. In unplowed areas, a minimum cover of 4 feet over the top of pipe shall be required. Lesser cover requirements will be allowed if provisions are made to divert winter flows that could cause freezing problems and an alternate means of disposing of the flows such as a dry-well is provided.

When storm sewers cross over or within 18 inches below water mains, they shall be constructed of structural sewer pipe, a 20 foot section, centered over or under the water main and the connecting joints encased. If structural sewer pipe is not used, storm sewers shall have all joints encased for the 20 foot section. If a storm sewer is laid less than 10 feet horizontally from a water main, these requirements shall also apply. Corrugated metal pipe shall be fully encased for all sizes for the conditions described above.

Encasements shall consist of a reinforced concrete collar 6 inches thick and extended 12 inches on either side of the joint. The minimum reinforcement shall be #4 bars, continuous, placed at each corner of the section tied with #3 bars at 3 foot centers.

The minimum clearance between storm sewers and other utilities shall be 12 inches unless one of the pipe is encased, which reduces the clearance to 6 inches. In all cases, suitable backfill, compaction, and/or protection shall be provided to prohibit settling or failure of either pipe system.

C. Inlets and Grates

Where a clear and present danger exists such as a siphon, a drop in elevation adjacent to a sidewalk or road, a long pipe with one or more manholes, or at pipes which are near playgrounds, parks, and residential areas, a grate may be required. For most pipes through embankments and crossing streets, grates will not be required.

Storm inlets shall be installed where sump conditions exist or street runoff-carrying capacities are exceeded. When inlets are installed on "continuous grade" conditions rather than at sump locations, in most cases some gutter flow will not be intercepted by the inlet. The amount of "inlet carry over" must be included in the evaluation of the inlet and downstream facilities. All curb openings shall be installed with the opening at least 2 inches below the flow line elevation. Because of debris plugging, pavement overlaying, parked vehicles, and other factors which decrease inlet capacity, a reduction shall be applied to the inlet capacity.

The outlet pipe of the storm inlet shall be sized on the basis of the theoretical capacity of the inlet, with a minimum diameter of 24 inches, or 16 inches minimum dimension if elliptical or arch pipe is used.

D. Manholes

Table 4.2 sets forth the maximum allowable manhole spacing for storm sewers. Manholes shall be placed wherever there is a change in size, abrupt change in direction, elevation or slope, where there is a junction of two or more systems or laterals, or when the maximum distance from Table 4.2 is reached.

Table 4.2
MAXIMUM ALLOWABLE MANHOLE SPACING

Pipe Vertical Dimension (inches)	Maximum Allowable Distance Between Manholes and/or Cleanouts (feet)
24 to 36	400
36 to 60	500
> 60	750

V. CULVERTS

The size, shape, and type of culvert crossings shall be based on the calculated flow quantities as well as existing topographic conditions. Soil tests and water analysis may be required to determine the suitability of materials in questionable areas. Allowable materials for culverts include corrugated metal and concrete.

The structural design of culverts shall conform to those methods and criteria recommended by the manufacturer for that culvert type and for the conditions found at the installation site. However the culvert, as a minimum, shall be designed to withstand an HS-20-44 loading in accordance with the design procedure set forth in the current American Association of State Highway and Transportation Officials (AASHTO) "Standard Specifications for Highway Bridges".

All culvert installations (except under major arterials or from large drainage areas) shall be designed with an overflow capacity for the major storm. Culverts under major arterials or conveying flows from drainages with areas in excess of 0.5 square miles shall have sufficient capacity to pass the 100-year storm runoff assuming that 20 percent of the inlet is plugged. Culverts under local and collector streets shall be designed to carry the 25-year storm discharge.

Ponding above culvert entrances will not be allowed if such ponding will cause property or roadway damage, culvert clogging, saturation of fills, detrimental upstream deposits of debris, increase existing flood plain elevation or inundate existing or future facilities. The limitations in Table 5.1 are to be used as a guide in alleviating some of the problems due to ponded water. The HW/D ratios listed in Table 5.1 are to be applied to culverts at street crossings and should not be applied in the case of an outlet from a detention facility or sedimentation facility.

Culvert design shall be based on the runoff quantities for the appropriate design storm and include inlet and outlet structure design. The minimum pipe diameter for culverts in public right of ways shall be 24 inches. The minimum pipe dimension shall be 16 inches where elliptical or arch pipe is used. Roadside ditch culverts for private driveways shall have a minimum diameter of 18 inches. This minimum shall be increased to 24 inches if the culvert length exceeds 25 feet. All culvert designs shall include an analysis that determines whether inlet or outlet control conditions govern for both 100-year and 25-year storm runoff.

All inlet structures shall be designed to minimize entrance losses. All culverts shall be fitted with flared end sections, headwalls, wingwalls, or other approved methods to minimize entrance losses. Projecting ends shall not be permitted (except beneath driveways). Ditch sections and profiles shall be transitioned at culvert inlets and outlets to allow for adequate cover over the culvert and provide inlet and outlet conditions which will not cause erosion or sediment deposition.

Culvert slopes shall be designed so that neither silting nor excessive outlet velocities resulting in scour can occur. A minimum design velocity of 3 feet per second for the minor storm is recommended to prevent siltation. Design outlet velocities for the 25-year excess of 6 feet per second shall require erosion protection. If outlet velocities exceed 12 feet per second, energy dissipation shall be required.

Table 5.1

MAXIMUM HEADWATER/DIAMETER RATIOS (HW/D)

Storm Frequency	HW/D
25-year	1.0
100-year	1.5

VI. OPEN CHANNELS

All open channels shall be designed to carry the major storm (100-year recurrence interval). Channels shall be designed to be stable and prevent additional contributions of sediments due to erosion of the bed or banks. Channel lining with rip rap or use of energy dissipation structures shall be used to provide a stable channel when necessary. A minimum of one foot or 25 percent of the design depth, whichever is greater, of freeboard shall be incorporated into channels. The design of channels on bends or curves shall take into consideration the centrifugal and gravitational forces on the flow within the channel section.

Modifications to all open channels within designated flood hazard areas shall comply with the Flood Control Regulations contained in the Breckenridge Flood Damage Prevention Ordinance. Flood hazard areas are delineated on the Flood Boundary and Floodway Maps prepared by the Federal Emergency Management Agency (1980). In areas where these maps are not available, the mapping In the Breckenridge Drainage Master Plan shall govern or the Town Engineer may require mapping be produced.

VII. DETENTION STORAGE

A. General

The main purpose of a detention facility is to store the excess storm runoff associated with an increased proportion of impervious cover associated with development and discharge this excess at a rate similar to the rate experienced from the basin without development. Additionally, detention facilities can be designed to be multi-purpose and assist in fulfilling requirements of the "Breckenridge Water Quality and Sediment Transport Control Ordinance".

B. Design Criteria

All detention facilities shall be designed for the runoff resulting from the minor storm and major storm: The minor storm runoff is required in addition to the major storm runoff to prevent an increase in historic rates of runoff over a range of conditions. The facility shall be designed to release the runoff from the developed condition at or below the calculated historic peak runoff rate for the two specified storms. Facilities with dam height in excess of 10 feet, surface area in excess of 20 acres or volume in excess of 100 acre feet are referred to as "jurisdictional dams" and shall require approval of the plans by the State Engineer's office.

C. Maintenance Requirements

An important part of a detention facility is the continued maintenance of the facility to ensure it will function as designed. Maintenance of detention facilities involves removal of debris and sediment and periodic inspection of outlets. Such tasks are necessary to preclude the facility from becoming unhealthy and to retain the effectiveness of the detention basin. Maintenance responsibility lies with the owner of the land, except as modified by specific agreement. Maintenance responsibility shall be delineated on the Final Plat. Maintenance access for detention ponds need not be specified as an easement but must be adequate for maintenance and shown on the Final Plat. Should the owner fail to adequately maintain the facilities, the Town shall have the right to enter the property for the purpose of operations and maintenance. All such maintenance costs and associated legal fees will be assessed to the property owner.

D. Exemptions

Specific projects may be exempted from the detention requirements based on the small size or proximity to an existing stormwater conveyance system of adequate size to convey the developed condition runoff. The Town Engineer shall require supporting analysis and certification that exclusion from the detention requirement will not cause any adverse downstream impacts.