CITY OF CALDWELL
ENGINEERING DEPARTMENT

CALDWELL MUNICIPAL STORMWATER INFRASTRUCTURE DESIGN MANUAL

March 2024

Contents

1. STORMWATER MANAGEMENT

1.1. LEGISLATIVE AUTHORITY

The City of Caldwell has the authority to manage stormwater within incorporated City limits and its impact area associated with roadways, subdivisions, planned unit developments, and new construction. The City of Caldwell does not have exclusive responsibility for historic and agricultural drainage activity and facilities in the corporate limits and impact area of the City. The following regulations shall apply where the City has jurisdiction.

Idaho Constitution

The City has constitutional authority as a municipal corporation to promulgate regulations governing the discharge of stormwater within the public right-of-way, into the City's publically-owned stormwater system located within City limits. In instances where the drainage facility is owned by another agency, the City shall defer to or may add requirements to those of the owner. (Article XII Section 1)

Jurisdiction and Ownership

The City has authority to control discharges into the public right-of-way or into any stormwater or drainage facilities within the public right-of-way through its ownership of the right-of-way. (See Title 50, Idaho Code, Section 1330)

Flood Prevention

Title 50, Idaho Code, Section 333 gives the City authority to minimize flooding. All proposals which include development within a Special Flood Hazard Area (SFHA) within the City of Caldwell are subject to the review and approval of the City Floodplain Administrator.

Land Use Planning Act

Title 67, Idaho Code, Section 6518 authorizes the City to adopt standards for storm drainage systems.

Other

This section shall not be construed as an exhaustive list of the City's authority to dictate stormwater management methods. The City may assert other jurisdictional authorities where applicable.

1.2. PURPOSE AND INTENT

Stormwater management necessitates a calculated effort to control the size and severity of flooding, water quality impacts of runoff events, and erosion and sediment control mechanisms. Previous local stormwater management programs have focused on flood control and MS4 permit compliance. Idaho Department of Environmental Quality (DEQ) and the US Environmental Protection Agency (EPA) regulations may require a more comprehensive management program in the future.

In 1987, EPA added a new subsection to the National Pollutant Discharge Elimination System (NPDES) of the Clean Water Act and EPA published implementing regulations in 1990. These regulations require control of pollutants in urban stormwater discharge to surface waters, and mandate an extensive permitting process for municipal storm sewer systems. This applies to communities and urbanized areas with populations over 100,000.

For surface waters of particular concern ("water quality limited"), the Idaho Department of Environmental Quality has promulgated an "anti-degradation" policy for certain pollutants. The lower Boise River, which receives runoff from the City of Caldwell, is a "water quality limited" stream segment and is subject to the "anti-degradation" policy.

A stormwater management program is needed to meet the stated objectives of environmental regulations. This design manual outlines the City's stormwater management requirements. It is intended to accomplish these objectives and set up the "Best Management Practices" (BMP) for managing stormwater discharge from new developments. City of Caldwell anticipates that this manual will require modification as State and Federal regulations change.

1.3. MANAGEMENT AND PERFORMANCE REQUIREMENTS

This stormwater management design manual addresses three distinct system performance standards: flow control, water quality protection (treatment), and acceptable redirection of excess stormwater. Although these goals must be addressed for the construction phase of a development, this design manual specifically pertains to the permanent stormwater control and treatment for the completed development.

1.3.1 Flow Controls

Stormwater infrastructure management encompasses the design and implementation of a control system to achieve the following objectives:

- Mitigate downstream impacts of increased stormwater flow caused by land development activity.
- Accommodate stormwater and other flows from upstream lands and developments by providing adequate conveyance facilities through development sites.
- Preserve functionality and capacity of existing drainage methods and facilities. Prevent encroachment of runoff from new development into abandoned or unmaintained drainage conveyances. Prevent or minimize informal, unnamed, and/or unmanaged drainage patterns across private property boundaries.

1.3.2 Water Quality Protection

Management of surface water and groundwater quality necessitates design and implementation of a control system to achieve the following objectives:

- Minimize and mitigate quality impacts to surface water and groundwater from contaminants introduced to stormwater runoff caused by land

development. Utilize sediment and erosion controls to limit the addition of sediment into runoff.

- Control the quantity of water contaminants through construction of facilities that treat stormwater runoff. Properly designed treatment facilities remove sediment and chemical contaminants before stormwater reaches groundwater or a surface water channel.
- Properly redirect treated stormwater runoff by allowing it to return to groundwater or a surface water channel by way of filtration, overflow, or other best management practice.

1.3.3 Erosion and Sediment Control

Developed sites and sites undergoing development activity must mitigate the potential erosion and sedimentation impacts caused by their earth-disturbing activity. Erosion caused by new and existing developments must be managed by design and implementation of a control system. The sources of sediment may be controlled through the use of diversions, ground cover, lined channels, sediment basins, sediment control structures, filtering and screening membranes, street sweeping, inlet protection, the elimination of dirt tracking from construction sites, or other approved methods.

Prior to the beginning of construction, where construction activities disturb more than one acre, the developer or his representative must have a Stormwater Pollution Prevention Plan (SWPPP) in place and must file a Notice of Intent (NOI) with the EPA, in accordance with NPDES (National Pollutant Discharge Elimination System) requirements. The SWPPP will include provisions for reducing sediment discharges from the construction site and tracking of mud onto roadways. A copy of this plan and the NOI shall be provided to the City prior to any site grading.

1.3.4 Historic Drainage and Flow Redirection

The term "historic drainage" shall refer directly to the rights and responsibilities of a property owner described at Idaho Code 18-4308. The term "historic drainage" shall not be interpreted according to the following erroneous assumptions:

- The individual who previously farmed a parcel in question utilized drainage infrastructure to discharge all of their gravity irrigation runoff, therefore the new owner or developer may also discharge all of their stormwater runoff.
- The individual who previously farmed a parcel in question caused a reduction in water quality to receiving waters, such as a surface drain. Therefore, the new owner or developer may also discharge a similar measure of polluted or turbid stormwater.
- Agricultural discharges and stormwater discharges are allowed to be managed and regulated in a similar manner.
- An agent who owns or operates a drainage facility is obligated to allow stormwater runoff into the drain because they previously allowed agricultural runoff.

- A neighboring property may be required to accept runoff from any other property topographically higher in elevation, even when no previously established drainage pattern had occurred.
- A property undergoing new development is not required to convey established upstream drainage, agricultural, stormwater, groundwater, etc through their property to the nearby surface drain.

In fact, property owners and developers must always facilitate the following:

- Maintain historic drainage ways.
- Memorialize newly shared drains with an easement free of obstructions, accessible for maintenance.
- Create onsite storage for the additional runoff created by the development. Surface hardening lowers permeability in developed areas.

1.4. INNOVATIVE DESIGNS

Any storm drainage or flood control infrastructure which utilizes technology that is new, innovative, or different from facilities presumed in the scope of this manual may be accepted for review and approval at the sole discretion of the City Engineer or their acting designee. Any facility accepted for review under this paragraph shall be evaluated to meet the full intent of this manual. This section does not require the City to approve any particular innovative design.

1.5. URBAN HYDROLOGY

As rain falls on an undeveloped watershed, trees, grass, or other vegetation may intercept some precipitation. Precipitation that reaches the ground starts to fill depressions and infiltrate into the ground. If rainfall is in excess of the storage and absorptive capacity of the soil, surface runoff occurs.

As land is developed, the surfaces are graded and covered with non-porous materials. The reduced infiltrative capacity causes the quantity and rate of runoff from a developed area to be greater than from an undeveloped area. During rainfall events, the runoff may move more quickly through the drainage system due to unnatural routing of the flows and increased flow rates. If properly designed conveyance infrastructure is not installed at the developed site, minor or major flooding can result.

This manual is intended to protect downstream drainage systems and water quality from potentially adverse effects of upstream development.

1.6. DRAINAGE DESIGN SUBMITTAL

Review and approval of the Drainage Report by the City of Caldwell does not constitute an engineering review of the entire project plans and calculations. The review is for ensuring general conformance to City policies and requirements. The submitting design engineer is solely responsible for the functionality of the design. All submittals to the City shall be stamped and signed by a Professional Engineer registered in the State of Idaho.

The Drainage Report includes the method of the design and operation of the drainage system. The report should include sufficient narrative, maps, diagrams, and calculations to be a standalone document. All necessary information for Drainage Report review shall be included

in the submittal. The report should be submitted with the development plan submittal. An incomplete submittal provides sufficient cause for the City to reject the entire development application for engineering compliance review.

For any multi-phase developments, the drainage report must include all pertinent stormwater data from other phases that drain to or accept drainage from the newer phase, including contributing drainage basins, stormwater facilities constructed previously, temporary facilities, points and routes where irrigation or drainage ways enter and leave the parcel, users of any irrigation facilities, etc. With permission from the owner of the surface waterbody, stormwater storage facilities may fill, , then discharge up to a rate of one miner's inch (0.02 cfs) per acre of the drainage basin.

An incomplete Drainage Report (calculation set) or topographic map shall be cause for the City's plan review staff to return a drainage design submittal with an un-reviewed and unapproved status. The developer's engineer shall re-work the drainage design until it is complete and meets all of the necessary information contained within this section. Submittals returned as incomplete shall not be allowed to "hold" any priority in the plan review queue. The following items must be included in the Drainage Report:

1.6.1 Topographic Survey Map

Submit a topographic survey map of the development site and 100 feet beyond showing existing drainage and irrigation water conveyance systems within the site on an 11" X 17" drainage basin map.

The entire development shall be delineated into basins, including any contributing areas upstream of the development. Proposed drainage basins shall be clearly defined and correlated with the calculations. Elevation grade breaks and other delineations, as needed, shall define each basin. Proposed finished-grade contours (minimum of 1 foot intervals) shall be shown for the development site and shall extend 100 feet beyond the site. The following items shall be shown on the map:

- All existing and proposed drainage and gravity irrigation facilities (e.g., detention and retention facilities, storm drains, swales, outlet structures, irrigation facilities, culverts, agricultural drains, etc)
- All 100 year floodplain and/or floodway boundaries based on the most current information produced by FEMA. (Stormwater storage facilities may not be located in a floodway.)
- Legend defining map symbols, North arrow, and scale bar;
- Finished grading plan for entire development, displaying parcel-boundary elevations. The drainage basin map should correspond to the grading plan.

1.6.2 Volume Calculations

Stormwater volume calculations must be completed for each basin. Hydrologic and hydraulic calculations and narrative shall demonstrate the calculation methodology (equation name and equation). Each basin's calculations must include:

- Acreage of the entire development

- Acreage of the basin
- Peak flow rate
- Runoff volume
- Any contributing volume from offsite or upstream
- Gutter flow hydraulics
- Inlet capacity
- Pipe capacities
- Sand-and-grease trap and/or other treatment device flow rate
- Storage facility volume
- Infiltration rate and volume, where applicable
- Discharge rate and volume to offsite, where applicable
- Any other calculations needed to show ultimate storage

1.6.3 Infrastructure

The drainage report should also include the plan, profile, and calculations of new or modified drainage and irrigation water systems, including conveyance facilities, pipework, treatment devices, infiltration and percolation facilities, and any storage basins, inclusive, from inlet to overflow or outlet.

1.6.4 Non Residential Development

Commercial or industrial development shall be calculated on a lot-by-lot basis at the time of building permit application except that the subdivider shall provide handling of stormwater from public street frontages which shall be handled in a common lot, or easement(s) confined within lot lines or by written maintenance agreement between affected lot owners if across lot lines.

Individual commercial or industrial lot owners shall be responsible for the handling of all stormwater generated upon their own lot consistent with the provisions of this Chapter. The developer of a subdivision shall be responsible to provide infrastructure for handing of all public street storm drainage and infrastructure accessible to lot owners for the continuation of site drainage.

1.6.5 Geotechnical Report

The submittal must include a geotechnical report or soil analysis with percolation test. The geotechnical report should be used to determine the soil classification and the groundwater elevation. The report should include a map of the locations of all soil borings or explorations, with boring depth data. Boring logs and respective infiltration rates shall be established at the actual location of the infiltration facility. Developers may not recycle geotechnical reports from offsite locations. Soil classification or percolation testing shall be utilized to establish infiltration rates. Development proposals which include geotechnical borings which are not sufficiently deep may not be utilized as assumptions for design purposes. For example, a designer may not utilize a geotechnical report with 5 ft deep borings or 5 ft percolation test to design an infiltration facility which ends at a depth of 7 ft. Insufficient proof of infiltrative rate/capacity provides sufficient cause for the City to reject the entire development application for engineering compliance review

Groundwater elevation measurements shall expire two (2) years from the date the exploration was performed. Groundwater elevation measurements performed between November 1 and March 30 are assumed to be seasonally low. The designer shall add two (2) feet to the highest measured elevation or provide justification why a variance should be issued.

1.6.6 Floodplain Compliance

All new development and re-development within the City of Caldwell is required to comply with the City's Flood Damage Prevention Ordinance. The City's Floodplain Administrator is hereby authorized to place additional capacity and/or performance requirements upon a redeveloped drainage system to accommodate safe passage of flood volumes. Stormwater control structures may not be placed in the floodway without an Engineer's Certificate of No Rise (No Rise) or a Letter of Map Revision (LOMR).

1.6.7 Agreements

Drainage proposals must include copies of any associated permits, drainage easements, and discharge agreements.

2 DESIGN OVERVIEW

2.1. GENERAL RULES

A storm drainage system established for any new development or redevelopment must, at minimum, maintain the functionality and capacity of the existing downstream drainage system. All upstream drainage rights shall be maintained, and downstream drainage privileges shall be preserved, per Idaho Code 18-4308. In addition, the following rules shall apply:

2.1.1 Grandfather Clause

The design requirements contained in this manual shall not be applied retroactively. Any existing development (and the associated impervious area) as of the date of enactment of this manual, and discharging to an existing storm drainage system, may continue to discharge. **The addition of any impervious area greater than 1,000 square feet, subsequent to the enactment of this manual, shall be subject to the provisions of this manual.** The modification of any existing drainage system or the addition of impervious areas that will increase quantity or decrease quality of runoff shall constitute "development" and render the existing system subject to the provisions of this manual.

2.1.2 Engineer's Rule

The design of any drainage system shall be under the responsible direction and control of an engineer having requisite training and experience in stormwater system design. All drawings and reports shall be stamped by the engineer of record.

A drainage facility which fails to function as designed, and in conformance with this manual, shall be redesigned, reworked and/or reconstructed at the expense of the developer and the design engineer until the original design intent is met.

2.1.3 Downstream Rule

Downstream drainage system capacity shall be preserved. The existing system(s) and adjacent property shall not be adversely affected by upstream development. Where no historic drainage rights exist, an upstream or upslope development may not assume the right to direct drainage onto a neighboring parcel. It is the developer's responsibility to ensure that the runoff, storm and domestic, from a development not increase pollutant load and discharge rates not exceed a development's reasonable share of downstream capacity. The City Engineer may promulgate such requirements and procedures needed to achieve this requirement.

2.1.4 Continuation of Existing Systems

Each existing stormwater, irrigation, and drainage conveyance for upstream or downstream properties shall be continued across the development. The conveyance may be relocated within the development, but the original or relocated facility must meet the applicable requirements set forth in this manual and the requirements of any other agency having jurisdiction. In no case shall a conveyance facility be reduced in capacity from the pre-developed condition. The City Engineer may promulgate such requirements and procedures needed to achieve this requirement. The City Engineer may require one or more methods or control mechanisms to meet the applicable needs of this section.

2.1.5 Irrigation Rule

Irrigation facilities shall meet the criteria of the irrigation agency having jurisdiction over the facility. Irrigation delivery systems (from the canal or water source) shall not be combined with storm drains, and stormwater storage facilities shall not be combined with gravity irrigation return flow. The design and location of irrigation facilities shall be subject to the City of Caldwell Irrigation Design standards and approval of the City Engineer.

2.1.6 Discharge Rule

Any development proposing new or increased discharge off-site, in compliance with this manual, shall obtain permission in writing from the owner of the canal, ditch, drain or pond into which discharge shall occur. In addition, the design of new discharging facilities shall be subject to the review and approval of the entity operating or maintaining the canal, ditch, drain, or pond. Any development proposing to increase the rate or reduce the quality of discharge from a site may be denied permission to discharge, either by the City or by an outside agency. Should the City of Caldwell authorize a discharge to surface water, such permission shall not supersede authorization of the owner of the canal, ditch, drain or pond.

2.1.7 Acceptable Risk Rule

This manual is not intended to remove all flood risk. Runoff from storms larger than the design storm is not accounted for within the constraints of this manual. Storms larger than the design storm may cause property damage, injury, or loss of life.

2.2. DESIGN STORMS

The following storm conditions shall be assumed in the design of storm drainage system components:

Retention Storage: 100 year storage capacity
Detention Storage: 25 year storage capacity

In circumstances where **overflow above the storage basin capacity** from detention facilities can be transported through a secondary conveyance system to an alternate drain or waterway (not the City's MS4), without danger to persons or property, for the 100-year storm, the detention facility can be sized for the 25-year return frequency storm. In all instances, the system capacity shall treat and store a volume commensurate to a 0.61" storm event or larger (Simply, 0.61" x Acreage of development).

2.3. RUNOFF RATE

Determination of runoff rate for various storm conditions is important in the design of an acceptable storm drainage system. Accurate modeling of tributary area to a drainage way can be a complicated, time-consuming process. This section introduces simplified modeling methods acceptable for design.

2.3.1 Calculation Methodology

The peak flow rate after development shall be determined for use in designing conveyance components (channels, pipelines, and gutters) of the drainage system. The computation of peak flows for each system shall be included in a Drainage Report. Design storm frequencies for determining peak rates are shown above.

The rate of discharge shall be calculated using the proper methodology. The peak rate for areas up to eighty acres shall be calculated using the Rational Method or approved derivatives. The Natural Resource Conservation Service (NRCS) method TR No. 55 may be used for areas larger than eighty acres, at special request of the developer. All such requests are subject to authorization by the City Engineer or their designee.

2.3.2 Rational Method Equation

The equation for the rational method follows:
Q = CIA (peak flow rates in cfs)
C = non-dimensional runoff coefficient
I = average rainfall intensity in inches per hour (in/hr), over a duration equal to the time of concentration tc, for the contributing area.
Tc = time of concentration in minutes
A = size of the contributing area (acres)

Table 1 - Runoff Coefficient Table
"C" coefficients for "Rational Method Equation" Peak Discharge Rate

Business	
Downtown Areas	0.95
Urban neighborhood areas	0.70
Residential	
Single family	0.50
Multi family	0.75
Residential (rural)	0.40
Apartment dwelling areas	0.70

Industrial and Commercial	
Light areas	0.80
Heavy areas	0.90
Parks, cemeteries	0.10
Playgrounds	0.20
Railroad yard areas	0.20
Unimproved areas	0.10
Streets	
Asphalt	0.95
Concrete	0.95
Brick	0.85
Gravel	0.40
Drives and Walks	0.85
Roofs	0.95

For large areas with mixed surfaces, a weighted coefficient shall be used. **The methods "right-of-way plus 20 feet" and "right-of-way plus 2000 square feet per lot" shall not be used in calculations.** Any contributing areas shall use the appropriate coefficient for foreseeable future land uses.

The time of concentration (t_c) is defined as the time required for runoff to travel from the most distant point in the basin to the point of measurement or discharge. The storm duration will determine the peak runoff rate. The slope and runoff coefficient and may be estimated by various methods. For overland travel distances greater than 1,000 feet, the Izzard (1946), Kirpich (1940), SCS lag equation or velocity charts (1975) may be used.

Rainfall intensity shall be based upon the intensity-duration-frequency information in Table 2. It is not necessary to consider times of concentration less than 10 minutes.

Table 2 - Intensity-Frequency-Duration (IDF) Table for Caldwell, Idaho
Source: NOAA Atlas 2

Frequency (years)						
Duration	2	5	10	25	50	100
(Minutes)	Intensity in Inches per Hour					
10	0.67	0.75	0.82	1.04	1.41	2.11
15	0.56	0.63	0.69	0.88	1.19	1.78
30	0.39	0.44	0.48	0.61	0.82	1.24
60 (1 hr)	0.25	0.28	0.30	0.39	0.52	0.78
120 (2 hrs)	0.21	0.24	0.27	0.34	0.44	0.64
180 (3 hrs)	0.18	0.21	0.24	0.30	0.38	0.52
360 (6 hrs)	0.12	0.15	0.18	0.22	0.23	0.27
720 (12 hrs)	0.07	0.10	0.11	0.13	0.15	0.16
1440 (24 hrs)	0.05	0.06	0.07	0.08	0.09	0.10

The size of the drainage area shall include all on-site areas and any off-site lands tributary to the design point.

2.3.3 NRCS TR55 Method

See NRCS TR55 for application and calculation method.

The time of concentration shall use the methodologies described above. Runoff curve numbers shall be pre-approved by the City Engineer.

Computer software adaptations of this method are acceptable provided their data and graphical printout are submitted for review.

2.3.4 Other Methods

Other methods of determining peak rate of flow and discharges based on sound engineering principles and with proven results may be used only if pre-approved by the City Engineer.

2.4. RUNOFF VOLUME

Runoff volumes shall be calculated to determine storage requirements for retention and detention facilities. Volumes shall be calculated based upon return frequencies listed in Table 2

2.4.1 Criteria for Calculating Runoff Volumes

The storm duration used for volume design shall be the duration that results in the largest storage volume requirement in a 24-hour period. Storm durations from t_c to 24 hours shall be checked. The beneficial and reasonable contributions of offsite discharge, infiltration and percolation may be included when determining peak storage volume requirements.

- Volumes shall be included on the plans.
- Volumes and design methodology shall be shown in the Drainage Report.
- Designers must use the City of Caldwell's published IDF table data.

3 CONVEYANCE SYSTEM

3.1. OVERVIEW

A stormwater conveyance system includes any pipeline, ditch, swale, borrow pit, channel, gutter, or drain having as one of its purposes the transporting of stormwater runoff. This section is pertains to design of pipelines, gutters, and channels and relies on the storm criteria and calculation methodologies outlined within this manual.

3.2. LOCATION

Stormwater conveyance components may be located in public right-of way or on community-owned private property in easements subject to the following conditions. (Stormwater storage facilities may not be located in public right-of-way.)

3.2.1 Public Right-of-Way

The positioning of conveyance facilities, including gutters, in right-of-way is subject to the approval of the City Engineer. In all instances, conveyance lines must maintain Idaho Department of Environmental Quality (DEQ) minimum separations from potable water lines (10 feet horizontal, 18 inches vertical). Manhole rings and covers should be positioned to minimize contact with wheeled traffic and to avoid interference with other utilities.

3.2.2 Easements

It shall be the City's preference to place stormwater conveyance facilities – including pipes, channels, swales, etc. – in an HOA-owned common lot or public right-of-way for ease of access. Pipelines and open channels may be located on private property if easements of adequate width for construction, maintenance, and HOA access to the pipeline or channel are provided. **The private property easement shall clearly and specifically forbid encroachments and obstructions such as trees, shrubs, and fence.** Such encroachments effectively remove accessibility for inspection by City stormwater compliance staff and the HOA, HOA-ensured preservation of the facility, as well as workspace for maintenance contractors and rehabilitation of the conveyance, when necessary. Encroachment restrictions must be promulgated and enforced by the community "covenants, codes, and restrictions (CC&R's)." Residents who knowingly or unknowingly place improvements, landscaping, vegetation, fencing, or other obstructions inside a drainage easement do so at their own risk of loss or damage.

The required easement width shall be a minimum of twenty (20) feet, but may be widened up to thirty (30) feet or more, depending on pipe size and depth, at the discretion of the City Engineer or engineering staff under their charge. Easements running along property lines shall be situated such that the centerline of the pipe is offset at least 2.5 pipe diameters from the property line.

In the event that encroachments into a private property easement cannot be avoided, such as an exterior boundary of a development, a private property

easement may not be used without a variance from the City Engineer or their designee. The designer should present one or more reasons why a drainage easement across private property is unavoidable. Cost prohibitions associated with additional fill and/or grading shall not constitute a valid reason. In order to ensure its preservation, such a conveyance shall be piped.

Preferred methods: Parcels may be bordered by an HOA-owned common lot which facilitates drainage or parcels may be graded toward the public right-of-way. **In no instance shall any privately-owned lot be graded to drain onto or across a neighboring privately-owned lot outside of an abovementioned easement, regardless of the property boundaries of the development under review.**

3.2.3 Public Utilities Easement

Storm drain structures may not be placed in the ***front*** public utility easement. In the event that the designer has successfully been issued a variance from the City Engineer to install a stormwater conveyance in the ***rear*** of one or more lots, it should be placed in the public utility easement.

3.3. PIPE STANDARDS

3.3.1 Size

Pipe size shall be dictated by peak flow and hydraulic capacity. For multi-lot developments, minimum pipe diameter shall be twelve (12) inches. Hydraulic capacity must meet or exceed 100% of the design peak flow. For single-lot or multifamily developments, where no part of the storm drain system is publically owned, maintained, or in the public right-of-way, the twelve (12) inch minimum pipe diameter shall not apply if 100% of hydraulic capacity is met.

3.3.2 Depth of Bury

The pipe shall have a required cover of at least 16 inches. In all instances, the top of the pipe shall be below the roadway section (below subbase). The City Engineer or Engineering Department staff may require additional pipe cover and/or bury depth when traffic loading dictates the need. Where bury depth is not feasible, a thicker walled traffic-rated pipe may be necessary. The City Engineer or Engineering Department staff may require a pipe type upgrade at their discretion.

3.3.3 Material

The pipeline shall be constructed of at least SDR 35 PVC, with watertight joints. Higher pressure rating will be required on PVC pipe when depth of bury is less than thirty (30) inches. Other plastic-type pipe materials may be acceptable outside of the right-of-way and only at locations which are anticipated to never receive vehicular traffic, when supplied with watertight joints. Proposals including other plastic-type pipe may be rejected at the discretion of the City Engineer or Engineering Department staff.

3.4. SYSTEM CAPACITY

3.4.1 Conveyance System

The conveyance system shall be designed to accommodate the peak flow of the design storm return frequency. The system consists of catch basins, drop inlets, streets, street gutters and conduit systems. The conveyance system should convey the design storm to the receiving waters with the maximum treatment and the minimum impact to the public. **All lots must be graded toward the conveyance system.** Grading proposals which propose sheet flow onto neighboring private parcels or into surface water channels may be rejected by the City Engineer, their designee or Engineering Department staff.

3.5. MULTIPLE USE FACILITIES

Stormwater conveyances shall be designed to convey stormwater runoff from upstream areas, using the design storm indicated in Table 2. Developers must make every effort to prevent the comingling of stormwater and irrigation water (live or return) except inside major drains. Typically, all named drains shall be considered major drains, for example Noble Drain, Solomon Drain, Dixie Drain, Wilson Drain, Mason Creek Drain, Indian Creek, "A" Drain, "B" Drain, "C" Drain, and so forth. Where separation is not feasible, the applicant may apply for a variance from the City Engineer and the conveyance facility pipe must be sized for both maximum flows: passage of the entire irrigation delivery and the design storm event. Existing facilities of insufficient and/or questionable capacity or condition may not be used to convey new runoff flow.

3.6. CLOSED CONDUIT

3.6.1 Hydraulic Capacity

Hydraulic capacity may be calculated by various acceptable methods for closed conduits such as Hazen-Williams Formula, Darcy-Weisbach Equation and Manning Equation.

3.6.2 Velocities

Velocities in closed conduits flowing full shall not be more than eight (8) feet per second, unless the conduit is designed for higher rates, nor less than two (2) feet per second.

3.6.3 Energy Dissipaters

Energy dissipaters and/or rip-rap shall be provided at inlets, outlets, and outfalls as needed to prevent scouring of the conveyance, storage, and downstream systems.

3.6.4 Catch Basins

Catch basin inlets shall be designed to accommodate the design flow. In order to protect curb and gutter integrity, each catch basin shall be designed a minimum of 20 feet away from a neighboring catch basin. Enlarged catch basins intended for highway use may not be installed in residential or commercial communities or

community frontage. The City Engineer or their designee may authorize a frontage variance from this catch basin policy in locations where community frontage is classified as a principal arterial roadway.

3.6.5 Siphons and Surcharged Systems

Storm drain piping shall have free surface flow and not be surcharged up to the design storm without an approved variance from the City Engineer. Publically owned or maintained storm drain systems shall be free draining. Storm drain siphon proposals of public storm drain in new developments are not allowed, unless the application includes an approved variance by the City Engineer or their designee. Storm drain siphons may be acceptable for retrofitted public infrastructure or within privately owned and maintained systems.

When siphon drains are utilized, the "equivalent hydraulic slope" will maintain a flow in the pipe flowing full of at least three feet per second (3 ft/s). The "equivalent hydraulic slope" is defined as the difference in elevation between gutter flow lines divided by the length of siphon.

3.7. OPEN CHANNEL

3.7.1 Channel Liners

Open channel conveyances must be lined with material intended to minimize erosion. Acceptable liners may include: gravel/aggregate, cobbles, sand, sod, hydro seed, or properly-anchored fiber mats. The City Engineer or Engineering Department staff may reject unlined conveyance proposals.

3.7.2 Hydraulic Capacity

Hydraulic capacity may be calculated by various acceptable methods for open channels such as the Darcy-Weisbach Equation and the Manning Equation.

3.7.3 Velocities

Velocities in open channels at design flow shall not be greater than the velocity, determined from channel conditions, to erode or scour the channel lining (generally 5 feet/sec). Super-critical velocities should be avoided. Borrow ditch conveyance facilities (if permitted) shall not be allowed on road sections where the ditch invert exceeds 3% slope without provisions for reducing velocities, such as check dams, or other energy dissipation BMPs.

3.8. GUTTER CAPACITY

Street gutters may provide stormwater conveyance up to their hydraulic capacity. Beyond that limit, subsurface piping or flow routing will be required to facilitate proper drainage. The minimum gutter grade shall be 0.4%. In limited circumstances, where no reasonable option exists, the City Engineer may allow a minimum gutter grade of 0.3%. Gutter flow shall be intercepted by an underground conveyance or storage system at a maximum spacing determined by gutter hydraulic capacity.

3.8.1 Hydraulic Capacity

The hydraulic capacity of irregular channels can be calculated using Manning's Equation and appropriate coefficients. Channel depth is limited in accordance with the provisions of Section 3.8.2.

3.8.2 Water Depth in Street Sections

The street section may be utilized for water conveyance as outlined below. The street section may not be utilized for storm water **storage**. For storm events less than or equal to the design storm, the street and gutter section may be used to convey water to catchments with the following restrictions:

- Local Streets: Design storm flow cannot encroach into private property, or exceed 2-inch depth at the crown.
- Collector Streets: Design storm flow cannot overtop the curb and at least one 10-foot lane must be free of water.
- Arterial Streets: Design storm flow cannot overtop the curb and at least one 12-foot lane in each direction must be free of water.

3.8.3 Valley Gutters

Valley gutters are not allowed across collector and arterial streets.

3.8.4 Street Grades

Water flowing down steep grades at high velocity can be dangerous to small children. Where flow depths exceed 6-inches, mean velocities in the gutter at peak flows shall not exceed 8-feet per second. Excessive depth and velocity shall be corrected through diversion of runoff, drop inlet structures or redesign of the street.

4 STORAGE FACILITIES

4.1. INTRODUCTION

Storage facilities temporarily store stormwater runoff to minimize the potential for flooding and to remove sediments and pollutants from the water. Retention storage facilities store the runoff until it percolates, infiltrates or evaporates away. Detention facilities are similar, except that a controlled overflow to an existing drainage way is also included. Detention facilities discharge any volumes larger than the "water quality event." Both retention and detention facilities may have overflows through a secondary conveyance to a discharge location.

The elements of detention or retention may be incorporated into basins, swales or underground facilities such as infiltration beds or French drains. The criteria for design are itemized below. Table 4 compares requirements for retention and detention facilities:

Table 3 - Comparison of Retention and Detention Facility Requirements

PARAMETER	RETENTION	DETENTION

Design Storms SS 2.2	Minimum 100 year event	Minimum 25 year event w/ overflow
Overflows SS 4.6.3 Water Quality Event SS 4.2.5	Overflow discharge allowed, But not required	Discharge quantities greater than the "water quality event" at a rate of 0.02 CFS/acre
Sand and grease trap Or sediment removal device SS 4.4.1	Required (includes infiltration facilities) Must treat the first 0.61" of precipitation, prior to any storage overflow	
Rock Trench SS 4.6.1 Outlet requirements SS 4.7.1	Rock filled trench to minimize standing nuisance water	Rock filled trench to route nuisance water to outlet
Emptying requirement SS 4.6.2	120 hours	
Infiltration/Percolation SS 5.1, 5.3	16 feet boring below bottom of facility	12 foot boring below bottom of facility
Infiltration facilities not allowed SS 5.2	Bedrock or impervious soils within 16 feet	Bedrock or impervious soils within 12 feet
Infiltration rate SS 5.3	70% of perc test or 50% of Soil Classification	
Design calculation rate SS 5.6	Most impermeable remaining Strata rate	

4.2. STORAGE FACILITY RULES

4.2.1 Historic Drainage Rate

The maximum off-site discharge rate for the design storm (post development) shall be limited to 1.0 miner's inch (0.02 CFS) per acre, provided the downstream system has proven adequate capacity and there was historic discharge from the property. (Sites smaller than 1.0 acre may be eligible for a variance from this requirement due to inconveniently small orifice size needed.)

4.2.2 Storm Return Frequency

Detention and retention facilities shall be designed for the 25-year or 100-year return frequencies. In all cases, the storage facility must have capacity to hold a 0.61" event before discharging.

4.2.3 Storm Duration

For the design storm return frequency, the storm duration which produces the peak storage requirement, shall be used for design. Storm durations between the time of concentration and 24-hours shall be investigated.

4.2.4 Storage Facility Sites

Stormwater storage facilities and their associated inlet pipes, outlet pipes, and sand-and-grease traps shall be located outside of the existing or master planned right-of-way.

For single-lot developments, storm drain facilities shall be located on private property within a perpetual operation and maintenance easement. For multi-lot residential developments, storage facilities shall be located in a common lot. The City Engineer may allow a variance for multi-lot residential developments less than two (2) acres in area. If the variance is allowed, all such stormwater infrastructure must be located within the confines of an adequately sized perpetual operation and maintenance easement, and the lot on which the easement is located meets all minimum lot requirements exclusive of the easement(s).

In addition, the retained storage depth is not more than three (3) feet; and side slopes are 3:1 or flatter. Design submittals which propose steeper side slopes, up to 4:1 (rise:run), or a deeper storage depth, should be fully fenced, with a minimum of an 8-ft wide gate for maintenance access. Interior (community-facing) fencing should be no higher than 4 feet, to allow for ease of visual inspection. Other proposed exceptions to this section shall require the approval of the City Engineer and must meet or exceed the function and ease of maintenance of a stormwater management facility constructed without exception.

For commercial or industrial development, stormwater storage facilities and associated inlet pipes, outlet pipes, and sand-and-grease traps shall be located outside of the existing or master planned right-of-way, and shall be located in either a common lot or a perpetual operation and maintenance easement with full accessibility for inspection, maintenance, and rehabilitation construction. Facilities shall be contained in easements for needed conveyance to lots or to a historic drainage conveyance.

Storage facility sites must be fully stabilized with grass or aggregate, if located at grade.

4.2.5 The Water Quality Event

For the purpose of protecting water quality in the receiving water, retention and detention basins shall treat and retain the water quality storm event. At a minimum, at least 0.61 inches of runoff over the site area shall be retained (not discharged off-site). In all cases, the facility should be designed to empty within 120 hours of the last storm. (For example: (0.61 in) x (1 ft/12 in) x (10 acre site)(43,560 sq ft/1 acre) x (0.50 runoff coefficient) = 11,071.5 cu. ft. must be retained.)

4.3. OPERATIONAL RESPONSIBILITY

Regardless of location of a stormwater retention or detention facility in any type of private residential, industrial, or commercial development, maintenance of the facility shall not be the responsibility of the City unless maintenance is expressly assumed, in writing, by the City.

The responsibility for operation and maintenance of retention or detention facilities must be clearly defined and noted on development plans. The City is not to have drainage system or landscaping operation and maintenance responsibility for any private development located on private property or in common lots.

4.3.1 Storm Drainage from Offsite

Single lot developments may not accept additional off-site drainage for retention or detention unless there are legal agreement(s) setting forth the conditions of use and assignment of responsibility for future maintenance.

4.3.2 Multi-Use Facilities

Storage facilities may be designed as open surface facilities for multi-use such as parks or open space as long as a public nuisance or safety hazard is not created. Woody vegetation, such as trees, may not be planted inside or over stormwater storage facilities. Permanent or semi-permanent structures such as fencing, concrete pads, gazebos, picnic tables, sport courts, playgrounds, and similar community amenities may not be placed inside a stormwater storage facility.

4.3.3 Idaho State Code Requirements

Retention and detention facilities which incorporate infiltration trenches, French drains, or any subsurface percolation element for storm water management shall conform to Title 42, Chapter 39, Idaho Code, and to the Idaho Department of Water Resources Rules (IDWR) for Waste Disposal and Injection Wells (IDAPA 37.03.03) if required.

4.3.4 Infiltration Surface

Basins/Swales/Ponds. The infiltration surface area must be reduced to the area of any infiltration windows, if such are constructed. The infiltration surface for ponds is the area of the horizontal projection of the percolation interface (window only), not including pond side slopes. In instances where native soils are sufficiently permeable and no formal infiltration window is anticipated, only the bottom surface of the pond may be considered an "infiltration area" for design purposes (no side slopes).

Infiltration trenches. The infiltration surface for seepage trenches is the horizontal projection of the trench bottom surface. See also section 6.

4.4. SEDIMENT CONTROL

All stormwater storage facilities shall include one or more sediment removal device(s) of sufficient capacity to treat flow up to a 0.61 inch storm event. For storms larger than 0.61 inches, the quantity in excess of 0.61 inches may bypass the sediment removal device and flow directly into the storage facility. Bypasses are not allowed from the roadway directly into

surface waters. Bypasses are include a diversion box or manhole; it **must** be a separate structure from and at a higher elevation than the sediment removal device (or sand and grease trap).

4.4.1 Sand and Grease Traps

Runoff into storage facilities shall flow through a sand and grease trap with a throat velocity less than or equal to 0.5 feet per second for the design flow. Minimum trap retention time upstream of the throat shall be 40 seconds at peak flow for the water quality event (0.61" storm).

An array of traps may be utilized to meet this criterion including the use of alternative methods for the treatment of stormwater and removal of sediment as approved by the City Engineer.

Any proposed alternate method of sediment removal shall meet or exceed the function and ease of maintenance of a stormwater retention or detention facility constructed with standard sand and grease traps.

4.4.2 Sediment Removal Alternatives

Other innovative and proprietary sediment removal devices such as permeable pavers, forebays, and tree vaults may be considered upon request of the designer or applicant. Each of these shall meet the same flow rate requirements as sand and grease traps (0.5 feet per second or less).

4.5. EMBANKMENTS

The following criteria shall apply in the design of storage basins:

4.5.1 Freeboard

Facilities shall be designed to accommodate the runoff from a design storm with the return frequency. Open basin facilities shall be designed with freeboard above the maximum design water elevation in accordance with the table below. For design purposes, the freeboard volume may not be included in the storage capacity of the pond.

Table 4 - Freeboard Requirements

Water Depth	Freeboard
0-12 inches	4 inches
12-24 inches	6 inches
24+ inches	12 inches

4.5.2 Side Slopes

The retained storage depth is not more than three (3) feet; and side slopes are 3:1 or flatter. Design submittals which propose steeper side slopes, up to 4:1 (rise:run) or a deeper storage depth, should be fully fenced, with a minimum of an 8-ft wide gate for maintenance access. Interior (community-facing) fencing should be no higher than 4 feet, to allow for ease of visual inspection.

Storage facility side slopes shall not exceed 4:1. Side slopes on facilities located in easements shall not exceed 4:1 and shall meet other requirements of Section 4.2.4.

If the facility will also be acting as a decorative water feature, meaning an amenity which contains water year-round or throughout the irrigation season, slopes shall not be greater than 2:1 five feet into the water feature from the bank. The City Engineer shall have the discretion to determine which facilities may be deemed decorative.

4.5.3 Embankment Top Width

The minimum top widths of all embankments are listed in the table below.

Table 5 - Minimum Embankment Top Widths

Height (ft)	Top Width (ft)
0 – 3	6
3 – 6	8
6 – 10	10
10 – 15	12

4.5.4 Embankment Height

The design top elevation of all embankments, after compaction and settling, shall equal or exceed the maximum water surface elevation, plus the required freeboard height. The design height of the embankment is defined as the vertical distance from the top down to the bottom of the deepest finished grade.

4.5.5 Embankment Material

All earth fill shall be free from brush, roots, and organic material that might decompose and shall be compacted to 95% of Maximum Standard Proctor Density.

4.5.6 Wet Basin Safety Ledges

Safety ledges shall be constructed on the side slopes of all perpetually wet basins having a pool of water greater than or equal to 5 feet in depth. The ledges shall be 4 to 6 feet in width and located each of 2 feet below and 2 feet above the permanent water surface.

4.6. RETENTION FACILITY CRITERIA

Retention facilities shall be designed to accommodate the runoff volume from the design storm with allowance freeboard as indicated in Section 4.5.1. The facility shall be designed to empty within 120-hours for the design storm. Design proposals should address nuisance water from over-irrigation, plugging of pond bottoms, or any other condition which may cause standing water in the facility over the required 120-hour drain time.

4.6.1 Nuisance Water

Except where a high water table does not permit it, nuisance water shall be stored in a rock trench to avoid the creation of mosquito breeding areas.

4.6.2 Time to Empty

The infiltration surface shall be sized, relative to pond or trench volume, for the retention facility to empty within 120 hours for the design storm. The depth of ponds or the width of seepage trenches may be limited by this requirement.

4.6.3 Overflow Drain

For property having established historical drainage rights, the retention facility may include an overflow drainage line from the retention facility to a point of historical discharge. Pipe sizing shall be a minimum of 12 inch diameter or have capacity of two miner's inches per acre of the drainage basin, whichever is larger.

4.6.4 Proof Test

Each constructed retention facility shall be filled to the retained depth for the design storm, soaked for four hours, refilled to retained depth and timed to completely drain. The criterion of section 4.6.2 shall be met or the pond shall be rejected. The Engineering Department shall be informed a minimum of two days in advance of proof testing and will make the final determination of approval or rejection. The preference of the City of Caldwell is that non-potable water be utilized for this test when it is reasonably available.

4.7. DETENTION FACILITY CRITERIA

The design of any detention facility requires consideration of several factors:

- size of the basin
- minimum free board depth
- maximum allowable depth of temporary ponding
- design storm recurrence interval
- storm duration
- timing of the inflow (time of concentration)
- allowable outflow rate (0.02 cfs/acre)
- amount of time water is allowed to remain in the facility.

The requirements may be balanced via the preparation of three items: an inflow Hydrograph, a depth-storage relationship, and a depth-outflow relationship. These items are combined to determine the outflow rate, depth of stored water, and volume of storage at any specific time, as the runoff passes through the detention facility. Outlets shall be controlled through the use of an orifice inside a manhole or other approved structure. Other design considerations are discussed in the following sections.

4.7.1 Outlets

Outlet pipes from multi-lot developments shall be at least 12-inches in diameter. Orifice plates shall be used with trash racks or equivalent to prevent clogging. Facility bottoms shall be sloped to outlets. A rock filled trench shall convey nuisance water caused by over-irrigation from inlets to outlets.

4.7.2 Water-tight Walls and Joints

Water-tight sealant or other leak control methods are to be installed along outlet pipes as necessary.

4.7.3 Scour Protection

Suitable slope protection, such as rip-rap, rigid geo-grid, or fiber mats, shall be placed upstream and downstream of principal outlets to prevent scour and erosion. High velocity discharges require energy dissipaters.

4.7.4 Orifice Plates

Orifice plates or other flow restriction devices shall be provided to limit discharge to 0.02 cfs/acre, in accordance with Section 4.2.1. The orifice opening shall be drilled into an end cap placed on the outlet pipe such that the cap can be rotated to contain water quality events with the orifice rotated to the top. With the orifice rotated to the bottom, the basin shall have the ability to be totally drained for maintenance.

4.7.5 The Water Quality Event

For the purpose of protecting receiving water quality, detention basins shall retain the "water quality event" of storms. At a minimum, at least 0.61" of runoff from impervious area shall be retained (not discharged off site). See also SS 4.2.5.

5. INFILTRATION AND PERCOLATION FACILITIES

5.1. DESIGN OF AT-GRADE INFILTRATION FACILITIES

For the purposes of this manual, storage basins are above ground storage facilities, such as grassy swales or ponds, intended to contain design storm runoff without overflowing. These facilities may be combined with below ground percolation facilities.

The maximum groundwater elevation shall be determined from the geotechnical report (or percolation test) and utilized for facility design. Proposed facility bottom elevations within three feet of seasonal high groundwater levels shall have a minimum 24 inch layer of well-graded fine aggregate material placed such that the bottom surface of said fine aggregate is located no lower than the high water elevation. (Aggregate shall meet the gradation requirements of ITD Standard Specification 703.02, "Fine Aggregate for Concrete").

A geotechnical report of the area immediately around the proposed facility shall be approved by a Professional Geologist or by a Professional Engineer, registered in the State of Idaho and practicing in the field of geoscience. The geotechnical report shall include an evaluation of the soil strata to a depth of at least sixteen (16) feet below existing grade for retention facilities and at least twelve (12) feet below existing grade for detention facilities, if infiltration is proposed. In all instances, **geotechnical report excavations must extend at least two (2) feet below the bottom of the proposed facility** to determine if the probable maximum high groundwater elevation will encroach into the facility or if impermeable layers exist. No storage credit may be taken for volumes below seasonal high groundwater elevation. The geotechnical report shall be included in the drainage report.

5.2. INFILTRATION FACILITIES NOT ALLOWED

There are several conditions that rule out a site as an infiltration facility. Sites unsuitable for infiltration or percolation must provide storage for the entire design event, with a zero (0 in/hr) infiltration rate. Such designs should minimize access to open, standing water, which facilitates pest breeding.

- Bedrock or impervious soils within sixteen (16) feet (retention facilities) and twelve (12) feet (detention facilities) of the infiltrating surface, unless the material is removed and replaced with suitable drain materials. The horizontal area of any such backfilled window shall be used for design calculations;
- Infiltrating surface on top of fill unless the fill is clean sand or gravel and no water quality degradation will occur;
- Surface and underlying soil of SCS Hydrologic Group C, or the saturated infiltration rate less than 0.25 inches per hour;
- Facility located within 100-feet of an existing domestic water well.
- Facility located within 25 feet of a potable water main.

5.3. INFILTRATION RATES

The design of an infiltration basin is dependent on the selection of an appropriate infiltration rate. This may be determined either directly through performance of a percolation test or indirectly based on classification of soil types. Borings shall extend through the proposed infiltration facility down to sixteen (16) feet (retention facilities) and twelve (12) feet (detention facilities) below the bottom of the infiltration facility.

5.3.1 Percolation Test

Infiltration rate may be established using the results of a percolation test performed in conformance with procedures outlined in Exhibit "A" and under the responsible charge of a registered Professional Engineer or Professional Geologist. The infiltration rate for design purposes is 70% of the percolation rate established in the test. Percolation tests shall be performed at the actual location and elevation of the most impermeable permanent (unexcavated) layer below the proposed facility. Percolation test results shall be included in the drainage report. The City Engineer, their designee, or Land Development Inspector shall have the authority to require percolation testing during construction and inspection, should site conditions indicate that percolation may be inhibited by onsite findings.

5.3.2 Soil Classification

Infiltration rate may be established using the results of soil classification of the infiltration surface. The infiltration rate for various soil types is listed in Table 4. Soil classification shall be done by a registered Professional Engineer or Professional Geologist experienced in the field of geoscience. For design purposes, the infiltration rate shall be 50% (retention facilities) and 70% (detention facilities) of the listed rate in the table below.

Table 6 – Infiltration Rates

SCS Group and Type	Infiltration Rate (in/hr)

A. Sand	8
A. Loamy Sand	2
B. Sandy Loam	1
B. Loam	0.5
C. Silt Loam	0.25*
C. Sandy Clay Loam	0.15
D. Clay Loam & Silty Clay Loam	<0.09
D. Clays	<0.05
*Minimum rate. Soils with lesser rates shall not be considered for infiltration.	

5.4. MATERIAL VOID SPACE

Table 7 indicates the effective void volume for typical materials used in below-grade percolation facilities. The designer may determine void volumes for other materials by laboratory analysis and submit them to the City Engineer for review. The sand filter pore volume may not be used as storage volume for the facility. No storage may be allowed for pore volume below the water table.

Table 7 – Void Volume of Typical Materials

Material	Volume (%)
Blasted Rock	30
Uniform sized gravel (1 – 2")	40
Graded gravel (3/4" minus)	30
Gravelly, sandy pit run	25
Sand	20

6. DESIGN OF BELOW-GRADE PERCOLATION FACILITIES

Percolation facilities are below ground, such as French drains or seepage beds that may be designed to percolate the design storm runoff below ground. The water may be stored within structural cavities or in the pore space of granular fill before it percolates into the ground through a sand filter.

If there is not a positive outflow, or retention exceeds 25% of storage, percolation facilities shall be designed as a **retention** facility (ie must be properly sized for 100-year event capacity).

Accepted engineering design formulae shall be used in determining storage volumes and infiltration rates.

5.4.1 Sand Filter

A minimum 12-inch layer of fine aggregate material shall be placed below all percolation facilities and a minimum 24 inch layer of fine aggregate material shall be placed below all percolation facilities within three feet of the high water table. The bottom surface of said fine aggregate shall be located no lower than the high water elevation. The fine aggregate material shall meet the gradation requirements of ITD Standard Specification 703.2, "Fine Aggregate for Concrete".

5.4.2 Filter Fabric

The facility shall have an approved filter fabric (4 oz/square yard) placed between the storage media and the surrounding soil. No filter fabric should be placed between the storage media and the sand filter. No filter fabric should be placed at the bottom of infiltration facilities.

6.1. PERCOLATION FACILITIES NOT ALLOWED

There are several conditions that rule out a site as a percolation facility. Sites unsuitable for infiltration or percolation must provide storage for the entire design event, with a zero (0 in/hr) infiltration rate. Such designs should minimize access to open, standing water, which facilitates pest breeding.

- Bedrock or impervious soils within sixteen (16) feet (retention facilities) and twelve (12) feet (detention facilities) of the infiltrating surface, unless the material is removed and replaced with suitable drain materials. The horizontal area of any such backfilled window shall be used for design calculations;
- Infiltrating surface on top of fill unless the fill is clean sand or gravel and no water quality degradation will occur;
- Surface and underlying soil of SCS Hydrologic Group C, or the saturated infiltration rate less than 0.25 inches per hour;
- Facility located within 100-feet of an existing domestic water well.
- Facility located within 25 feet of a potable water main.

6.2. SOIL STRATA CHARACTERISTICS

Soil borings or test pits shall be taken at the trench sites to classify soil types. When the soil strata has varying infiltration characteristics, the minimum or most impermeable rate for any remaining unexcavated soil strata shall be used for design calculations. The cross sectional area of any excavation window shall be used for design calculations. The infiltration rates described in Table 6 shall apply. A percolation test may be used to define infiltration rates instead of Table 6.

At field locations where adverse earth conditions (hardpan, caliche, bedrock, unstable soils, water sources, etc.) are observed, a City inspector shall have the authority to slow construction of a stormwater storage facility to require a percolation test.

7. MISCELLANEOUS SPECIFICATIONS

7.1. IRRIGATION AND DRAINAGE FACILITIES

Stormwater conveyance and storage facilities shall be separate and distinct from non-storm systems, such as irrigation, irrigation return, and sanitary sewer flows, with the exception of landscape or irrigation overspray. Existing non-storm systems rerouted or piped through new developments (except sanitary sewers) shall not be located in the public right-of-way, except at crossings. These systems should be located in individual easements.

Non-stormwater drainage networks may not be combined with the storm drain system, even downstream of a storage facility. Alternately, stormwater storage facilities may not overflow into a non-stormwater drainage network, resulting in a shared overflow and/or shared outfall where the flow meets surface water. At locations where separation is absolutely infeasible, the applicant may apply for a variance from the City Engineer and the conveyance facility pipe must be sized for both maximum flows: passage of the entire irrigation delivery and the design storm event. Existing facilities of insufficient and/or questionable capacity or condition may not be used to convey new runoff flow. The designer must clearly demonstrate that sufficient capacity is or will be made available.

In all instances, non-stormwater runoff may not be combined with stormwater flow ahead of a storage facility. (This practice will cause the facility to fail prematurely.)

Approved discharges of storm drain facilities into publically owned drainage systems shall be at centralized, readily accessible locations.

7.2. DESIGN SPECIFICATIONS

This section sets forth the minimum standards, specifications, standard details, etc. to be used for the design of storm water and drainage facilities. Except as modified herein, all work shall be in accordance with the current IDAHO STANDARDS FOR PUBLIC WORKS CONSTRUCTION (ISPWC) utilized by the City of Caldwell.

7.2.1 Discharge Pipes

All discharge pipes shall end in a corrugated metal end section or a cast-in-place concrete headwall. Wing walls and energy dissipaters shall be included when scour conditions are proposed.

7.2.2 Testing

The City Engineer may require testing (such as the mandrel or air test) beyond the requirements of ISPWC as needed to ensure proper installation of pipe.

7.2.3 Manhole Design Standard

Manholes shall be designed according to the City of Caldwell Standard Specifications, Standard SDMH.

7.2.4 Manhole Spacing

Manholes shall be provided at all intersections of two or more pipe segments and at all locations where the pipe changes direction. Manhole spacing shall not exceed 400 feet.

7.2.5 Manhole Frames and Covers

Manhole frames and covers shall be cast iron conforming to specification ASTM A 48 Class 30. They shall be suitable for HS-25 loading capacity. All storm drain manhole covers shall have a cast-in-place concrete collar (SD-508), and the words "STORM DRAIN" cast integrally in the top of the cover, per City of Caldwell Supplemental Specifications. Manhole covers shall be set within 1-foot of finished grade. The manhole cover shall be flush with the finished grade. Concrete collars are required to be placed, after paving is complete.

7.2.6 Catch Basins

Catch basins located within street right-of-way shall be SD 601 Type I or SD 604A Type IV with a 1-foot sump (City of Caldwell Supplemental Specifications). Catch basin grates and frames shall be welded steel, capable of an HS-25 loading. Hooded-type catch basins shall not be allowed.

7.2.7 Post Construction Record Drawings

Prior to final acceptance of the development, record or as-built drawing in hard copy form must be submitted to the City.

EXHIBIT "A"

STANDARD PERCOLATION TEST

The use of the percolation test is to be used in conjunction with a site survey and soil profile analysis. It is not to be used as the sole determiner of a proposed disposal site's infiltrative capability. The following outlines a procedure for making a standard percolation test.

1. Dig or bore a hole with horizontal dimensions of six (6) to eight (8) inches and with vertical sides to a depth of at least eight (8) inches in the zone of anticipated soil absorption.

2. Carefully scarify the bottom and sides of the hole with a knife or other device to remove any smeared surfaces.

3. Place about one (1) inch of coarse sand in the bottom of the hole to prevent scouring and sediment. A small section of standard four-inch diameter perforated drainpipe is handy to prevent water splash on the hole sidewall.

4. Fill the hole with at least eight (8) inches of water and allow the soil to presoak at least twenty four (24) hours. If the soil contains greater than 27% clay the soak period shall be extended to 48 hours. The water must be clear, free of organics, clay or high sodium content.

5. Measurement procedure. In soils where:

   (a) Water remains in the hole after the presoak period; adjust the water depth to six (6) inches. Measure the drop in water level every thirty (30) minutes. Continue the test until the last reading is the same as the previous reading or four (4) hours, whichever occurs first.

   (b) No water remains in the hole after the presoak period, add water to bring the depth to six (6) inches. Measure the drop in (30) minute intervals, refilling the hole to the six (6) inch depth after each thirty (30) minute reading. Continue the test until the last reading is the same as the previous reading or four (4) hours, whichever occurs first.

   (c) The first six (6) inches of water soaks away in less than thirty (30) minutes, the time interval between measurements should be ten (10) minutes.

6. Calculations:

   Percolation Rate, Minutes/inch = Time, in Minutes / Water Drop, in Inches

7. At least two percolation tests should be run on each site, one test at each end of the proposed facility, in the zone of the most impervious soil layer.