Chapter 2
Stormwater Management Principles

Contents

1.0 Introduction

Principles, policies and criteria for effective management of stormwater drainage and water quality are necessary to protect and improve the general health, safety, welfare, and economic well-being of the City of Woodland Park, surrounding unincorporated areas, South Platte tributaries and the Fountain Creek watershed. Drainage affects all governmental jurisdictions and parcels of property, requiring a program that balances both public and private involvement. The City is a headwaters city, surrounded by a pristine mountainous environment and the way that drainage and water quality are managed in Woodland Park affect the surrounding environment and downstream drainageways. Sound management of drainage and water quality, as described in the Manual is consistent with the City's Comprehensive Plan desire to protect the mountain environment, wildlife, and scenic beauty surrounding Woodland Park.

When planning stormwater management facilities, certain underlying principles provide direction. The principles are made operational through policy statements (see Chapter 3). The policies are implemented through technical criteria and data, procedures, funding, construction, operation and maintenance for stormwater improvements. When considered in a comprehensive manner, on a regional level with public and private involvement, stormwater management facilities can be provided in a manner that will enhance the general health, safety and welfare of the region, while also providing economic, environmental and social benefits. The effectiveness of these policies will depend on their faithful and consistent application and integration into policies and practices in related areas such as land use and transportation planning and design.

2.0 Principles

The following principles for stormwater management shall guide the planning, design and implementation of stormwater facilities.

1. **Drainage is a regional phenomenon that does not respect the boundaries between governmental jurisdictions or between properties.** Systems that are planned and designed without considering regional implications can be ineffective and costly. Therefore, it is necessary to formulate programs that include public, private and multi-jurisdictional involvement. The governmental agencies involved must provide coordination, consistent standards, master planning, and possibly, joint-funding for key projects to achieve optimum results.

2. **A stormwater management system is a subsystem of the total urban infrastructure system.** Developing a stormwater system independent of considering how it relates to other infrastructure systems limits the potential for compatible integration and increases the probability of conflicts between the functions of different types of infrastructure. Stormwater management system planning and design must be compatible with local and regional comprehensive plans and must be coordinated with planning and designs for land uses, open space, utilities, wildlife, recreation, transportation corridors and other infrastructure.

3. **Development activity can greatly alter the amount and character of runoff resulting in significant impacts to man-made or natural systems.** Land development activities and supporting infrastructure (buildings, roads, schools, parking, etc.) have the potential to introduce significant changes to hydrology and water quality, including increased peak flow rates, runoff volumes and pollutant loadings that can cause negative impacts such as flooding, water quality degradation, erosion and sedimentation. These changes have the potential to damage man-made improvements as well as natural systems. Increased flow rates and runoff volumes typically result from increased runoff from impervious areas. Water quality degradation can result from

the mixing of runoff with pollutants associated with human activity, from increased sediment loads and/or from hydromodification effects of increased runoff on streams. Generally, the effects of development are most pronounced for runoff from the more frequent storm events, including those that may not have produced significant runoff prior to development. The increased frequency and volume of runoff from these events can significantly alter the hydrologic conditions in a watershed. Implementation of water quality features, channel stabilization measures and flood control detention are typically necessary to mitigate the adverse hydrologic and water quality effects of urbanization.

4. **Every urban area has a minor and a major drainage system, whether or not they are actually planned and designed.** The minor drainage system, sometimes referred to as the "initial system," is designed to provide public convenience and to accommodate moderate, frequently occurring flows. The major system carries more water and operates when the rate or volume of runoff exceeds the capacity of the minor system. Both systems should be carefully considered.

5. **Handling runoff properly is largely a space allocation problem.** The volume of water present at a given point in time in an urban region cannot be compressed or diminished. Channels and storm sewers serve both conveyance and storage functions. If adequate provision is not made for drainage space demands, stormwater runoff will conflict with other land uses, result in damages, and impair or disrupt the functioning of other urban systems.

6. **The diversion of storm runoff from one watershed or basin to another can introduce significant capacity, legal and social problems.** Drainage problems should not be transferred from one watershed or basin to another. Diversions should be avoided unless specific and prudent reasons justify and dictate such a transfer, and downstream damages are sufficiently mitigated.

7. **Resources to implement stormwater plans and improvements are limited. Drainage systems should be a multi-objective and multi-means effort.** The many competing demands placed upon space and resources require a stormwater management strategy that meets multiple objectives, including the preservation of ecological systems, water quality enhancement, groundwater recharge, recreation, wetland preservation, enhancement and creation, protection of landmarks/amenities, control of erosion and sediment deposition, and creation of open spaces.

8. **Natural systems possess a number of beneficial features that should be preserved and incorporated into the design of the stormwater management system.** Good designs incorporate the effectiveness of the natural systems rather than negate, replace or ignore them. Existing features such as natural drainageways, depressions, wetlands, floodplains, permeable soils, habitat, and vegetation provide for infiltration, help control the volume and rate of runoff, extend the travel time, prevent erosion, filter sediments and other pollutants, and recycle nutrients and support the ecology.

9. **Natural drainage systems respond to and are dependent upon the full range of hydrologic conditions and sources of water, including snowmelt, groundwater and the full range of rainfall events.** To be effective, the planning and design of stormwater systems must address all of these potential sources of water and the full range of potential rates of flow and volumes and how they may be altered by development activity.

10. **The stormwater management system must be designed, beginning with the outlet or point of outflow from the project, giving full consideration to potential impacts and the effects of off-site flows entering the system.** The design of the stormwater management system shall take into

account runoff from upstream sites and shall evaluate the downstream conveyance system to ensure that it has sufficient capacity to accept design discharges without adverse backwater or downstream impacts such as flooding, stream bank erosion, channel degradation, and sediment deposition. An assessment of potential downstream impacts should be based on quantifiable measures that relate to basin conditions immediately after project completion and with regard to future development and its timing.

11. **Poorly maintained systems may not function properly, reducing their effectiveness and reducing the benefits from the economic investment required to construct them.** Operation and maintenance procedures and activities must be developed and documented with the facility design, including the identification and acquisition of rights of access. Clear assignment of maintenance responsibilities must be identified and assigned to an established entity with the resources and understanding required to ensure proper ongoing maintenance.

12. **Floodplains, both regulated and unregulated, are areas of potential hazard due to high rates of runoff.** Modification of floodplains requires large investments in resources, and risks can increase when they are not properly managed. Flooding potential exists throughout the drainage system and is not limited to "regulatory" floodplains. In addition, flooding potential is not limited to regulated flows, and flow estimates may not accurately represent risk. It is not a question of *if* regulatory flows will be exceeded, but *when* they will be exceeded. The preservation of floodplains serves to reduce flood flows, minimize hazards, preserve habitat and open space, improve water quality, create a more livable environment, and protect the public health, safety, and welfare.

13. **Sufficient land rights must be reserved.** When space requirements are considered, the provision for adequate drainage becomes a competing use for space along with other land uses. If adequate provision is not made in a land use plan for drainage requirements, stormwater runoff can conflict with other land uses and impair or disrupt the functioning of other urban systems. Natural processes possess a prescriptive easement for intermittent occupancy by runoff. Encroachments into this easement can adversely affect adjacent properties and natural systems during inevitable periods of natural easement occupancy.

14. **Drainage law places certain obligations on those who cause or oversee modifications to the natural effects of the hydrologic cycle and the conveyance of runoff overland.** It is incumbent on individuals and agencies to safeguard the right of those potentially impacted by modifications to stormwater runoff to reduce the potential for impacts to public health, safety and welfare and to maintain the orderly development of human-made systems.