

# CITY OF GOLDEN



## STORMWATER DRAINAGE MAINTENANCE PLAN

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A handwritten signature in black ink, appearing to read 'Dan Hartman'.

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## Contents

|  |    |
|--|----|
| <b>I. OVERVIEW</b> .....   | 3  |
| <b>A. Introduction</b> .....                                     | 3  |
| <b>B. Responsibility</b> .....                                   | 3  |
| <b>II. DRAINAGE SYSTEM COMPONENTS</b> .....                      | 3  |
| <b>A. The Subsurface System</b> .....                            | 3  |
| <b>B. The Surface System</b> .....                               | 4  |
| <b>III. OPERATIONS POLICY – INSPECTION AND MAINTENANCE</b> ..... | 7  |
| <b>A. Inspections</b> .....                                      | 7  |
| <b>B. Maintenance</b> .....                                      | 9  |
| <b>IV. Privately Owned Systems</b> .....                         | 12 |
| <b>V. Applicable Ordinances</b> .....                            | 13 |
| <b>VI. Mosquito Control</b> .....                                | 14 |

# STORMWATER DRAINAGE MAINTENANCE PLAN

## I. OVERVIEW

### A. [Introduction](#)

Urbanization and development affect both quantity and quality of stormwater discharged to receiving waters. It is important for the City to manage changing conditions as well as maintain and monitor existing infrastructure. Proper management of the stormwater drainage system ensures that impacts to water quality are minimized and the stormwater runoff is responsibly conveyed.

### B. [Responsibility](#)

Maintaining an adequate stormwater quality and stormwater collection and conveyance system is a combined and cooperative effort between the Stormwater, Engineering and Environmental Services Divisions of the Public Works Department. This system is also referred to as a “municipal separate storm sewer system” (MS4).

- a) Engineering - The Engineering Division is instrumental in the initial design and acceptance of new drainage systems to see that they meet current standards and practices. Engineering also works closely with Mile High Flood District who provides Master Drainageway Planning and Maintenance assistance.
- b) Environmental Services - The Environmental Services Division provides information pertaining to requirements of the City’s Phase II MS4 Permit.
- c) Stormwater – The Stormwater Division performs inspections and ensures maintenance of the components that make up the drainage system.

## II. DRAINAGE SYSTEM COMPONENTS

### A. [The Subsurface System](#)

#### **Storm Sewer Pipe**

Storm sewer pipe ranges in sizes from 4” to 168” in diameter. Pipes are made of concrete, polyvinyl chloride (PVC), and high density polyethelene (HDPE). Some older sections of pipe were constructed of corrugated metal. Storm sewers convey runoff from inlets to channels.

## **Stormwater Manholes**

Stormwater manholes serve as junction points for various sizes of stormwater pipes. Manholes are most commonly made of precast concrete.

## **Inlets**

Stormwater is conveyed to the majority of inlets from drainage of street and gutter sections of the paved roadways. Inlets within the City are generally categorized as follows:

- a. The “Catch Basin” or “Type R” Inlet:  
Receives stormwater through an open section of the curb face in the gutter section of the street;
- b. The “Grate Type Drop Box” Inlet:  
Receives stormwater directly from the gutter section through a grated lid; and
- c. The Combination “Open Curb Face with Grate” Inlet:  
Receives stormwater through a combined open section of the curb base and an adjacent grated lid. These are few in number and are being replaced over time with the catch basin type.

## **B. [The Surface System](#)**

### **Outfalls**

Outfalls generally route piped stormwater to open channels or other stormwater conveyances such as curb and gutter.

### **Drainage Chases**

Drainage chases include sidewalk chases and curb chases connecting inlets.

### **Curb and Gutter**

Curb and gutter transport stormwater along streets to inlets.

### **Channels**

The stream network in Golden is comprised of Clear Creek, which flows from west to east, and its tributaries.

### Clear Creek

Clear Creek has its source in the Rocky Mountains at the Continental Divide. After flowing easterly through the mountains, Clear Creek enters the high plains at Golden and flows northeasterly to Commerce City, where it joins the South Platte River. The 400-square mile drainage area of Clear Creek above Golden is characterized by steep slopes, rugged terrain, and forests. Within Golden, the Clear Creek flood plain contains heavily developed areas as well as parks, campgrounds, and municipal buildings.

There are **11 ½ miles** of tributaries within Golden that flow into Clear Creek. Tucker Gulch, Magpie Gulch and Arapahoe Gulch are left-bank tributaries, providing drainage for areas north of Clear Creek. Kenney's Run and Lena Gulch are right-bank tributaries, providing drainage for areas south of Clear Creek. The confluences of Tucker Gulch, Magpie Gulch, Arapahoe Gulch and Kenney's Run with Clear Creek occur within the City of Golden. The confluence of Lena Gulch with Clear Creek occurs downstream of the city.

### Tucker Gulch

Tucker Gulch begins in the foothills northwest of Golden. It then travels through Golden Gate Canyon before entering the City west of the intersection of State Highway 93 and Golden Gate Canyon Road. It travels southeast through the City before it enters Clear Creek near Vanover Park. Tucker Gulch drains an area of 11.22 square miles above Clear Creek.

### Cressman Gulch

Cressman Gulch is a left-bank tributary to Tucker Gulch whose 1.48-square mile drainage area covers the foothills and valley area west of North Table Mountain. The drainage areas in the upper portions of these stream basins have steep slopes and cover complexes that vary from forested areas to rangeland with rock outcroppings, to new residential and commercial subdivisions. Cressman Gulch enters Tucker Gulch just east of the intersection of North Ford Street and Mesa Drive.

### Magpie Gulch

Approximately one-half of the area of Magpie Gulch lies within the City of Golden with the remaining area located in unincorporated Jefferson County. Magpie Gulch enters the City northwest of the intersection of State Highway 93 and State Highway 58. It flows east through a culvert below State Highway 93 then travels south. The lower portion of Magpie Gulch drains through various structures to an outfall Clear Creek.

Throughout the upper watershed, Magpie Gulch drains primarily through one well-defined drainageway. The Hall Dam and Reservoir is located in Magpie Gulch approximately 1600 feet upstream of S.H. 93. Through review of information from the State Engineer's Office (SEO) it appears that the dam was constructed in the early 1970's. The dam is a compacted earth structure with rock protection at the upstream face and downstream toe. The dam has a reported design capacity of 6 acre-feet with a 3.5-foot freeboard based on SEO records and the water storage right granted to Hall

Reservoir in Case No. W-7606-74. Due to various inadequacies, the dam is currently restricted to a maximum water level of 10 feet below the crest of the dam.

### Arapahoe Gulch

Arapahoe Gulch and its tributaries drain a 0.41 square mile basin and begins on the west side of State Highway 93 and Iowa Street. In the residential development west of State Highway 93 several extended detention basins were constructed to intercept stormwater runoff and ultimately discharge stormwater to Arapahoe Gulch. Stormwater is routed to Arapahoe Gulch through series of pipes and roadside ditches. The Arapahoe Gulch channel begins south of Iowa Street between Arapahoe Street and Washington Avenue. It travels southeast just east of Arapahoe street all the way to Clear Creek where it discharges near the Golden Fire Department.

Between 2<sup>nd</sup> Street and Clear Creek, Arapahoe Gulch includes various reaches of open channel and pipe culverts of various materials, and larger box culverts. A 2004 study performed by Wright Water Engineers indicated that the channel and culverts are below 100-year capacity along most of the reach between 2<sup>nd</sup> Street and Clear Creek, and extensive flooding of properties would occur during major storm events. Arapahoe Gulch is piped across the Church Ditch and the ditch does not intercept runoff from the gulch itself.

### Kinney Run

The West Fork of Kinney Run and its tributaries drain a 3.43-square mile basin that starts on the eastern face of Lookout Mountain. It flows west through a box culvert under 6<sup>th</sup> Avenue then runs through the northwest side of Fossil Trace Golf Course.

The East Fork of Kinney Run drains a 1.78-square mile basin that starts on the western face of South Table Mountain. It runs northeast along South Golden Road and Ford Street until it joins Kinney Run West Fork at 20<sup>th</sup> Street and Jackson Street to form Kinney Run. Kinney Run flows northwest through Golden through an 8-foot diameter corrugated metal pipe. It enters Clear Creek near Ford Street. The intervening 1-square mile basin between the confluence of East and West Forks Kinney Run and the mouth of Kinney Run consists of mostly residential properties and the Downtown Golden area in the valley between Lookout and South Table Mountains.

The upper portions of both East and West Fork Kinney Run basins have steep slopes and rugged terrain.

### Lena Gulch

Lena Gulch begins on Lookout Mountain and flows northeasterly, where it joins Clear Creek in Wheat Ridge. Apex and Jackson Gulches drain the foothill area south of Lookout Mountain before joining Lena Gulch near the intersection of Heritage Road and U.S. Highway 40 at the base of the foothills to form Lena Gulch. The drainage area of Jackson and Apex Gulch are characterized by steep slopes, bedrock outcrops and some forested areas.

Lena Gulch then flows parallel to the north side of U.S. Highway 40 through Golden. This

reach also receives runoff from the northwestern slope of Green Mountain. The total drainage area of Lena Gulch within Golden, 3.68 square miles. Lena Gulch travels through Golden along the north side of U.S. Highway 40 in area occupied primarily by residential property on the west side of Golden and commercial properties on the east. At several locations along Lena Gulch, the natural channel has been diverted and partially filled.

### **Flood Attenuation Facilities and Water Quality Control Measures**

Flood attenuation and water quality facilities are fed by surface or subsurface systems and are a vital part of the City's flood control and water quality. Generally, flood attenuation and water quality are provided within the same facility but may also be provided for separately.

Flood attenuation is provided by detaining stormwater runoff and restricting the release rate to at, or near, historic rates. The 100-year storm event is the standard for calculating the volume required. Emergency spillways or weirs allow for volumes exceeding the 100-year volume to be released, if necessary. The City encourages new development and redevelopment to minimize directly connected impervious area, allowing the natural processes of infiltration to the extent possible.

Water quality is achieved through processes including settling, filtering, adsorption/absorption, and biological uptake. Facilities such as Extended Detention Basins, Sand Filters, Bioretention, and Porous Pavements facilitate those processes and are used to treat pollutants carried by storm runoff.

## **III. OPERATIONS POLICY – INSPECTION AND MAINTENANCE**

### **A. Inspections**

Inspections are important to stormwater infrastructure within the City to verify proper function. They allow the City to note locations and components of the infrastructure that require maintenance and inform long-term planning and budgeting for replacement for public infrastructure.

Inspection of the surface system includes functional and aesthetic needs. Functional maintenance is important for performance and safety reasons and aesthetic is important primarily for public acceptance of stormwater facilities.

Major capital replacements (reconstruction of a pond or replacement of outlet structure, grates, culverts, etc.) will be prioritized based upon inspection results and are subject to long term budget and capital improvement programming.

## **Public Infrastructure:**

The following minimum inspection frequencies have been established by the Stormwater Division for public infrastructure:

### *Subsurface System*

- Inlets: Twice per year
- Manholes: Once per year
- Pipes: Video inspection on all pipes beneath streets that are on the annual street paving program and once every five years for all pipes

### *Surface System:*

- Channels: Once per year and following major storm events
- Water quality and Flood Attenuation Facilities: Once per year and following major storm events
- Chases: Once per year
- Outfalls: Once per year and following major storm events
- Curb and Gutter: Curb and gutter are inspected and replaced as part of the asphalt and concrete replacement program.

Inspections will determine what repair or maintenance is needed. Inspection and cleaning will typically be performed during the same site visit, based generally on the scope of cleaning required. The condition of city-owned infrastructure will be evaluated and the information will be reported to the City Engineer. Repairs or replacement will be coordinated between the Stormwater and Engineering Divisions and will be prioritized based upon inspection results and by what locations are most crucial for proper function of the system.

## **Private Infrastructure:**

Private stormwater infrastructure will be formally inspected annually, generally in the spring, and may also be observed following storm events to verify it is functioning in accordance with the design. Follow up inspections will be performed to verify compliance with maintenance notifications as necessary.

## **Problem Sites**

The Stormwater Division has identified drainage system components that are “choke points,” flow obstructions, or sites prone to erosion or sedimentation. These sites, described below, are inspected and maintained differently or more frequently than other parts of the system. In addition to the inspection frequency listed below, problem sites will be inspected by the Stormwater Division after major storms and runoff events with sediment or trash/debris removed as necessary. The City is continually evaluating options to upgrade or retrofit these locations to remove them from the list of problem sites as well as all stormwater infrastructure within the City. Any modifications to existing infrastructure are evaluated based on cost effectiveness of the modification, the necessity

to modify locations versus others, as well as whether or not the modification reduces impact to water quality or reduces flood risk.

| SITE   | INSPECTION FREQUENCY | SPECIFIC SITE ISSUE   |
|--|----------------------|---|
| <b>Arapahoe Gulch</b>                                  |                      |   |
| - Inlet upstream of 5 <sup>th</sup> Street             | Min. 2x per year     | Debris accumulation   |
| - Channel upstream of 8 <sup>th</sup> Street           | Min. 2x per year     | Debris accumulation   |
| - “Forebay” at Clear Creek                             | Min. 2x per year     | Debris accumulation   |
| <b>W. Fork Kenney Run</b>                              |                      |   |
| - Pond upstream of US 6                                | Min. 2x per year     | Sediment accumulation   |
| - Ped. Bridge downstream of US 6                       | Min. 2x per year     | Sediment accumulation   |
| - Bypass inlet and ditch along Illinois at Golf Course | Min. 2x per year     | Sediment accumulation   |
| <b>Tucker Gulch</b>                                    |                      |   |
| - From Cressman Gulch confluence to Garden Glen Court  | Min. 2x per year     | Sediment accumulation some grass clipping and tree branch dumping |

## B. [Maintenance](#)

### **Vehicles/Equipment**

City-owned vehicles and equipment used for Stormwater maintenance include:

- 1 ton dump trucks
- 5 ton and larger dump trucks
- backhoe
- loader
- skid steer
- DR-mower
- 2 mechanical sweepers
- Combination jet/vac trailer
- Wood chipper
- Chainsaws
- Miscellaneous hand tools
- All-terrain vehicle

The Stormwater Division may also use private contractors and/or lease equipment not owned by the City to perform the required maintenance.

### **Preventive Maintenance—Street Sweeping Program**

Preventive maintenance of all drainage systems begins with an aggressive street sweeping program of all paved roadways. Our goal is to collect miscellaneous debris, sand, and leaves before it enters the system. This is done with the use of two street sweepers as described in the City’s *Street Sweeping Plan*.

## **Subsurface System**

Maintenance of inlets, manholes, and pipes will be performed during the inspection process. Maintenance typically requires the use of the vacuum truck or trailer and a 2-person crew. Silt and miscellaneous debris will be hauled offsite as it is removed from the structures and disposed of at the dump station at the City's Catamount Shops complex (operation of the dump station is covered in a separate standard operating procedure). Debris will not be stored on site.

The "older grate" type structures are typically shallow and can usually be cleaned with the use of a shovel and a 1 ton dump truck. The top (grate portion) of these older inlets are cleaned of leaves and miscellaneous debris after heavy rains. This allows the water to enter the system without any obstructions and prevents debris from entering the storm sewer system.

## **Surface System**

In general, maintenance of the public surface system is the responsibility of the City, however the Mile High Flood District maintains certain features and the City has the option of requesting assistance from Mile High Flood District.

Routine maintenance of the surface channel system consists of trash and debris pickup. In addition, the removal of vegetation such as shrubs and trees will be selectively performed to ensure that runoff will flow freely and with little or no obstruction. Thinning of shrubs and trees will also be performed with care to ensure that soil stabilization is minimally affected.

All dead trees and trees in the flow line of a structure such as a bridge or culvert restricting flow will be removed. This work will usually be performed with hand tools such as clippers and chainsaws.

Removal of sediment will be performed with the use of the skid steer, backhoe, and front end loader. The materials are hauled to an acceptable landfill site as they are generated with the use of dump trucks. Materials will not be stored on site.

Restoration work such as side slope reconstruction, rip rap installation, and general improvements to enhance their stability and maintainability will also be performed with the use of heavy equipment. The use of a contractor may be required for this type of work.

Routine maintenance of water quality and flood attenuation is carried out in general accordance with the Mile High Flood District Urban Storm Drainage Criteria Manual: Volume 3 Best Management Practices, deviations to these procedures may be required based on site specific needs. Routine maintenance for permanent water quality and

flood attenuation facilities includes trash and debris removal. Mowing of both native and turf grass, and thinning or removal of willows, shrubs, and trees are also included. This is typically hand work. Maintenance for overflow boxes, grates, filtration systems, trash racks, spillways, and inlet and outlet pipes will be performed as noted in the inspection process.

The following is a more detailed guideline for maintenance considerations:

| <b>Action</b>                | <b>Maintenance Objective</b>  | <b>Frequency of Action</b>   |
|------------------------------|---|--|
| Lawn mowing and lawn care    | Occasional mowing to limit unwanted vegetation. Maintain irrigated turf grass as 2.5 to 4 inches tall and non-irrigated native grasses to no less than 6 inches.  | Turf Grass – Routine Depending on aesthetic requirements<br><br>Native Grasses – Site specific   |
| Debris and litter removal    | Remove debris and litter from the facility to minimize outlet clogging and improve aesthetics.  | Routine – Including annual, pre-storm season (April and May) and following significant rainfall events.  |
| Erosion and sediment control | Repair and revegetate eroded areas in the basin and channels.   | Non-routine – Periodic and repair as necessary based on inspection.  |
| Structural                   | Repair inlets, outlets, forebays, low flow channel liners, and energy dissipaters as needed.  | Non-routine – Repair as needed based on regular inspections.   |
| Inspections                  | Inspect basins to insure that the basin continues to function as initially intended. Examine the outlet for clogging, erosion, slumping, excessive sedimentation levels, overgrowth, embankment and spillway integrity, and damage to any structural element. | Routine – Annual inspection of hydraulic and structural facilities. Also check for obvious problems during routine maintenance visits, especially for plugging of outlets. |
| Nuisance control             | Address odor, insects, and overgrowth issues associated with stagnant or standing water in the bottom zone.   | Non-routine – Handle as necessary per inspection or complaints.  |

|                  |   |   |
|------------------|---|---|
| Sediment removal | Remove accumulated sediment from the forebay, trickle channel, micropool, outlet structure and the bottom of the basin. | <p>Routine – Remove sediments from the forebay and trickle channel annually. Frequency may vary based on development upstream and may be required more or less often. Sediment should be removed from the micropool when the depth of the micropool has been reduced to approximately 18 inches. Sediment accumulation in the outlet structure should be removed as needed.</p> <p>Non-routine – Sediment should be removed from the basin when sediment accumulation occupies 20 percent of the WQCV or when sediment accumulation results in poor drainage. In general sediment removal from the basin will be required every 15-25 years but may be required more often based on site specific conditions.</p> <p>This should be estimated based on as-built drawings, O&amp;M Plans and photographs if available. If these are not available, observe locations around permanent structures such as outlet structures and trickle channels for obvious signs of sediment buildup.</p> |
|------------------|---|---|

**Special Maintenance--Contaminants**

Inspections should be performed in conjunction with routine storm sewer system maintenance. City staff should pay particular attention to identify contaminated stormwater, such as the presence of floating and suspended materials, oil and grease, discoloration, turbidity, odor, foam, or unusual vegetative growth.

If contents are discovered in any portion of the storm sewer system that look or smell suspicious like gas or oil, chemical-smelling sludges, etc., the following steps should be taken:

- a. Keep the contents isolated and do not allow it to mix with “clean” debris that has been removed from other locations.
- b. Call Environmental Services 303-384-8181 or 303-384-8136 with location, characteristics (smell, appearance) for further investigation.
- c. Environmental Services will assist in sampling, analysis and proper disposal protocol once the substance is determined.
- d. All confined space rules will apply.

**IV. Privately Owned Systems**

Annually, the Stormwater Division will ensure that the privately-owned storm systems within the city receive routine maintenance and are functioning as intended. Owners of private facilities

are required to clean and perform necessary repairs to inlets, manholes, underground pipe, channels and permanent CMs on their property. After work is complete by the property owner, facilities will be inspected by the City's Stormwater Division for compliance.

## V. Applicable Ordinances

### **Maintenance**

Golden Municipal Code section 13.30.110 – Maintenance Requirements

*The property owner shall be responsible for the maintenance of all stormwater collection and conveyance systems and quality control measures enacted pursuant to this chapter. All temporary quality control measures shall be removed after work on the site has been completed and the measures are no longer needed. Should any property owner fail to adequately maintain the stormwater collection and conveyance systems and quality control measures or remove the temporary quality control measures as required, the city may, after notifying the owner of the required maintenance and/or removal and the owner failing to perform such maintenance and/or removal, enter the affected property and perform or cause to be performed the required work and assess the charge for such work against the property owner, in accordance with the procedure set forth in this chapter regarding the assessment of costs. ( Ord. No. 2079, § 11, 7-12-2018 ; Ord. 1498, § 1, 2000; Ord. 1235, § 2, 1994)*

### **Right of Entry**

Golden Municipal Code section 13.30.130 – Right of Entry

*(a) Right of entry generally. Whenever necessary to make an inspection to enforce this chapter, or whenever a police or code enforcement officer, or city inspector has probable cause to believe there exists upon any premises any condition which constitutes a violation of the provisions of this chapter such officer/inspector shall first present proper credentials and request entry. If entry is refused, the officer/inspector shall give the responsible party, or if the responsible party cannot be located after a reasonable effort the officer shall post upon a conspicuous place upon the premises, a written notice of intent to inspect not sooner than 24 hours after the time specified in the notice. The notice shall state that the responsible party has the right to refuse entry and that in the event such entry is refused, inspection may be made only upon issuance of an administrative warrant by a municipal judge of the city, or by a judge of any other court having jurisdiction.*

*(b) Search warrants. A police or code enforcement officer or city inspector may appear before the municipal judge and upon a showing of probable cause shall request an administrative warrant entitling such officer to enter upon the premises, using such reasonable force as may be necessary to gain entry. The officer or inspector applying for such warrant shall not be required to demonstrate specific knowledge of the condition of the particular structure or premises at issue in order to obtain a warrant, but must show some factual or practical circumstances that would cause an ordinary prudent person to believe that entry to the premises has been*

*denied and that there exists a violation of the requirements of this chapter upon the premises.*

*(c) Emergencies. Whenever an emergency situation exists in relation to the enforcement of any of the provisions of this chapter, a police or code enforcement officer may enter upon any premises, using such reasonable force as may be necessary. An emergency situation includes any situation of imminent danger of loss of, or injury or damage to, life, limb, property or threat to public safety. It is unlawful for any owner or occupant of the building or premises to deny entry to any officer or to resist reasonable force used by any officer acting pursuant to this subsection.*

*( Ord. No. 2079, § 14, 7-12-2018 ; Ord. 1498, § 1, 2000; Ord. 1235, § 2, 1994)*

### **Nuisance Provisions – Non Stormwater Discharges**

Golden Municipal Code section 13.30.140 – Nuisance Provisions

*It is unlawful and constitutes a nuisance for any person to discharge or cause to be discharged or spilled any substance other than naturally occurring stormwater runoff into the city's storm drainage system, except for: landscape irrigation, lawn watering, diverted stream flows, irrigation return flow, rising groundwaters, uncontaminated groundwater infiltration, uncontaminated pumped ground water, springs, flows from riparian habitats and wetlands, water line flushing and discharges from potable water in accordance with CDPHE LRDG: Potable water, foundation drains, air conditioning condensation, water from crawl space pumps, footing drains, individual residential car washing, dechlorinated swimming pool discharges in accordance with CDPHE LRDG: Swimming pools, water incidental to street sweeping (including associated sidewalks and medians) and that is not associated with construction, dye testing in accordance with manufacturer's recommendations, stormwater runoff with incidental pollutants, discharges resulting from emergency firefighting activities, discharges authorized by a CDPS or NPDES permit, agricultural stormwater runoff, discharges that are in accordance with the division's low risk policy guidance documents or other division policies and guidance documents where the division has stated that it will not pursue permit coverage or enforcement for specified point source discharges, and other discharges approved by the division in accordance with MS4 Phase II Stormwater Permit Part I.E.2.a.v(Y). Nothing contained herein shall be construed to relieve any person discharging or causing to be discharged water into the storm drainage system from any liability for damage caused by the volume or quality of water discharged. ( Ord. No. 2079, § 14, 7-12-2018 ; Ord. 1498, § 1, 2000; Ord. 1235, § 2, 1994)*

## **VI. Mosquito Control**

The City began application of larvicide to control mosquito populations, as needed, in 1999. In May of 2003, in response to West Nile Virus, the City began using larvicide in all

identified potential breeding sites city wide. Current City policy is to perform mosquito control in select “problem areas”, in response to citizen complaints, and as needed based on inspection of stormwater infrastructure. Mosquito control and record keeping are performed in accordance with the City of Golden Mosquito Control Standard Operating Procedure. The City of Golden mosquito control program is based on general industry standards and may be modified based on best available information within the industry as well as guidance from US EPA, Colorado Department of Public Health and Environment and Jefferson County Public Health. Safety, reporting and records retention is done in accordance with applicable policies and regulations.

The larvicide currently in use is *Bacillus thuringiensis israelensis* (Bti). All areas of standing water where Bti has been dispensed, since May 2003, have been given a GPS location number and are mapped for future reference with new locations added as necessary. The date and location of each treatment is documented and includes the number of briquettes used.

Bti is a naturally occurring soil bacterium that, when ingested by larval mosquitos and black flies, is released into the larval stage mosquitos gut causing them to stop eating. Bti is an effective larvicide due to its low toxicity to non-target species, including humans, wildlife and pets. Larvicides are more effective and less toxic than adult mosquito sprays which are more likely to lead to human exposure. Bti is considered a non-restricted used pesticide and is widely used. Site conditions are evaluated to determine whether treatment is necessary. Bti application is based on the water body volume and is applied per manufacturer recommendations. Bti is generally applied only to shallow stagnant water bodies of less than 24 inches in depth or water bodies, which after a period of low precipitation may meet those standards.