

# CHERRY HILLS VILLAGE

## Checklist for Phase III Drainage Report

This checklist for a Phase III Drainage Report has been adapted from both the Arapahoe County Stormwater Management Manual and checklist and the Southeast Metro Stormwater Authority (SEMSWA) checklist and shall be utilized for Drainage Submittals within Cherry Hills Village.

**Project Name:** \_\_\_\_\_  
**Engineer:** \_\_\_\_\_  
**Address:** \_\_\_\_\_  
**Phone:** \_\_\_\_\_ **Email:** \_\_\_\_\_

Yes	No	N/A	Requirements
<b>I. COVER SHEET</b>			

			1. Name of Project
			2. Address/Location of Project
			3. Owner Contact Information
			4. Developer Contact Information (if different than Owner)
			5. Engineer Contact Information (Registered Professional Engineer)
			6. Submittal date and revision dates as applicable

<b>II. CERTIFICATION STATEMENT</b>			
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			Include Certification Statement from a Registered Profession Engineer in the State of Colorado and the project Developer.
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<b>III. GENERAL LOCATION AND DESCRIPTION</b>			
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			1. Location
			a. Site Vicinity Map
			b. Lot, Block of Site if platted
			c. Township, Range, Section, and ¼ Section
			d. Streets, Roadways, and Highways adjacent to the proposed development, or within the area served by the proposed drainage improvements
			e. Names of surrounding or adjacent developments, including land use or zoning information
			2. Description of Property
			a. Area of site in acres and total proposed disturbed area
			b. Ground Cover, vegetation, site topography and slopes
			c. NRCS Soils Classification Map and discussion
			d. Major and minor drainageways
			e. Floodplains delineated by MHFD FHAD Studies or on FEMA FIRM Maps
			f. Existing irrigation canals or ditches
			g. Significant geologic feature
			h. Proposed land use and site activities and operations
			i. Groundwater investigations and discussion

<b>IV. DRAINAGE BASINS AND SUB-BASINS</b>
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1. Major Drainage Basins			
			a. On-site and Off-site major drainage basin characteristics and flow patterns
			b. Existing and proposed land uses within the basins
			c. Discussion of all drainageway planning or floodplain delineation studies that affect the major drainageways, such as MHFD FHAD Studies and Outfall System Planning studies (Refer to County Records)
			d. Discussion of the condition of the channel within or adjacent to the development, including existing condition, need for improvements, and impact on proposed development.
			e. Discussion of the impacts of the off-site flow patterns and paths, under fully developed conditions
2. Minor Drainage Basins / Sub-basins			
			a. On-site and Off-site minor drainage basin characteristics and flow patterns
			b. Existing and proposed land uses within the basins
			c. Discussion of irrigation facilities that will influence or be impacted by the site drainage
			d. Discussion of the impacts of the off-site flow patterns and paths, under fully developed conditions

## V. DRAINAGE DESIGN CRITERIA

1. Regulations			
			a. County/City criteria and optional provisions selected, when applicable
			b. Drainage Studies, Outfall Systems Plans, Site Constraints
2. Drainage Studies, Outfall Systems Plans, Site Constraints			
			a. Discuss previous drainage studies or master plans for the site or project
			b. Discuss drainage studies for adjacent developments and how those developments affect the stormwater facility designs
			c. Discuss MHFD Outfall Systems Plans and how recommendations in those studies affect the design
			d. Discuss impacts to stormwater management facility design, caused by site constraints
3. Hydrology			
			a. Runoff calculations method(s)
			b. Design storm recurrence intervals
			c. Design rainfall
			d. Detention storage and release rate calculation method(s)
4. Hydraulics			
			a. Methods used to determine conveyance facility capacities
			i. Inlet Design
			ii. Curb Cut Design
			iii. Storm Sewer Design (including hydraulic grade line and water surface profile calculation method and tools)
			iv. Rip Rap Design

5. Water Quality Enhancement			
			a. Discuss proposed post-construction BMP type
			b. Identify design procedures and WQCV
			c. Discuss proposed Source Controls for site activities
6. Groundwater Investigation			
			a. Discuss groundwater investigations and results
			b. Identify potential groundwater issues and remediation measures
<b>VI. STORMWATER MANAGEMENT FACILITY DESIGN</b>			
1. Stormwater Conveyance Facilities			
			a. Discuss general conveyance pattern for Project
			b. Discuss proposed drainage patterns
			c. Discuss storm sewer design, including inlet and pipe locations and sizes, tributary basins and areas, peak flow rates at design points, hydraulic grade lines, etc.
			d. Discuss storm sewer outfall locations and design, including method of energy dissipation
			e. Discuss how runoff is conveyed from all outfalls to the nearest major drainageway, including a discussion of the flow path and capacity downstream of the outfall to the nearest major drainageway
			f. Discuss open channel and swale designs, including dimensions, alignments, tributary basins and areas, peak flow rates at design points, stabilization and grade control improvements, low flow or trickle channel capacities, water surface elevations, etc.
			g. Discuss allowable street capacities
			h. Discuss maintenance aspects of the design and easements and tracts that are required for stormwater conveyance purposes
			i. Discussion of the facilities needed offsite for the conveyance of minor and major flows to the major drainageway
2. Stormwater Storage Facilities			
			a. Discussion detention pond designs, including release rates, storage volumes and water surface elevations for the Water Quality Capture Volume, Excess Urban Runoff Volume, 100-year, and emergency overflow conditions, outlet structure design, emergency spillway design, etc.
			b. Discuss pond outfall locations and design, including method of energy dissipation
			c. Discuss how runoff is conveyed from all pond outfalls to the nearest major drainageway, including a discussion of the flow path and capacity downstream of the outfall to the nearest major drainageway
			d. Discuss maintenance aspects of the design and easements and tracts that are required for stormwater storage purposes
3. Water Quality Enhancement Best Management Practices			
			a. Discuss the design of all structural water quality BMPs, including tributary areas, sizing, treatment volumes, design features, etc.

			b. Discuss how runoff is conveyed from all pond outfalls to the nearest major drainageway, including a discussion of the flow path and capacity downstream of the outfall to the nearest major drainageway
			c. Discuss the operation and maintenance aspects of the design and easements and tracts that are required for stormwater quality enhancement purposes
			d. Discuss the source controls that are necessary to prevent the potential for illicit discharge from site activities
4. Floodplain			
			<i>Undesignated Floodplain</i>
			a. Discuss resources and methodology for delineation of floodplain.
			<i>Designated Floodplain</i>
			a. Discuss the source of the floodplain information and level of detail (MHFD Flood Hazard Area Delineation or FEMA Flood Insurance Rate Maps)
			b. Discuss details of floodplain modifications, including level of encroachment, velocities, depths, stabilization measures, water surface elevations, etc.
			c. Discuss Floodplain Modification Studies, including Conditional Letter of Map Revision (CLOMR) and Letter of Map Revision (LOMR) requirements
			d. Discuss County/City floodplain development regulations and Floodplain Development Permit
5. Groundwater			
			a. Discuss improvements to mitigate groundwater impacts
6. Additional Permitting Requirements			
			a. Compliance with Section 404 of the Clean Water Act
			b. Compliance with the Endangered Species Act
			c. Other local, State, or Federal requirements
7. General			
			a. Discuss all tables, figures, charts, drawings, etc. that were used in design of stormwater management facilities and describe materials that are included in the appendix of the report

## VII. CONCLUSIONS

1. Compliance with Standards			
			a. City/Arapahoe Criteria
			b. MHFD Criteria
			c. Master Plans and MHFD Outfall Systems Plans
2. Variances			
			a. Identify provisions by section number for which a variance will be requested, or has been approved by Cherry Hills Village
			b. Provide justification for each variance requested
3. Drainage Concept			
			a. Discuss overall effectiveness of stormwater management design to properly convey, store and treat stormwater

## VIII. REFERENCES

			a. Reference all criteria, master plans, reports, or other technical information used in development of the concepts discussed in the drainage report
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## IX. APPENDICES

			A Drainage Plan
			a. See Drainage Plan Checklist
			B Floodplain Maps
			a. Provide FEMA Firm Map or other floodplain designation map
			C Soil Information
			a. Provide soil map and details
			D Hydrologic Computations
			a. Rainfall Information (hydrograph data, if applicable)
			b. Determination of runoff coefficients and times of concentration
			c. Land use assumptions for off-site areas
			d. Colorado Urban Hydrograph Procedure, if applicable
			i. Input parameter determination
			ii. UDSWMM Input parameter determination
			iii. CUHP/UDSWMM input and output
			e. Peak flow rate calculations for the minor and major storms
			f. Connectivity diagram showing relationship/connectivity of basins, conveyance facilities, detention ponds, and design points
			g. Floodplain hydrology
			E Hydraulic Computations
			a. Street capacities
			b. Curb cut capacities
			c. Inlet capacities
			d. Storm sewer capacities and hydraulic grade lines, including the loss coefficients
			e. Water Quality and Detention Facility Calculations
			i. Stage-storage-discharge determination for detention ponds utilizing the MHFD UD-Detention tool
			ii. Detention pond routing calculations
			iii. Water surface profiles
			iv. Emergency spillway sizing calculations
			v. Downstream/outfall capacity to the nearest major drainageway
			f. Energy dissipation at pipe outfalls
			g. Culvert Capacities
			h. Stabilization and grade control improvements
			i. pen channel or swale capacities
			j. Low flow and trickle channels
			k. Floodplain modeling
			F Referenced Information
			a. Copies of pertinent portions of referenced materials/drainage reports.