

## CHECKLIST FOR PHASE III DRAINAGE REPORT

**Yes    No    N/A    Report Requirements**

### I. COVER SHEET

			A. Name of Project
			B. Address
			C. Owner
			D. Developer
			E. Engineer
			F. Submittal date and revision dates as applicable

### II. GENERAL LOCATION AND DESCRIPTION

			A. Name of Project
			1. Site Vicinity Map
			2. Township, Range, Section, and ¼ Section
			3. Streets, Roadways, and Highways adjacent to the proposed development, or within the area served by the proposed drainage improvements
			4. Names of surrounding or adjacent developments, including land use or zoning information
			B. Description of Property
			1. Area in Acres
			2. Ground Cover, vegetation, site topography and slopes
			3. NRCS Soils Classification Map and discussion
			4. Major and minor drainageways
			5. Floodplains delineated by UDFCD FHAD Studies or on FEMA FIRM Maps
			6. Existing irrigation canals or ditches
			7. Significant geologic feature
			8. Proposed land use and site activities and operations
			9. Groundwater investigations and discussion

### III. DRAINAGE BASINS AND SUB-BASINS

			A. Major Drainage Basins
			1. On-site and Off-site major drainage basin characteristics and flow patterns and paths
			2. Existing and proposed land uses within the basins
			3. Discussion of all drainageway planning or floodplain delineation studies that affect the major drainageways, such as UDFCD FHAD Studies and Outfall System Planning studies
			4. Discussion of the condition of the channel within or adjacent to the development, including existing condition, need for improvements, and impact on proposed development.
			5. Discussion of the impacts of the off-site flow patterns and paths, under fully developed conditions

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			<b>B. Minor Drainage Basins</b>
			1. On-site and Off-site minor drainage basin characteristics and flow patterns and paths
			2. Existing and proposed land uses within the basins
			3. Discussion of irrigation facilities that will influence or be impacted by the site drainage
			4. Discussion of the impacts of the off-site flow patterns and paths, under fully developed conditions

### IV. DRAINAGE DESIGN CRITERIA

			<b>A. Regulations</b>
			1. County criteria and optional provisions selected, when applicable
			2. UDFCD criteria and optional provisions selected, when applicable
			<b>B. Drainage Studies, Outfall Systems Plans, Site Constraints</b>
			1. Discuss previous drainage studies or master plans for the site or project that influence the stormwater facility designs
			2. Discuss drainage studies for adjacent developments and how those developments affect the stormwater facility designs
			3. Discuss UDFCD Outfall Systems Plans and how recommendations in those studies affect the design
			4. Discuss impacts to stormwater management facility design, caused by site constraints, such as streets, utilities, light rail rapid transit, existing structures, etc.
			<b>C. Hydrology</b>
			1. Runoff calculations method(s)
			2. Design storm recurrence intervals
			3. Design rainfall
			4. Detention storage calculation method(s)
			5. Detention storage release rate calculation method
			<b>D. Hydraulics</b>
			1. Methods used to determine conveyance facility capacities
			2. Hydraulic grade line calculation method and discussion of loss coefficients
			3. Methods used to calculate water surface profiles
			<b>E. Water Quality Enhancement</b>
			1. Discuss proposed BMPs
			2. Identify design procedures and WQCV
			3. Discuss proposed Source Controls for site activities
			<b>F. Groundwater Investigation</b>
			1. Discuss groundwater investigations and results
			2. Identify potential groundwater issues and remediation measures

### V. STORMWATER MANAGEMENT FACILITY DESIGN

			<b>A. Stormwater Conveyance Facilities</b>
			1. Discuss general conveyance concepts
			2. Discuss proposed drainage paths and patterns

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			3. 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
			4. Discuss storm sewer outfall locations and design, including method of energy dissipation
			5. 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
			6. 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
			7. Discuss allowable street capacities
			8. Discuss maintenance aspects of the design and easements and tracts that are required for stormwater conveyance purposes
			9. Discussion of the facilities needed offsite for the conveyance of minor and major flows to the major drainageway
			<b>B. Stormwater Storage Facilities</b>
			1. Discussion detention pond designs, including release rates, storage volumes and water surface elevations for the 2-year, 100-year, and emergency overflow conditions, outlet structure design, emergency spillway design, etc
			2. Discuss pond outfall locations and design, including method of energy dissipation
			3. 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
			4. Discuss maintenance aspects of the design and easements and tracts that are required for stormwater storage purposes
			<b>C. Water Quality Enhancement Best Management Practices</b>
			1. Discuss the design of all structural water quality BMPs, including tributary areas, sizing, treatment volumes, design features, etc
			2. 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
			3. Discuss the operation and maintenance aspects of the design and easements and tracts that are required for stormwater quality enhancement purposes
			4. Discuss the source controls that are necessary to prevent the potential for illicit discharge from site activities
			<b>D. Floodplain</b>
			<i>Undesignated Floodplain</i>
			1. Discuss resources and methodology for delineation of floodplain.

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			<i>Designated Floodplain</i>
			1. Discuss the source of the floodplain information and level of detail (UDFCD Flood Hazard Area Delineation or FEMA Flood Insurance Rate Maps)
			2. Discuss details of floodplain modifications, including level of encroachment, velocities, depths, stabilization measures, water surface elevations, etc.
			3. Discuss Floodplain Modification Studies, including Conditional Letter of Map Revision (CLOMR) and Letter of Map Revision (LOMR) requirements
			4. Discuss County floodplain development regulations and Floodplain Development Permit
			E. Groundwater
			1. Discuss improvements to mitigate groundwater impacts
			F. Additional Permitting Requirements
			1. Compliance with Section 404 of the Clean Water Act
			2. Compliance with the Endangered Species Act
			3. Other local, State, or Federal requirements
			G. General
			1. 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
<b>VI. CONCLUSIONS</b>			
			A. Compliance with Standards
			1. Arapahoe County Criteria
			2. UDFCD Criteria
			3. Master Plans and UDFCD Outfall Systems Plans
			4. Cherry Creek Basin Control Regulation No. 72
			B. Variances
			1. Identify provisions by section number for which a variance will be requested, or has been approved by county (final version of Drainage Report)
			2. Provide justification for each variance requested
			C. Drainage Concept
			1. Discuss overall effectiveness of stormwater management design to properly convey, store and treat stormwater
<b>VII. REFERENCES</b>			
			Reference all criteria, master plans, reports, or other technical information used in development of the concepts discussed in the drainage report
<b>VIII. APPENDICES</b>			
			A. Hydrologic Computations
			1. Determination of runoff coefficients and times of concentration

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			2. Land use assumptions for off-site areas
			3. Colorado Urban Hydrograph Procedure input parameter determination
			4. UDSWM Input parameter determination
			5. Peak flow rate calculations for the minor and major storms
			6. Rainfall Information
			7. CUHP/UDSWMM input and output
			8. Hydrograph data, if applicable
			9. Connectivity diagram showing relationship/connectivity of basins, conveyance facilities, detention ponds, and design points
			10. Floodplain hydrology
			<b>B. Hydraulic Computations</b>
			1. Culvert Capacities
			2. Storm sewer capacities and hydraulic grade lines, including the loss coefficients
			3. Street capacities
			4. Inlet capacities
			5. Open channel or swale capacities
			6. Low flow and trickle channels
			7. Stabilization and grade control improvements
			8. Water surface profiles
			9. Stage-storage-discharge determination for detention ponds
			10. Detention pond routing calculations
			11. Emergency spillway sizing calculations
			12. Downstream/outfall capacity to the nearest major drainageway
			13. Energy dissipation at pipe outfalls
			14. Floodplain modeling
			<b>C. Water Quality Enhancement Best Management Practices</b>
			1. Design and sizing
			<b>D. Referenced Information</b>
			1. Copies of pertinent portions of all referenced materials or drainage reports.

### IX. CERTIFICATION STATEMENT

			Include Certification Statement from a Registered Profession Engineer in the State of Colorado and the project Developer. See Section 4.5.3 for more information.
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## CHECKLIST FOR PHASE III DRAINAGE PLAN

**Yes    No    N/A    Plan Requirements**

### I. OVERALL DRAINAGE PLAN

			A. 24" x 36" in size, 22" x 34" also acceptable when half size sets will be produced
			B. Title block and legend
			C. Show boundaries of entire development or project
			D. Existing or proposed streets, roadways, or highways
			E. Show limits of all major basins, including off-site basins where feasible
			F. General drainage patterns and flow paths, including those entering and leaving the site
			G. Topographic information
			H. Identify existing stormwater management facilities, upstream, downstream, or within the site, which will provide a stormwater management function for the site
			I. Overlay or figure showing layout of Detailed Drainage Plan sheets

### II. DETAILED DRAINAGE PLANS

			A. 24" x 36" in size, 22" x 34" also acceptable when half size sets will be produced
			B. Title block and legend
			C. Basin designations, design points, flow rates, volumes, release rates, consistent with County standards
			D. Scale 1"= 20' to 1"= 100', as required to show sufficient detail
			E. Existing (dashed or screened) and proposed (solid) contours with a 2 foot maximum contour intervals. In terrain where the slope exceeds 15%, the maximum interval is 5 feet. Contour must extend a minimum of 100 feet beyond property lines
			F. Existing utilities and structures
			G. All property lines and easements with type of easements noted
			H. Adjacent developments or ownerships
			I. Streets and roadways with ROW and flow line widths, type of curb and gutter or roadside swale, slopes flow directions, and crosspans
			J. Drainage basin and sub-basin limits
			K. Existing and proposed stormwater management facilities, including irrigation ditches, roadside swales, open channels and drainageways, storm sewers, culverts, detention ponds, water quality enhancement structures or features, etc. Information must be included regarding materials, sizes, shapes, and slopes
			L. Proposed outfall points and existing or proposed facilities to convey runoff to the nearest major drainageway, without damage to downstream properties
			M. Location and elevation of all existing and proposed 100-year floodplain boundaries, including the source of designation. All floodplain designations that exist for the site should be included, i.e. FEMA FIS, FHAD, and others.
			N. Summary Runoff Table