## **Drainage Report Checklist**

DESCRIPTION	PROVIDED (Engineer)	N/A	COMMENTS
General Info			
Cover sheet			
Project Name (Legal Name: Subdivision, Filing, Block, Lot, Address, etc.)			
Date (Revision Date, If Applicable)			
Applicant & preparer name and firm			
Responsible Party Certification			
PE certification statement, seal and signature			
Developer certification statement, signed & notarized			
Table of Contents			
Description of Property			
Location			
Township, range, section, quarter section			
City, County, State Highway and Local streets within and adjacent to the subdivision			
Names of surrounding developments			
General Project Description			
Area in acres (verify with plat if available)			
Major drainageways and facilities w/in and adjacent to the site			
Existing major irrigation facilities such as ditches and canals			
Drainage related easements within and adjacent to the site			
Existing ground cover (trees, shrubs, etc.)			
Existing soil conditions			
Proposed land use			
Drainage Basins & Sub-Basins			
Major Basin and Sub-Basin Descriptions			
Reference major drainageway planning studies			
Reference previous drainage studies affecting the site			
Identify presence of regulatory floodplains/floodways at site			
Reference FEMA flood insurance study/flood insurance rate maps			
Reference flood hazard area delineation (FHAD) report			
Discuss any proposed disturbance to most restrictive floodplain and if a LOMR will be required			
Basin drainage characteristics - existing and planned land uses affecting the site			
Coordination with surrounding development plans			
Identification of irrigation facilities within 100 feet of the project boundary and any which will influence or be influenced			
by project drainage flows (regardless of proximity)			
Identify presence or absence of any major drainageways on the site with total tributary area >130 acres			
Discussion of off-site drainage flow patterns onto the site and impact on development under existing and full developed basin			
Discussion of historic drainage pattern of the property (Supporting off-site delineation map included)			
Discussion of development impacts to off-site basins, if any			
Discussion of each proposed sub-basin, including drainage patterns, storm sewer configuration, and design points			

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DESCRIPTION	PROVIDED (Engineer)	N/A	COMMENTS
Drainage Design Criteria			
Regulations			
Discussion of compliance with the City's Code regarding floodplain and ponding			
Residential lots - completely outside of the floodplain with structures min 12" above base flood elevation (BFE)			
Non-residential lots and tracts - buildable area outside floodplain & finished grade min 12" above BFE			
Permitted uses planned within the floodplain, if any			
Discussion of compliance with MHFD maintenance eligibility program (MEP) review, if applicable			
Development Criteria Reference and Constraints			
Discussion of previous drainage studies for the site that influence or are influenced by the drainage design			
Complies with previous study/Does not comply (Discussion on changes from the previous study)			
Discussion of effects and/or coordination with adjacent drainage studies and developments			
Discussion of site drainage constraints (such as streets, utilities, existing structures, etc.)			
Hydrologic Criteria			
Identify design rainfall event, frequency, and duration			
Hydrology based on fully developed watershed conditions based on future land use (imperviousness)			
Identify runoff calculation method used			
Identify calculation method for detention storage and discharge			
Discussion and justification of criteria or methods other than City Standards or USDCM			
Hydraulic Criteria			
Identify various capacity references utilized in design			
Identify detention pond outlet design method			
ldentify check / drop structure criteria used			
Discussion of drainage facility design criteria other than City Standards & Specifications (i.e. MHFD, other)			
Variance from Standards and Specifications			
Identify provision by section number for which a variance is requested			
Provide justification and discussion for each variance requested, including specific location and updated condition			
Drainage Facility Design			
General Concept			
Discussion of typical existing drainage patterns			
Discussion of concept and proposed drainage patterns of the developed site			
Discussion of compliance with off-site runoff impacting the site and site runoff impacting downstream properties			
Discussion of all tables, charts, figures, drawings, calculations, etc. presented in the appendix			
Rip rap details and design			
Specific Details			
Discussion of specific drainage problems and solutions at design points			

DESCRIPTION	PROVIDED (Engineer)	N/A	COMMENTS
Discussion of detention storage required			
Minimum required 100 yr storage volume (& reference source and calculation used)			
Minimum required EURV storage volume (& reference source and calculation used)			
Proposed right-of-way frontage improvements routed to storage facility and included in storage volume			
Actual provided pond volumes (& reference source and calculation used)			
Water surface elevations (& reference source and calculation used)			
100 yr WSE based on 100yr detention volume			
Max spillway WSE based on spillway flow depth for 2x the 100yr flow			
Freeboard requirements (1' min above spillway flow depth) and elevation (& reference)			
Discussion of water quality (WQCV or accepted alternative) requirements and implementation of treatment method(s)			
Adjacent right-of-way frontage tributary to site included in treatment or (if existing) intercepted and bypassed			
A. WQCV for full tributary area to the site (including all tributary ROW areas) calculated			
B. EURV for entire development site including only new ROW improvements calculated			
Greater of A or B above used as basis for WQ release rate in the full spectrum detention design			
Discussion of Plugged Sump Inlet Overflow Analysis (confirmation no lots or buildings are effected, max ponding depth)			
Open Channels, Swales, and Roadside Ditches			
Discussion of design and applicable criteria			
Discussion of maintenance access and aspects of the design			
Discussion of easements and tracts dedicated for drainage & maintenance purposes			
Identify stormwater facilities proposed for acceptance into the MHFD MEP (if any)			
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Environmental Protection Criteria  Identify wetland areas, jurisdictional status, "Waters of the U.S." and "Waters of the State"			
Discuss project impacts and protections for the above elements			
Discuss compliance with State and Federal environmental permitting regulations			
Identify permitting and mitigation requirements			
Provide copy of 404 permit or determination of non-jurisdictional status from USACE for any identified wetlands			
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Conclusions Compliance			
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City Standards & Specifications, Code, Ordinances, & Policies	·····	·····	
City of Thornton MS4 (with summary of any undetained and/or untreated basins)			
Major drainageway plans (MHFD Outfall Systems Plan)			
MHFD USDCM Recommendations			
State of Colorado requirements (laws regarding drain times, water law)	Ц		
Additional permitting requirements (404, Endangered Species, CLOMR/LOMR, other)			
Drainage Concept		<u> </u>	
Effectiveness of design to control storm runoff			
Discussion of maintenance responsibility for public and private drainage facilities			
Discuss impact of proposed development on the Major Drainageway Planning Studies recommendations			
Variances			
Identification and justification of sections of Standards for which variances are requested			
References			
List all drainage reports and technical information used (including editions/dates)			
List all computer software used in analysis (including editions/dates)			

DESCRIPTION	PROVIDED (Engineer)	N/A	COMMENTS
Appendices			
Vicinity Map			
Onsite and offsite basin delineation maps with design points (historic and proposed)			
Studies & Reports			
Soils Maps (NRCS Custom Soil Resource Report, additional maps if used)			
Relevant portions of major drainageway planning studies, previous drainage studies affecting the site, FHAD, FEMA			
FIRM, wetlands study, 404 Permit, or any other applicable documents			
Hydrologic Computations (Historic and Developed)			
Most current edition / version of calculation spreadsheets (including MHFD-Inlet, MHFD-EDB, etc.) used			
Imperviousness Calculation & Runoff Coefficient Summary Tables			
Time of Concentration			
Rational Method Analysis for 5 yr and 100 yr			
For each basin and design point (i.e., routed cumulative flow)			
NOAA Atlas 14 rainfall data for site location as basis for rainfall events (preferred over quantities in City Standards)			
Storm Sewer Hydraulic Computations			
Minimum pipe size 18-inch RCP for all public storm sewers			
StormCAD (or equivalent) Analysis			
Pipe & Structure (Node) Skematic with MH and pipe labels matching Construction Drawing Plan & Profiles			
5 yr modeled HGL assumes a free outfall condition			
Peak 100 yr WSE at outfall used as tailwater condition for the 100 year HGL			
5 yr and 100 yr StormCAD Profiles (minor storm contained within the pipe, major below ground surface)			
5 yr and 100yr Input/Output Summary Tables			
Pipe Velocities (min 3 ft/s at half pipe flow wherever possible, max 20 ft/s)			
Inlet sizing and capacity calculations			
MHFD-Inlet outputs included (with all workbook sheets provided with expanded details)			
Basin ID & inlet Number identified on each sheet			
Outlet protection design calculations			
Pipe velocity and Froude number calculation at pipe outlet			
Streets Hydraulic Computations			
Street name and classification and inlet number/design point identified			
Street Capacity Analysis (see City Standards Section 400 and USDCM) (as performed by MHFD-Inlet)			
Use MHFD-Inlet "Q-allow" worksheets for upstream of sump/vertical curve and for on-grade inlets			
Verify max flow depth and spread width is acceptable (Per COT & USDCM)			
(12" max or crown of road measured at gutter flowline, cannot encroach onto any residential lot, contained within the ROW)			
Culverts Hydraulic Computation			
Calculations for flow capacity and developed flow and velocity through structure			
Identification of controlling condition (entrance or outlet)			
Maximum HW/D = 1.5			
Water surface elevations calculated and compared to allowable overtopping (with design storms identified)			
Open Channels (including Swales & Ditches) Hydraulic Computation			
Calculation of developed flow through the channel (type, velocity, etc.)			
Supporting labeled calculations for water surface elevations and required freeboard			
Riprap design calculations			

DESCRIPTION	PROVIDED (Engineer)	N/A	COMMENTS
extended Detention Basin (EDB) Hydraulic Computations			
Calculations of volume of storage required (WQCV, EURV and 100-year event)			
MHFD-Detention Workbook results included within report (PDF)			
MHFD-Detention workbook Excel file submitted as a supporting document alongside report			
Volume of provided detention pond (maximum volume)			
Based on spillway crest elevation (must be ≥ required 100 yr volume)			
Supporting labeled calculations for water surface elevations			
Supporting labeled calculations for minimum of one foot freeboard requirement			
Emergency overflow calculations			
Weir and spillway sized for 2x 100 yr developed peak inflow (from MHFD-Inlet) into pond (weir calculation provided)			
1 ft min freeboard above flow through spillway (as calculated immediately above)			
Calculations for spillway riprap sizing provided			
Inflow(s) energy dissipation method, sizing, and calculations (as applicable)			
Forebay - volume calculations and quantified release rate demonstrating velocity is slowed			
Trickle channel capacity (sized for forebay weir release rate)			
Outlet Structure Computations (per MHFD-EDB or SWMM Model)			
Shall meet allowable/required drain times based on USDCM			
Trash Rack (overflow) & safety grate(s) sizing calculations (with open area and clogging factor used)			
Capacity, velocity, and Froude No. calculations for oulets into pond and outlet structure outfall pipe			
Calculations for pond inflow(s) energy dissipation			
Calculations for outlet protection for outlets into pond and outlet structure pipe outfall			
Free outfall condition confirmed for receiving pipe when MHFD-EDB is used			
CUHP SWMM Model (or equivalent) provided if downstream receiving pipe is surcharged in 100-year event			
Bridges - Hydraulic computation performed in accordance with recommendations of USDCM Volume 2 Chapter 11			
Plugged Sump Inlet Overflow Analysis (Max Depth of Ponding based on local grading, resulting WSE, Overflow Route)			
Other Permanent SCM Calculations (if applicable)			
Calculations for WQCV requirements			
Calculations for storage volume requirements			
Supporting labeled calculations for outlet structure design			
Inflow(s) energy dissipation method, sizing, and calculations (as applicable)			
Runoff reduction calculations and exhibit (if applicable)			
All other design calculations necessary for design of Permanent SCM			
Construction SCM Calculations (if applicable) using UD-BMP (such as diversion swales, temporary sedimentation basins)			
Base Design Standards worksheets for Thornton MS4 compliance			