4.0 Introduction

The requirements presented in this section shall be used to aid the design engineer or applicant in the preparation of drainage reports, drainage studies, and construction drawings for stormwater management facilities. The requirements presented are the minimum necessary and will be used to evaluate the adequacy of all submittals to SEMSWA.

4.1 Review Process

4.1.1 Drainage Report Requirements. All development applications or land use proposals within the jurisdiction of these Criteria shall submit Drainage Reports, construction drawings, and as-built information in accordance with the requirements of this section. Drainage Report submittal requirements related to the type of development or land use proposal are outlined in Table 4-1. The number of Drainage Reports submitted with any development or land use proposal shall be based on the requirements of SEMSWA. Additional copies of the Drainage Report may be requested by SEMSWA. The submittal shall include a cover letter stating the type of report submitted (i.e., Master, Phase I, Phase II, or Phase III) and for what purpose the report has been prepared.

4.1.2 Stand Alone Document. The Drainage Report shall be a stand-alone document. When references are made or assumptions are based on previously submitted studies or reports, the Drainage Report must include the appropriate excerpts, pages, tables, and maps containing the referenced information. Assumptions made in previous reports must be verified and substantiated in all new reports. All submitted reports should be clearly and cleanly reproduced. Photocopies of charts, tables, nomographs, calculations, or any other referenced material must be legible. If reports are unreadable, resubmittal of readable copies shall be required.

4.1.3 Submittal Adequacy. Any submittal with incomplete or absent information may result in the report being returned to the author without review. SEMSWA reserves the right to require additional information with any submittal.

4.1.4 Pre-application Meeting. A pre-application meeting, established through the City of Centennial Land Use Services, is mandatory for all applicants undertaking any land development processing steps presented either herein or in the Regulations. The applicant shall consult with SEMSWA for general information regarding the Regulations, required procedures, possible drainage problems, and specific submittal requirements.

4.1.5 Review by Referral Agencies. The review and approval of other agencies, such as special districts, State or Federal agencies, local governments, affected jurisdictions, and other referral agencies may be required for some submittals. The applicant shall be required to address referral agency

comments and obtain approvals when necessary.

TABLE 4-1
DRAINAGE REPORT SUBMITTAL REQUIREMENTS

SUBMITTAL TYPE	DRAINAGE SUBMITTAL REQUIREMENTS
ZONING	
Conventional Zoning or PDP	Phase I Drainage Report
Master Development Plan	Transitional Phase II Drainage Report
Administrative Site Plan	Phase III Drainage Report
Final Development Plan	Phase III Drainage Report
Subdivision Development Plan	Phase III Drainage Report
Use by Special Review	Phase III Drainage Report
Location and Extent	Phase III Drainage Report
SUBDIVISION	
Preliminary Plat	Phase II Drainage Report
Final Plat/Replat	Phase III Drainage Report
Minor Subdivision	Phase III Drainage Report

Note: The Drainage Report submittal requirements as outlined in this Table are general guidelines and do not represent all circumstances under which specific drainage submittals may be required. Prior to the submittal, the applicant shall consult with SEMSWA for submittal requirements regarding applications or processes not addressed in this Table.

4.2 Acceptance

4.2.1 Phase III Drainage Report Approval Required for Construction. The acceptance of a Phase III Drainage Report and construction drawings must be obtained prior to construction of any drainage improvements within the City. Phase I and Phase II drainage studies are conceptual and are reviewed by SEMSWA, but they do not receive a formal acceptance and cannot be used for construction.

4.2.2 Two Year Acceptance for Phase III Drainage Reports. Phase III Drainage Reports will be valid for two years from the date of SEMSWA acceptance. If construction drawings have not been developed and accepted by SEMSWA within two years of the Drainage Report acceptance, the Phase III Drainage Report must be submitted for re-acceptance. In order to be re-accepted, it must be demonstrated that the concepts, designs, and calculations presented in the report are consistent with current SEMSWA criteria and standards. If new concepts, criteria, or standards have been adopted since the Drainage Report was accepted and then expired, submittal of an updated Phase III Drainage Report will be required. The updated Phase III Drainage Report must be accepted by SEMSWA and that report will provide the foundation for development of the construction drawings. Phase I, Phase II, and Master Plan Drainage studies are not formally accepted, and therefore not affected by the acceptance period.

4.3 Phase I Drainage Report and Plan

4.3.1 Requirement for Phase I Drainage Report and Plan Submittal. Submittal of a Phase I Drainage Report and Plan is required with specific development or land use proposals, as generally outlined in Table 4-1. The Phase I report will describe, at a conceptual level, the feasibility and design characteristics of stormwater management facilities within the proposed development. The Phase I report shall be prepared on 8½" x 11" paper and bound, and shall be in accordance with the information presented in the following section.

4.3.2 Report Contents. The following is an outline of the **minimum** Phase I drainage report requirements:

I. COVER SHEET

II. GENERAL LOCATION AND DESCRIPTION

A. Site Location
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

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 features
8. Proposed land use & site activities
9. Groundwater investigations

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. Reference 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 impacts of the off-site flow patterns and paths, under fully developed conditions

B. Minor Drainage Basins
   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 the impacts of the off-site flow patterns and paths, under fully developed conditions

IV. EXISTING STORMWATER CONVEYANCE OR STORAGE FACILITIES

A. Existing Stormwater Conveyance Facilities
   1. Existing conveyance facilities that will be incorporated into the design
   2. Existing conveyance facilities that will be incorporated into the design with modifications
   3. Existing conveyance facilities that will be rebuilt or abandoned

B. Existing Stormwater Storage Facilities
   1. Existing storage facilities that will be incorporated into the design
   2. Existing storage facilities that will be incorporated into the design with modifications
   3. Existing storage facilities that will be rebuilt or abandoned

V. PROPOSED STORMWATER CONVEYANCE OR STORAGE FACILITIES

A. Proposed Stormwater Conveyance Facilities
   1. Conceptual discussion of proposed drainage patterns and describe differences from historic patterns
   2. Conveyance of off-site runoff
   3. Discuss the content of any pertinent tables, charts, figures, graphs, drawings, etc. that are presented in the report
   4. Discussion of anticipated conveyance problems and potential solutions
   5. Discuss the anticipated major drainageway improvements
   6. Discuss the maintenance and access aspects of the design

B. Proposed Stormwater Storage Facilities
   1. Detention storage locations and conceptual outlet structure design
   2. Discuss anticipated storage problems and potential solutions
   3. Discuss the maintenance and access aspects of the design

VI. WATER QUALITY ENHANCEMENT BEST MANAGEMENT PRACTICES

A. Non-structural BMPs
   1. Discussion of non-structural BMPs that will be part of the stormwater management plan

B. Structural BMPs
   1. Discuss structural BMPs that will be part of the stormwater management design
   2. Discuss the operation, maintenance, and access aspects of the design

C. Source Controls
   1. Discuss site activities or operations that have the potential to impact water quality
   2. Discuss source controls that may be implemented to address site activities and operations

VII. FLOODPLAIN

A. Major Drainageway – Undesignated Floodplain
   1. Discuss floodplain issues and resources and strategy for floodplain delineation

B. Major Drainageway – Designated Floodplain
   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 the scope of floodplain modifications, if proposed, including justification of why they are necessary
   3. Discuss Conditional Letter of Map Revision (CLOMR) and Letter of Map Revision (LOMR) requirements
   4. Discuss SEMSWA floodplain development regulations and Floodplain Development Permit

VIII. POTENTIAL PERMITTING REQUIREMENTS

Identify other potential local, State and Federal permitting requirements.

IX. REFERENCES

Reference all criteria, master plans, reports, or other technical information used in development of the concepts discussed in the Drainage Report

X. APPENDICES

Provide copies of all pertinent information from referenced materials

4.3.3 Phase I Drainage Plan Requirements. The following is an outline of the **minimum** Phase I drainage plan requirements. All plans must be bound.

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
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” are acceptable plan sizes
B. Title block and legend
C. Symbols consistent with SEMSWA standards
D. Scale 1”= 20’ to 1”= 100’, as required to show sufficient detail
E. Existing topographic contours with a 5 foot maximum contour interval
F. Existing stormwater conveyance or storage facilities
G. Floodplain limits, based on available information or preliminary delineation information
H. Major drainage basin boundaries
I. Conceptual locations of stormwater conveyance or storage facilities, including detention ponds, water quality enhancement ponds, storm sewers, culverts, swales, etc., consistent with the proposed development plan
J. Proposed flow directions
K. Proposed contours, if they are available

4.4 Phase II Drainage Report and Plan

4.4.1 Requirement for Phase II Drainage Report and Plan Submittal. Submittal of a Phase II Drainage Report and Plan is required with specific development or land use proposals, as generally outlined in Table 4-1. The purpose of the Phase II Drainage Report is to refine the conceptual solutions identified in the Phase I Drainage Report and to identify and provide solutions to the problems that may occur onsite and offsite as a result of the development. All reports shall be prepared on 8½"x11" paper and shall be bound. The drawings, figures, plates, and tables shall be bound with the report or included in a pocket attached to the report. The report shall include a cover letter presenting the preliminary design for review and shall be certified by a Professional Engineer licensed in Colorado.

4.4.2 Report Contents. The Phase II Drainage Report generally consists of a narrative portion and appendices with supporting calculations and other pertinent information. The narrative shall lead the reader logically through the entire

analysis and design process and provide a clear picture of all stormwater management issues. The narrative portion shall provide detailed discussion regarding the general location and description of the site, off-site and on-site drainage basins and sub-basins, drainage design criteria, stormwater management facility design, and conclusions, as provided in Sections II through V of the outline presented in this section. Discussion of methodology, assumptions, input, and a summary of results shall be provided in the narrative for all hydrologic or hydraulic modeling efforts. Peak flow rates, storage volumes, critical water surface elevations, and stormwater management facility sizes shall also be summarized or discussed in the report narrative. The appendices must provide the appropriate backup information and calculations, but the reader should not have to review information contained in the appendices to have a clear and thorough understanding of the project and the stormwater management analysis and facility designs.

The following is an outline of the **minimum** Phase II drainage 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. Site Location
   1. Site Vicinity Map
   2. Township, Range, Section, and ¼ Section
   3. Existing and proposed streets, roadways, and highways adjacent to and within 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 features
   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

B. Minor Drainage Basins
   1. On-site and Off-site minor drainage basin characteristics and flow patterns and paths under historic and developed conditions
   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

A. Regulations
   1. SEMSWA criteria and optional provisions selected, when applicable
   2. UDFCD criteria and optional provisions selected, when applicable

B. Drainage Studies, Outfall Systems Plans, Site Constraints
   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.

C. Hydrology
   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

D. Hydraulics
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
4. Detention pond routing

E. Water Quality Enhancement
1. Discuss proposed BMPs
2. Identify design procedures and WQCV
3. Discuss proposed Source Controls for site activities

F. Groundwater Investigation
1. Discuss groundwater investigations and results
2. Identify potential groundwater issues and remediation measures

V. STORMWATER MANAGEMENT FACILITY DESIGN

A. Stormwater Conveyance Facilities
1. Discuss general conveyance concepts
2. Discuss proposed drainage paths and patterns
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. Stormwater Storage Facilities
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

C. Water Quality Enhancement Best Management Practices
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

D. Floodplain

Undesignated Floodplain

1. Discuss resources and methodology for delineation of floodplain.

Designated Floodplain

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 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

VI. CONCLUSIONS

A. Compliance with Standards
   1. SEMSWA 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 SEMSWA (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

VII. REFERENCES

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

VIII. APPENDICES

A. Hydrologic Computations
   1. Determination of runoff coefficients and times of concentration
   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. Hydraulic Computations
   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. Downstream/outfall capacity to the nearest major drainageway
11. Energy dissipation at pipe outfalls
12. Floodplain modeling

C. Water Quality Enhancement Best Management Practices
   1. Design and sizing

D. Referenced Information
   1. Copies of pertinent portions of all referenced materials or drainage reports.

Note: Hydraulic computations will be required with the Phase II drainage report if the information necessary to perform the calculations is available. Availability of information will be determined by SEMSWA staff, based on the level of detail contained in the application submitted to SEMSWA. Regardless of present availability, all hydraulic computations will be required in the Phase III drainage report.

4.4.3 Certification Statement. The report shall contain a certification page with the following statement:

"I hereby affirm that this report and plan for the Phase II drainage design of (Name of Development) was prepared by me, or under my direct supervision, for the owners thereof, in accordance with the provisions of the *SEMSWA Stormwater Manual* and the Urban Drainage and Flood Control District Criteria Manual, and approved variances and exceptions thereto. I understand that SEMSWA does not and will not assume liability for drainage facilities designed by others."

SIGNATURE:_____
Registered Professional Engineer
State of Colorado No. _____
(Affix Seal)

4.4.4 Standard Forms. Use appropriate copies of SEMSWA's Standard Forms applicable to the design. When using SEMSWA standard forms, charts, nomographs, etc., the form must be annotated as necessary to depict the specific information pertinent to the site. The engineer is required to show the appropriate information relative to the design and provide the lines, notes, etc. to depict how the design information was arrived at. For example, when using street gutter capacity charts, a separate chart for each street section shall be submitted, with the specific street criteria highlighted and the final result circled.

Forms that are copied out of the book, without the appropriate annotations are not adequate and submittals will not be accepted as complete

4.4.5 Checklists. The appropriate checklists, as referenced in the individual sections of this manual must be completed and submitted with the Drainage Report. Appropriate notations shall be provided with the checklist to assist the reviewer in determining whether the design is complete. (i.e. If a specific item is not addressed, an explanation should be provided.)

4.4.6 Phase II Drainage Plan Requirements. The following is an outline of the minimum Phase II drainage plan requirements. All plans must be bound.

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
F. General drainage patterns and flow paths, including those entering and leaving the site
G. Topographic information
H. Identify existing and proposed 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 SEMSWA 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

NOTE: The items listed above will be required with the Phase II drainage report, or a written explanation as to why information cannot be provided.

4.5 Phase III Drainage Report and Plan

4.5.1 Requirement for Phase III Drainage Report and Plan Submittal. The purpose of the Phase III Drainage Report is to update the concepts, and to present the design details on construction plans for the drainage facilities discussed in the Phase II Drainage Report. Also, any change to the Phase II concept must be presented. All reports shall be typed on 8½" x 11" paper and bound. The drawings, figures, charts, plates and/or tables shall be bound with the report or included in a folder/pocket attached at the back of the report.

4.5.2 Report Contents. The Phase III Drainage Report shall be prepared in accordance with the outline shown in Section 4.4.2, above.

4.5.3 Certification Statement. The report shall be prepared by or under the direction of an engineer licensed in Colorado, certified as shown below. The report shall contain a developer certification sheet as follows:

"I hereby affirm that this report and plan for the Phase III drainage design of (Name of Development) was prepared by me, or under my direct supervision, for the owners thereof, in accordance with the provisions of the SEMSWA *Stormwater Manual* and the Urban Drainage and Flood Control District Criteria Manual, and approved variances and exceptions thereto. I understand that the SEMSWA does not and will not assume liability for drainage facilities designed by others."

SIGNATURE:_____
Registered Professional Engineer
State of Colorado No. _____
(Affix Seal)

"(Name of Developer) hereby certifies that the drainage facilities for (Name of Development) shall be constructed according to the design presented in this report. I understand that the SEMSWA does not and will not assume liability for

the drainage facilities designed and/or certified by my engineer and that the SEMSWA reviews drainage plans pursuant to Colorado Revised Statutes \; but cannot, on behalf of (Name of Development), guarantee that final drainage design review will absolve (Name of Developer) and/or their successors and/or assigns of future liability for improper design. I further understand that approval of the Final Plat, Final Development Plan, and/or Subdivision Development Plan does not imply approval of my engineer's drainage design."

_____
Name of Developer

_____
Authorized Signature

4.5.4 Phase III Drainage Plan Requirements. The report drawings shall follow the requirements presented in Section 4.4.6, above.

4.5.5 Electronic Submittal Requirements. A complete, electronic copy of the approved version of the Phase III Drainage Report, including all drawings, plates, figures, and tables must be submitted on 3½" disk or compact disc (CD) before execution of the plat or plans by the Centennial City Council.

4.6 Special Drainage Reports

4.6.1 Transitional Phase II Drainage Report. The Phase II Drainage Report requirements may be reduced at the request of the applicant if there is uncertainty regarding the final developed characteristics of individual parcels, lots, or sites within the proposed development. There is frequently uncertainty with commercial and business park developments at the preliminary or final plat stage regarding the size and placement of buildings, the detailed lot or parcel grading, the extent of paved areas, and the location of local stormwater management facilities and on-site detention facilities, if regional detention is not provided for the entire development. As the individual lots or parcels develop, separate Phase III Drainage Reports are typically prepared as the site characteristics and layout, are determined. If a Transitional Phase II Drainage Report is prepared for a development, the Phase II Drainage Report requirements shall be adhered to with the following exceptions or modifications:

1. Conservative assumptions may be made for areas where there is uncertainty regarding drainage factors related to the development of the site.
2. The level of detail may be reduced in the hydraulic and hydrologic analysis in areas where uncertainty exists.
3. Areas where assumptions are made and where the level of detail is limited shall be clearly identified so that they can be analyzed in full detail with the individual Phase III Drainage Reports and updated Transitional Phase II Drainage Report.
4. Storm water runoff routing calculations shall be completed using the assumed conditions. The Drainage Plan shall show flow paths and the method of

conveyance (open channel, street, or street and storm sewer). In addition, preliminary sizing shall be provided for all conveyance facilities, based on the conservative assumptions, if necessary.

5. The longitudinal slope on streets may not be established, but the direction of the slope and the location of the high points and the sumps in the streets shall be determined.
6. The location of detention and water quality facilities shall be shown on the plan. The volume and land area required shall be conservatively estimated; and the type of detention shall be described. The detailed outlet design calculations are not required.

It is important that all other requirements of a Phase II Drainage Report are addressed in detail. Specifically, attention needs to be given to the following points.

1. Full detail shall be provided on the analysis of offsite flows entering the development.
2. Full detail shall be provided on the analysis of the conveyance of flow from the development to the nearest major drainageway.
3. Detailed floodplain delineations shall be provided for all major drainageways within or adjacent to the development.

A Transitional Phase II Drainage Report is not considered to be final until it has been updated to reflect the land use characteristics, final grading, and local storm sewer facilities of the individual lots or parcels within the development. The developer must commit to updating the Transitional Phase II Drainage Report, as Phase III Drainage Reports are completed for the individual lots or parcels. Continuous updating is necessary, as details become available, to ensure that the original assumptions are valid, to ensure that general drainage patterns are consistent with the original assumptions, and to ensure that properly sized stormwater conveyance facilities, detention facilities, and water quality facilities are provided for the entire development.

4.6.2 Floodplain Modification Study. When improvements that require modification of the 100-year floodplain are proposed, a floodplain modification study shall be required. The requirements for a floodplain modification submittal are provided in Chapter 5.

4.6.3 Cherry Creek Basin Permanent BMP Plan Required Prior to Land Disturbance. The Colorado Department of Public Health and Environment (CDPHE), Water Quality Control Commission (WQCC), Regulation No. 72, Cherry Creek Reservoir Control Regulation, requires that a Permanent BMP Plan be submitted to SEMSWA and approved prior to the commencement of land disturbance activities. The Phase II Drainage Report and Plan requirements outlined in Section 4.4 of this chapter, specifically those related to water quality enhancement, satisfy the minimum requirements of the Permanent BMP Plan. Therefore, the Phase II Drainage Report and Plan must be reviewed and accepted by SEMSWA prior to the issuance of a Grading Permit for land

disturbance activities. This requirement will not apply to proposed land disturbance activities or projects where post construction, permanent, water quality enhancement BMPs are not required, as described in Chapter 14, or as determined by SEMSWA.

4.7 Stormwater Facilities Maintenance Agreement

Stormwater Management Facilities must be properly maintained in order to ensure that they function as designed. SEMSWA requires that a Stormwater Facilities Maintenance Agreement be executed for all stormwater facilities. The agreement requires that the stormwater management facilities be maintained in accordance with the Operation & Maintenance Manual for the facility. A copy of the SEMSWA Stormwater Facilities Maintenance Agreement can be found on the SEMSWA website at www.semswa.org.

4.8 Operation and Maintenance Manual for Stormwater Management Facilities

4.8.1 Operation and Maintenance Manual Requirement. Detention ponds, open channels, post-construction water quality BMPs, and other stormwater management facilities require proper maintenance in order to ensure that they function as designed. An O&M Manual must be developed in conjunction with the final design to provide operation and maintenance guidance for all detention ponds, open channels, post-construction BMPs, and other stormwater management facilities as determined by SEMSWA, to be submitted for SEMSWA acceptance prior to SEMSWA acceptance of the construction drawings. The O&M Manual shall be prepared by the design engineer and certified by the owner and design engineer in accordance with O&M Manual template provided on the SEMSWA website and as described in Section 4.8.2.

The purpose of the O&M Manual is to educate and provide guidance and standard forms for those entities that will be responsible for the maintenance of stormwater management facilities.

4.8.2 Development of the O&M Manual. The O&M Manual template developed by SEMSWA shall be used as the foundation for all stormwater management facility O&M Manuals. There are locations identified on the template cover page and in the table of contents and narrative sections where project specific information must be inserted. In general, the project specific information that must be inserted includes, but is not limited to, project name and location, developer name and contact information, design engineer and contact information, a general project description, and a description of the stormwater management facilities and BMPs constructed with the project and that are covered by the O&M Manual.

The template also identifies standard appendices that must be included in the O&M Manual. Standard Operating Procedures, Inspection forms, and Maintenance forms have been developed by SEMSWA for some of the commonly constructed stormwater management facilities. If Standard Operating Procedures, Inspection forms, or Maintenance forms are available for a specific

stormwater management facility, they shall be used and inserted in the appropriate appendix. If Standard Operating Procedures, Inspection forms, or Maintenance forms have not been developed by SEMSWA for a specific stormwater management facility, they must be developed by the design engineer in a format that is consistent with those developed by SEMSWA. The remaining appendices consist of an overall stormwater facilities map for the project, a plan and profile sheet, and a detail sheet for each of the specific facilities which are developed by the design engineer in accordance with the example templates. The O&M Manual Development Instructions, the O&M Manual template, and facility specific Standard Operating Procedures, Inspection Forms, Maintenance Forms, are available on the SEMSWA website at www.semswa.org.

4.9 Construction Drawings

4.9.1 Stormwater Management Improvements. Stormwater management improvements within the public right-of-way, and drainage easements or tracts are required to be designed, constructed and accepted in accordance with SEMSWA standards and criteria. Construction drawings must be developed for all stormwater management improvements and submitted to SEMSWA for review. SEMSWA acceptance of final construction plans is a condition for issuance of the Stormwater Public Improvement Permit (SPIP).

4.9.2 Construction Plan Submittal. When improvements are to be constructed, construction drawings shall be submitted with the Phase III Drainage Report.

1. Construction Plan Requirements. The construction drawings shall comply with the requirements specified in Chapter 3 of the Arapahoe County Roadway Design and Construction Standards. The construction drawings shall be prepared in accordance with sound engineering principles, SEMSWA criteria, and the City requirements for subdivision design. Construction documents shall include geometric, dimensional, structural, foundation, bedding, hydraulic, landscaping, and other details as needed to construct the storm drainage facility(s), including downstream conveyance.

The construction plans for the stormwater management improvements shall include the following information, at a minimum, for the specific facilities or components of the stormwater management system.

I. STORM SEWER AND CULVERTS

A. Plan view showing horizontal locations of all pipes, inlets, manholes, junction boxes, and outlet structures with appropriate horizontal control
B. All streets, roadways, highways, property lines, ROW lines, existing and proposed easements and tracts
C. Profile of all pipe mains, laterals, or culverts with all inverts, rim elevations, sizes, lengths, slopes, design flow rates
D. Minor and major storm hydraulic grade lines

E. Pipe outlet protection on plan and profile views
F. Utilities adjacent to or crossing storm sewer or culvert alignment
G. 1" = 20' scale, minimum, grading details for all pipe and culvert inlets and outlets
H. Maintenance access improvements
I. CDOT M&S Standard Details
J. Additional design details, as required
K. CDOT M&S Standard Notes

II. OPEN CHANNELS, SWALES, CHANNEL STABILIZATION

A. Plan view showing horizontal locations of all channels and swales, including locations of grade control structures and stabilization measures, such as check structures, drop structures, toe protection, bank stabilization, low flow or trickle channels, with appropriate horizontal control
B. All streets, roadways, highways, property lines, ROW lines, existing and proposed easements and tracts
C. Profile along channel alignment with all invert elevation and top of channel bank elevations, and design flow rates
D. Water surface limits on plan view
E. Water surface profiles for the minor storm, major storm, and emergency conditions
F. Maintenance access improvements
G. Side tributary channels and pipe outlets
H. Utilities adjacent to or crossing channel alignment
I. SEMSWA Standard Details
J. Additional design details, as required
K. SEMSWA Standard Notes

III. DETENTION/STORAGE FACILITIES

A. Plan view showing horizontal locations of the pond, including locations of low flow or trickle channels, outlet structure, emergency overflow spillway, pipe or channel inlets, etc. with appropriate horizontal control
B. All streets, roadways, highways, property lines, ROW lines, existing and proposed easements and tracts
C. Profile along trickle or low flow channel from all inlets/structures to the outlet structure and pipe with all invert and outlet structure elevations and water surface elevations
D. 1" = 20' scale, minimum, grading details for all pipe and culvert inlets and outlets
E. Water surface limits for the minor storm, major storm, and emergency overflow conditions
F. Summary table on plan view with stage-storage-discharge characteristics
G. Maintenance access improvements
H. Utilities adjacent to or crossing the detention area

I. SEMSWA Standard Details
J. Additional design details, as required
K. SEMSWA Standard Notes

IV. WATER QUALITY ENHANCEMENT BMPS
A. Plan view showing horizontal locations of the improvements
B. All streets, roadways, highways, property lines, ROW lines, existing and proposed easements and tracts
C. Profile of improvements, as required
D. Maintenance access improvements
E. Utilities adjacent to or crossing the improvements
F. SEMSWA Standard Details
G. Additional design details, as required
H. SEMSWA Standard Notes

4.9.3 Certification. Construction Drawings submitted for review and acceptance shall be prepared by a professional engineer, registered in the State of Colorado. The construction drawings must include the following statement on the cover sheet:

"I hereby affirm that these construction drawings for (name of subdivision, development, or project) were prepared by me (or under my direct supervision) in accordance with the requirements of the Roadway Design and Construction Standards and the SEMSWA Stormwater Management Manual.

Name of Engineer
PE Number
Name of Engineering Firm

This statement shall be signed, stamped and dated by the Registered Professional Engineer who prepared or directed the preparation of the drawings.

4.10 Record Drawings and Acceptance of Improvements

All stormwater improvements that have been constructed within City right-of-way and stormwater easements must be accepted by SEMSWA. SEMSWA's acceptance process verifies that the improvements have been constructed in accordance with the requirements. SEMSWA acceptance does not mean that SEMSWA accepts the facilities for maintenance. Maintenance of stormwater facilities is the responsibility of the property owner or as otherwise defined by legal agreement or documents. SEMSWA will perform necessary inspections to ensure that maintenance is being performed. Submittal requirements for the acceptance process are described in Chapters 7 and 11 of the Arapahoe County Roadway Design and Construction Standards.

4.10.1 Record Drawing Requirements. Record drawings, including the required "Statements of Substantial Completion" by the Project Engineer and Surveyor shall be submitted in accordance with Chapter 7 of the Arapahoe County Roadway Design and Construction Standards. The record drawings shall be

submitted as original black line reproductions suitable for scanning as a computer image in a format acceptable to SEMSWA.

In order to efficiently update the Arapahoe County system-wide stormwater inventory maps, SEMSWA requests that electronic files be provided in addition to hard copy record drawings.

4.10.2 Acceptance. The process for SEMSWA's acceptance of public improvements is described in Chapter 11 of the Roadway Design and Construction Standards.

4.11 Summary Table of Required Certifications and SEMSWA Action

TABLE 4-2
SUMMARY OF REQUIRED CERTIFICATIONS AND SEMSWA ACTION

ITEM	CERTIFICATION REQUIRED	SEMSWA ACTION
Phase I Drainage Report	None	Review and comment
Phase II Drainage Report	Engineer/Developer	Review and comment
Phase III Drainage Report	Engineer/Developer	Approval
Transitional Phase II Drainage Report	Engineer/Developer	Approval
Construction Drawings	Engineer	Approval
Record Drawings	Engineer/ Land Surveyor	Probationary Acceptance
O&M Manual for Stormwater Facilities	Owner/Developer	Review & Acceptance
Floodplain Modification Study	Owner/Developer/ Engineer	Approval