Contents

900 DESCRIPTION 1
901 GENERAL DESIGN CRITERIA 1
901.01 Design Storms 1
901.02 Storm Sewer and Inlets 1
901.03 Street Capacities 1
901.04 General 2
901.05 Water Quality 2
901.06 Detention 2
902 DRAINAGE PLAN SUBMITTAL REQUIREMENTS 3
902.01 Review Process 3
902.02 Conceptual Drainage Report 3
902.03 Preliminary Drainage Report 5
902.04 Final Drainage Report 11
903 DRAINAGE IMPROVEMENTS ON PRIVATE PROPERTY 11
904 TERM OF PLAN APPROVAL 12
905 RECORD DRAWINGS 12

900 DESCRIPTION

1. Storm drainage improvements design and reporting requirements shall be completed in accordance with these. The Town of Frederick has adopted the *Urban Storm Drainage Criteria Manuals (Volumes 1-3*) and the *South Weld I-25 Corridor Master Drainage Plan*. Urban Drainage manuals are available on-line and the South Weld study is available through Weld County. The Town of Frederick may adopt additional drainage studies. It is the Developers responsibility to contact the Town.

2. In accordance with Section 116 of these specifications, a complete set of record drawings shall be stamped and signed by a Professional Engineer registered in the state of Colorado and submitted to the Town Engineer at the completion of construction. Also, a *Certification Letter* shall be submitted prior to issuance of any building permits describing any deviations from the approved plan set and/or drainage report with As-built survey information and submitted for consideration by the Town Engineer. This Certification Letter shall also have as-built survey information for all detention facilities with actual storage and design storage volumes included.

901 GENERAL DESIGN CRITERIA

901.01 Design Storms

Minor Storm (Design excluding detention) = 5-year Return Frequency Storm

Minor Storm (Detention only) = 10-year Return Frequency Storm

Major Storm (Design and Detention) = 100-year Return Frequency Storm

Notes:

a. If the property is within the Tri-Town Basin as identified in the South Weld I-25 Corridor Master Drainage Plan the release from on-site detention facilities shall be limited to the 2-year existing condition peak discharge during the 100-year storm event.

901.02 Storm Sewer and Inlets

The storm sewer and inlets shall have a minimum design capacity equal to the minor storm peak flows. Storm sewer must be RCP. The minimum storm sewer size is 15-inch diameter.

901.03 Street Capacities

1. Gravel Road

Major Storm Event – The 100-year runoff tributary to the borrow ditches shall be contained entirely within the ditches. Additional ROW may be required to increase the capacity of the ditches if the 100-year runoff exceeds the capacity of the ditches.

2. Local Road

Minor Storm Event – No curb overtopping.

Major Storm Event – The maximum depth at the centerline of the roadway may not exceed 0.10-feet.

3. Collector Road

Minor Storm Event – No curb overtopping.

Major Storm Event – The spread must be contained in the ROW. The depth at the flowline must not exceed 18-inches and also maintain one 12-foot travel lane open.

4. Arterial Road

Minor Storm Event – The spread must be contained in the ROW. The spread must also maintain at least one 12-foot travel land free of water in each direction.

Major Storm Event – The spread must be contained in the ROW. The spread must also maintain at least one 12-foot travel lane free of water in each direction.

901.04 General

The report shall demonstrate safe passage of 100-year flows (off-site and on-site) through the project site and into the downstream receiving body or structure.

901.05 Water Quality

Water quality detention shall have a minimum holding time of 24-hours and a maximum holding time of 40-hours. Design of water quality features including Best Management Practices (BMPs) shall be per UDFCD Criteria Manual Volume 3 requirements and subject to final approval by the Town.

901.06 Detention

All stormwater detention facilities shall be designed per UDFCD Criteria. Emergency spillways are required on all ponds set at the 100-year water surface elevation so that in the event the pond outlet is blocked the runoff will be conveyed over the spillway and continue in a safe manner on the original drainage path. Emergency spillways shall not be utilized to convey the 100-year storm runoff under normal conditions, they are for emergencies only.

Retention and Percolation ponds with pumping facilities are allowed in the Town of Frederick only with written approval from the Town Engineer.

902 DRAINAGE PLAN SUBMITTAL REQUIREMENTS

902.01 Review Process

All new developments within the jurisdiction of the Town of Frederick shall submit drainage reports in accordance with the requirements of this section. Further, the Town of Frederick has adopted the Urban Drainage and Flood Control District standards and therefore, all requirements therein shall be in effect in conjunction with these requirements. Preliminary and Final Drainage Reports shall be submitted in hard copy (2) and electronically including: 1) spreadsheet summary tables; 2) runoff and routing model inputs and outputs; and 3) AutoCAD drawings.

902.02 Conceptual Drainage Report

1. The purpose of the Conceptual Drainage Report is to identify and define conceptual solutions to problems, which may occur on-site and off-site as a result of the development. In addition, those problems that exist on-site prior to development must be addressed during the conceptual phase. All reports shall be typed on 8-1/2" x 11" paper and bound. The drawings shall be bound within the report or included within a pocket attached inside the back cover of the report. The report needs to stand-alone and therefore all important reference material should be copied and included within the report appendix. The report shall include a cover letter presenting the conceptual design for review and shall be prepared by or supervised by a professional engineer licensed in Colorado. The report shall contain a certification sheet as follows:

   "I hereby certify that this report for the conceptual drainage design of (Name of Development) was prepared by me (or under my direct supervision) in accordance with the provisions of the Urban Drainage and Flood Control District Storm Drainage Criteria and supplemental Town of Frederick requirements for the owners thereof."

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

2. Report Contents

   The Conceptual Drainage Report shall be prepared in accordance with the following outline and contain the applicable information listed:

   a. General Location and Description

      i. Location

1. Township, range, section, ¼ section.
2. Local streets within and adjacent to the development.
3. Major open channels and facilities.
4. Names of surrounding developments.

ii. Description of Property

1. Area in acres.
2. Ground cover
3. Major open channels.
4. General project description.
5. Irrigation facilities.

b. Drainage Basins and Sub-Basins

i. Major Basin Description

1. Reference to I-25 Corridor Master Drainage Plan (Anderson, 2000) or other plans accepted by the Town.
2. Major basin drainage characteristics
3. Identification of all nearby irrigation facilities within 100 feet of the property boundary.

ii. Sub-Basin Description

1. Historic drainage patterns on the subject property.
2. Off-site drainage flow patterns and impact on the subject property.

c. Drainage Facility Design

i. General Concept

1. Drainage problems encountered and solutions at specific locations.
2. Maintenance access and aspects of the design.

3. Drawing Contents

A General Location Map shall be provided at a scale of 1" = 2000' or larger in sufficient detail to identify upstream off-site drainage areas flowing into the development and general drainage patterns. A vicinity map should be included on an .5" x 11" sheet.

A Drainage Plan of the proposed development shall be provided at a scale from 1" = 100' to 1" = 200' on a 24" x 36" drawing. The plan shall show the following information:

a. Existing contours at 2-feet maximum intervals.

b. Property lines, lot lines, and easements.

c. Streets with names.

d. Existing drainage facilities, structures, irrigation facilities, and sizes.

e. Overall drainage area boundary and sub-area boundaries.

f. Proposed flow directions using arrows.

g. Conceptual location of storm sewers, swales, open channels, culverts, detention ponds, and other appurtenances.

h. Location of all defined 100-year floodplains affecting the property.

i. Any other items so noted within the Drainage Report

902.03 Preliminary Drainage Report

1. The purpose of the Preliminary Drainage Report is to identify and define preliminary solutions to problems, which may occur on-site and off-site as a result of the development. In addition, those problems that exist on-site prior to development must be addressed during the preliminary phase. All reports shall be typed on 8.5" x 11" paper and bound. The drawings shall be bound within the report or included within a pocket attached inside the back cover of the report. The report needs to stand-alone and therefore all important reference material should be copied and included within the report appendix. The report shall include a cover letter presenting the preliminary design for review and shall be prepared by or supervised by a professional engineer licensed in Colorado. The report shall contain a certification sheet as follows:

"I hereby certify that this report for the preliminary drainage design of (Name of Development) was prepared by me (or under my direct supervision) in accordance

with the provisions of the Urban Drainage and Flood Control District Storm Drainage Criteria and supplemental Town of Frederick requirements for the owners thereof."

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

2. Report Contents

The Preliminary Drainage Report shall be in accordance with the following outline and contain the applicable information listed:

a. General Location and Description

1. Location

a. Township, range, section, 1/4 section.

b. Local streets within and adjacent to the development.

c. Major open channels and facilities.

d. Names of surrounding developments.

2. Description of Property

a. Area in acres.

b. Ground cover.

c. Major open channels.

d. General project description.

e. Irrigation facilities.

b. Drainage Basins and Sub-Basins

1. Major Basin Description

a. Reference to I-25 Corridor Master Drainage Plan (Anderson, 2000) or other plans accepted by the Town.

b. Major basin drainage characteristics

c. Identification of all nearby irrigation facilities within 100-feet of the property boundary.

2. Sub-Basin Description

    a. Historic drainage patterns on the subject property.
    b. Off-site drainage flow patterns and impacts on the subject development.

3. Summary Table that includes the following information for each sub-basin:

    a. Basin Name

    b. Area (acres)

    c. Initial flow length (ft)

    d. Travel flow length (ft)

    e. Average basin slope (ft/ft)

    f. Impervious area (acres and percent)

    g. Runoff Coefficients (5-year; 10-year and 100-year)

    h. Time of Concentration (with input parameters)

    i. Peak Runoff Rate (5-year; 10-year and 100-year)
    Refer to the example table.

c. Drainage Design Criteria

1. Regulations: Discussion of the optional criteria selected or the deviation from the Town or UDFCD criteria if any.

2. Development Criteria Reference and Constraints

    a. Discussion of previous drainage studies (i.e., project master plans) for the subject property that influence or are influenced by the drainage design and how the plan will affect drainage design for the site.

    b. Discussion of the drainage impact of site constraints such as street, utilities, existing structures, and development or site plan.

3. Hydrological Criteria

    a. Identify design rainfall.

b. Identify runoff calculation method.

b. Identify detention discharge and storage calculation method.

c. Identify design storm recurrence intervals.

d. Discussion and justification of other criteria or calculation methods used that are not presented in or referenced by the Town or UDFCD criteria.

4. Hydraulic Criteria

a. Identify various capacity references.

b. Identify detention outlet type.

c. Identify check/drop structure criteria used.

e. Discussion of other drainage facility design criteria used.

d. Drainage Facility Design

1. General Concept

a. Discussion of concept and typical drainage patterns.

b. Discussion of compliance with off-site runoff considerations.

d. Discussion of the content of tables, charts, figures, or drawings presented in the report.

e. Discussion of anticipated and proposed drainage patterns.

2. Specific Details

a. Discussion of drainage problems encountered and solutions at specific design points.

b. Discussion of detention storage and outlet design

c. Discussion of maintenance access and aspects of the design.

3. Summary Table(s)

a. Discharge at Design Points

ii. Design points should include at a minimum: all culverts, inlets, pipes or channel sections where a

change of flowrate occurs or a design component proposed.

iii. All Design Points should have peak 5-year and 100-year flows summarized in this table.

iv. Location/Description of Design Component

v. Minimum facility size

4. Detention Pond Table(s)

a. Each detention pond should have a table that summarizes the *Area-Stage-Storage-Discharge relationship* for each detention facility.

b. The outlet invert elevation and 100-year maximum water surface elevation should be specified on this table.

Refer to the example tables.

e. Conclusions

1. Compliance with the Town and UDFCD criteria.

2. Drainage Concept

a. Effectiveness of drainage design to control damage from storm runoff.

b. Influence of proposed development on the Local Master Drainage Plan recommendations.

c. Approval of affected irrigation company or other property owner to be obtained.

f. References: Reference all criteria and technical information used.

g. Appendices

1. Hydrology Computations

a. Land use assumptions regarding adjacent properties.

b. Initial and major storm runoff computations at specific design points.

c. Historic and fully developed runoff computations at specific design points.

2. Hydraulic Computations

a. Culvert sizing.

b. Storm sewer sizing (15-inch RCP minimum).

c. Street capacity evaluation.

d. Storm inlet sizing.

e. Swale sizing.

f. Open channel sizing.

g. Check and/or drop structure sizing.

h. Detention pond area/volume capacity and outlet sizing.

3. Drawing Contents

A General Location Map shall be provided at a scale of 1" = 2000' or larger in sufficient detail to identify upstream off-site drainage areas flowing into the development and general drainage patterns.

A Drainage Plan of the proposed development shall be provided at a scale from 1" = 100' to 1" = 200' on a 24" x 36" drawing. The plan shall show the following information:

a. Existing and proposed contours at 2-feet maximum intervals,

b. Property lines, lot lines, and easements.

c. Streets with names.

d. Existing drainage facilities, structures, irrigation facilities, and sizes.

e. Overall drainage area boundary and sub-area boundaries.

f. Proposed flow directions using arrows.

g. Proposed storm sewers, swales, open channels, culverts, cross-pans, and other appurtenances, including cross-sections of swales and open channels.

h. Proposed outfall point for runoff from the development area and facilities to convey flows to the final outfall point without damage to downstream properties.

i. Routing and accumulation of flows at various critical points for the minor storm runoff.

j. Routing and accumulation of flows at various critical points for the major storm runoff.

k. Detention storage facilities and outlet works, including proposed 100-year water surface elevations.

l. Location and elevations of all defined 100-year floodplains affecting the property.

m. Location of all existing and proposed utilities.

n. Routing of off-site drainage flows through the development.

o. Minimum lowest opening elevations of residential and commercial buildings above the 100-year water surface in streets, open channels, ditches, swales, or other drainage facilities, as illustrated by the preliminary grading plans.

p. Proposed on-site private and public drainage easements.

q. Proposed off-site private and public drainage easements.

902.04 Final Drainage Report

1. The purpose of the Final Drainage Report is to update the preliminary design concepts, and to present the design details for the drainage facilities discussed in the Preliminary Drainage Report. Also, any change to the preliminary concept shall be presented.

2. All reports shall be typed on 8.5" x 11" paper and bound. The drawings shall be bound within the report or included within a pocket attached inside the back cover of the report. The report needs to stand-alone and therefore all important reference material should be copied and included within the report appendix. The report shall include a cover letter presenting the final design for review and shall be prepared by or supervised by a professional engineer licensed in Colorado. A certification sheet similar to the Preliminary Drainage Report shall be included indicating Final Drainage Report.

903 DRAINAGE IMPROVEMENTS ON PRIVATE PROPERTY

1. Drainage improvements on private property that do not receive storm runoff from other parcels, do not serve public area and are not within Town drainage easements or right of way, will not be reviewed or maintained by the Town. However, private sewers shall still meet typical levels of service including not flooding vehicles in parking lots and adequate freeboard on finished floor elevations. The Town Engineer may make exceptions in writing.

2. All groundwater drainage facilities shall remain private and require an encroachment permit from the Town to be constructed and operated in a public right of way or on public land. Groundwater discharge is subject to Town approval and water quality standards that might be imposed by the Town.

904 TERM OF PLAN APPROVAL

Drainage plans shall be valid for two years after approval of the Final Drainage Report unless the Town Engineer estimates that off-site or on-site changes may have significant effect on the proposed plan.

905 RECORD DRAWINGS

1. A Pond Certification Letter with As-Built Survey prepared by a registered engineer is required to be submitted for review and acceptance by the Town Engineer prior to issuance of a certificate of occupancy for a commercial or industrial lot, public facility, or conditional acceptance of Public Improvements within a subdivision.

2. The As-Built Survey shall identify the designed and constructed contours of the pond and embankment as well as elevations the outlet structure.

3. The Pond Certification Letter shall describe the difference between the proposed and constructed pond grade, capacity, outlet structure, etc. and verify that the pond will function as designed and meets the requirements of the UDFCD Criteria Manual and these Standards and Specifications.