



# Major Engineering Design

## Stormwater and Drainage Requirements

City of Aspen Engineering Department

There are three main components to a Major Engineering Design.

1. Stormwater and Drainage
2. Utilities
3. Public Improvements

The following checklist contains all information that must be included within a Major Engineering Submittal in regard to **Stormwater and Drainage**. Please reference supporting documents for Utilities and Public Improvement Requirements.

Refer to the COA Urban Runoff Management Plan for all stormwater and drainage standard requirements. The purpose of this document is to outline submittal requirements not to specify standards.

Refer to the document titled “Criteria for Major Engineering Review” to determine if your project triggers the need for a Major Engineering Plan and Report in the permit submittal.

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Engineering Major Submittal Requirements Updated March 2022



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## Stormwater and Drainage Requirements

### Drainage Report

#### *General*

1. Signature, date, and stamp of a Colorado Professional Engineer.
2. Description of the existing site, including common location, topography, land use, ground cover, soil type, drainage pattern, and receiving system.
3. Description of the proposed project, including changes to land use, topography, ground cover, soil type, drainage pattern and receiving system.
4. Discussion of any previous drainage studies (i.e., project master plans) for the site that influence or are influenced by the drainage design and the mitigation plan for any negative impacts.
5. Discussion of the effects of adjacent drainage issues.
6. Reference to major drainage way planning studies such as flood hazard delineation reports, master plans, and flood insurance rate maps.
7. Discussion of the drainage impact of site constraints such as streets, utilities, existing structures, and development or site plan.
8. Identification of all ditches and waterways within the watershed that will influence or be influenced by the site drainage.
9. Discussion of easements and tracts for drainage purposes, including the conditions and limitations for use.
10. Report must include printed copies of the input and output files for all computer models used for the analysis and design.
11. Reference plan drawings as needed.

#### *Drainage Basins and Sub-basins*

12. Describe existing and proposed sub-basins, including ground cover, acreage, soil type, and location and method of discharge.
13. Delineate and reference sub-basins on a map with contours. Each drainage basin should be labeled with its area (in acres), runoff coefficient (C), and Q (cfs).
14. Discuss offsite drainage patterns and impact on site under existing basin conditions and fully developed basin conditions.
15. Discuss pre-developed/historic and post-developed drainage flow rates at specified point locations (should match labeled locations on plan).



### *Low Impact Site Design*

16. Describe what efforts have been made to reduce runoff and increase infiltration (e.g. reduce impervious area, disconnect impervious area, route runoff via landscape rather than hard infrastructure).

### *Hydrologic Criteria*

#### *Properties Inside the Aspen Mountain Drainage Basin*

17. Identify flow capacity of all drainage facilities.
18. Calculate storm inlet and area drains capacity with a clogging factor = 50%.
19. Calculate pipe sizes with capacities and area of contribution. Show pipes can convey flow from the contributing area with 80% capacity or less.
20. Provide open channel design and calculations for all swales. Show capacity and water surface elevation on all swales.
21. For large scale or Public Storm systems calculate storm sewer capacity including capacity of next two downstream drainage structures at the connection point (max velocity 20 ft/sec, HGL 12 inches below ground, EGL below ground, minimum velocity of 5 ft/sec at half full conduit flow).
22. For large scale or public storm systems calculate gutter capacity (max velocity 10 ft/sec, allowable spread = 4 feet minor storm, 12-inch depth at flow line for major storm,  $n=.016$  for street,  $n=.025$  for grass)
23. Calculate the downstream/outfall system capacity to the major drainage way system. Verify there is capacity for any additional runoff leaving the developed site.
24. Identify the runoff calculation method. Typically, the Rational Method is utilized. Refer to Chapters 2 and 3 of the URMP for rainfall and runoff information.
25. Identify the design storm recurrence intervals. Typically, the 10- and 100-year storms will be utilized.
26. Include discussion and justification of criteria and calculation methods used.
27. Identify the proposed sub-basins area, impervious area, rainfall intensity, time of concentration, runoff coefficients, runoff rate, and required WQCV for each proposed sub-basin.
28. Provide calculations of the WQCV for each sub basin. For each sub basin call out what onsite BMP will be utilized to capture the WQCV leaving that sub-basin.
29. Discuss overflow rates and where runoff beyond the WQCV will be routed.
30. Provide discussion that all runoff above the WQCV is routed to the City storm system or to a functioning curb and gutter which ultimately leads to a storm system. If runoff cannot be routed to the City system, the property is required to provide detention.
31. If a property drains to an alley demonstrate the alley is graded to convey all runoff from the block. If an alley cannot adequately convey runoff from the entire contributory area then detention will be required on the site.
32. Provide discussion that any runoff above the WQCV is not routed onto neighboring properties.



### Properties Outside the Aspen Mountain Drainage Basin

Include the following in addition to all items listed for properties *Inside* the Aspen Mountain Drainage Basin:

33. Calculate the historic runoff rate for each sub basin. The historic condition is entirely vacant land with no development nor impervious area.
34. Calculate the post development runoff flows for each sub-basin prior to inclusion of detention.
35. Identify the detention storage calculation method. Refer to Chapter 5 for acceptable detention calculation methods. Refer to section 8.5.4.2 for a drywell detention calculation method.
36. Compare post-development flows with detention infrastructure to pre-development flows. Post development flows must not exceed pre-development flows offsite. Calculate and call out historic and proposed runoff rates for each location that runoff leaves the site.
37. If applicable provide Hydrographs at critical design points.

### Proposed Facilities

38. Describe proposed best management practices (BMPs) used to treat the water quality capture volume. Provide sizing calculations and locations of BMPs used. Describe runoff routing to the BMP and overflow routing out of the BMP.
39. For properties outside the Aspen Mountain Drainage Basin describe detention facilities, detention methods, and outlet design.
40. Provide volumes and release rates for detention storage facilities and information on outlet works.
41. Discussion of easements and tracts for drainage purposes, including the conditions and limitations for use.
42. Discussion of the off-site drainage facilities needed for the conveyance of minor and major flows to the major drainage way.
43. Provide a separate section of the report that includes a narrative of the Operation and Maintenance requirements of the proposed on site drainage improvements. Include a description of access for maintenance operations, maintenance schedule, and contact information for party responsible for maintenance.

## Grading and Drainage Plan

### General

1. Signature, date, and stamp of Colorado Professional Engineer on each plan sheet.
2. Vicinity map with north arrow and scale.
3. Scale of 1"=10' to 1"=40' or plan must be provided in sufficient detail and clarity to identify drainage flows entering and leaving the development and general drainage patterns.
4. Benchmark and tie to the City of Aspen Survey.
5. Name of the subdivision or project, property map and parcel number.
6. Date of preparation, scale, and symbol designating true north.
7. Legend to define map symbols.



8. Property lines and easements with purposes noted.

#### *Grading and Spot Elevations*

9. Existing and proposed contours at 1-foot maximum intervals. In terrain where the slope exceeds 15%, the maximum interval is 10 feet. If necessary to show offsite drainage patterns the contours shall extend beyond the property lines. Additional topography can be obtained from the City of Aspen GIS Department.
10. Finished floor and grade at foundation elevations of all buildings. In residential developments also provide lot corner elevations and any grade break elevations critical to the grading concept. Show positive drainage away from structures as required by Building Code (IRC – R401.3 and IBC – 1805.3.4).
11. Spot elevations critical to describe drainage features and their functions (e.g. inlets, cross pans, spillways, inlets/outlets of manholes, culverts, and storm sewers).

#### *Drainage Basins and Stormwater Routing*

12. Overall drainage area boundary and drainage sub-area boundaries for all basins on and off site.
13. Proposed outfall point for runoff from the developed area and facilities to convey flows to the final outfall point without damage to downstream properties.
14. Routing and accumulation of flows at various critical points for the initial and major storm runoffs listed on the drawing.
15. Routing of offsite drainage flow through the development.
16. Flow path leaving the development through the downstream properties ending at a major drainage way.
17. Summary Runoff Table.

#### *Floodplain and Top of Bank*

18. Location, elevation, and FIRM rate code for all existing floodplains within 100' of property.
19. Indicate the top of slope of the Roaring Fork River and its tributaries (Hunter Creek, Castle Creek, and Maroon Creek) and delineate the 15' no-touch setback.
20. All major drainage ways for which the 100-year floodplain and floodway have been defined shall have the 100-year floodplain and floodway delineated on the plans. This also applies to detention basins.

#### *Existing and Proposed Site Plans*

21. Existing building footprints, streets, utility locations and elevations, ROW width, flow line width, curb type, sidewalk, approximate slopes, drainage facilities and structures, irrigation ditches, roadside ditches, drainage ways, gutter flow directions, and culverts. All pertinent information such as material, size, shape, slope, and location shall also be included.
22. Proposed building footprints, streets, utility locations and elevations, ROW width, flow line width, curb type, sidewalk, approximate slopes, drainage facilities and structures, irrigation ditches, roadside ditches, drainage ways, gutter flow directions, and culverts. All pertinent information such as material, size, shape, slope, and location shall also be included.

#### *Conveyance Infrastructure*

23. Proposed type of street flow (i.e., vertical or combination curb and gutter), roadside ditch, gutter, slope and flow directions, and cross pans.



24. Proposed storm sewers and open drainage ways, including inlets, manholes, culverts, and other appurtenances, (i.e. riprap protection, allowable manhole spacing = 400 ft).
25. Profile views for all subsurface drainage facilities showing their size, slope, lengths, design storm hydraulic grade lines (major and minor), energy grade lines, cover, details of structures and/or City Standard details, and relationship with existing utilities. Refer to the COA Engineering Design Standards for minimum utility separation requirements.
26. Cross-sectional views of all open channels, including irrigation ditches, trickle channels, spillway structures, etc., as necessary. These views shall include applicable easement/property line/ROW boundaries and water surface elevations such as the 100-year storm depth, 2-year storm depth, major storm (100-year) freeboard, and irrigation operating level.

#### *Landscaping*

27. Proposed landscaping (berms, planters, shrub beds, trees, etc.). Overlay the actual landscape plan onto the proposed grading and drainage plan.

#### *Natural Hazards*

28. Natural hazards: The designation of all areas that constitute natural hazard areas including but not limited to snow slide, avalanche, mudslide, and rockslide. Show areas with slopes from 30% to 40% and areas with slopes greater than 40%. Areas with slopes from 30% to 40% and areas with slopes greater than 40% will require a slope stability study performed by the Colorado Geological Survey (800-945-0451). Refer to Chapter 6 of the COA Engineering Design Standards.

#### *Details*

29. Civil details of dry wells, outlet structures, foundation drain sumps, custom design, etc.

#### *Erosion and Sediment Control*

30. Erosion prevention and sediment control measures for all phases of construction, including areas of revegetation.