CITY OF Killdeer
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# Stormwater Management Standards

## Applicability

If the project creates more than 20,000 square feet of new impervious area, these standards apply. Note that impervious area includes, but is not limited to, pavement, rooftops, sidewalks, driveways, and gravel surfaces.

## Design Requirements

1. If the City deems that the project will significantly increase downstream or upstream flood elevations, the City may place additional drainage and stormwater requirements on the project beyond those listed below.
2. Implement stormwater management BMPs to reduce the post-development peak discharge rate to the pre-development peak discharge rate for the 2-year, 5-year, 10-year, and 100-year, 24-hour events.
3. The site shall safely pass the 100-year event (i.e. no homes, buildings, or structures are inundated). Please note that the conveyance system (storm sewer, roadside swales, and overland flow) will need to have the capacity to drain the site to the proposed stormwater facilities.
4. Stormwater management facilities shall have a maximum drain down time of 72 hours. If infiltration in the stormwater management facilities is relied upon, Applicant shall discuss and obtain approval from the City that this is an acceptable approach. Additional design recommendations will be provided by the City if infiltration in stormwater facilities is proposed.
5. Capacity of stormwater facilities shall account for off-site runoff contributions.
6. Storm sewer and inlets shall be designed such that the hydraulic grade line (HGL) does not exceed the ground surface up to and including the 5-yr design event.
7. Streets, curbs, gutters, and inlets should be designed such that no overtopping of the curb occurs and a width of at least 12’ must be maintained within the center of each road to allow for safe vehicle passage during storm events up to the 5-yr event. Flow extents shall not exceed the right-of-way or roadway easement for the 100-yr design event.
8. Provide a minimum separation distance between water mains and storm sewer similar to the separation required for sanitary sewer. As an alternative, the Applicant can prepare a design to limit the potential for contamination of the water supply from storm sewer flow.
9. All culvert, storm sewer, and basin outlets shall be designed to have a stable outlet and not cause downstream erosion.
10. Sag curves on roadways shall be designed such that the ponding extents from the 100-yr design event do not extend past the right-of-way or roadway easement. Inlets at sag points shall include curb openings or other means to address the potential for clogging from debris accumulation.

**Drawing Contents**

1. Site Plan including the information below (Scale not greater than 1"=200')
    a. Property Lines;
    b. Natural and Artificial Water Features;
    c. 100-Year Floodplain and/or Floodway;
    d. NWI Wetland Boundaries (delineated, if available);
    e. Existing Contours to 100 feet past property line (2-foot maximum interval), also list data source and vertical datum;
    f. Existing Impervious Area; and
    g. Existing Culvert Sizes and Lengths.
2. Proposed Site Plan drawing set including the information below, as applicable (Scale not greater than 1" = 200')
    a. Proposed Contours (same interval as existing);
    b. Proposed Impervious Area;
    c. Proposed Culvert Sizes and Lengths;
    d. Prepare grading plan for each stormwater facility, although a separate sheet of each facility is not needed provided each facility is clearly labeled on the overall site plan;
    e. Cross sections of each stormwater facility (not required but recommended for ease of review);
    f. Prepare stormwater facility outlet details or note culvert geometries (size, type, endwall condition, inverts) for all outlets;
    g. Provide an emergency overflow location on all stormwater management facilities to accommodate flows in excess of the facility capacity;
    h. Provide plan and profiles of all storm sewer, which also shows all other existing and proposed utilities to identify potential conflicts; and
    i. Outlot locations and easements (including drainage easements).

**Report Contents**

1. Narrative describing the proposed project
2. Describe the ultimate discharge point for the stormwater (river name) and how it gets there.
3. Describe past studies that are relevant to the project area (including source, date, and any information available).
4. Describe known past flooding events that are relevant to the project area (including source, date, and any information available).
5. Data used and gathered for this study.
6. Describe the methodology used to determine compliance with the peak discharge criteria. We recommend using NRCS (Curve Numbers, Times of Concentration, Type II Distribution) or SWMM methodology. If another method is selected by the Applicant, prior approval of the Applicant's desired approach is necessary.

7. When using NRCS methodology, runoff from the pervious and impervious areas of the site should be computed separately (i.e. if there are 5 acres of pervious at CN = 61 and 5 acres of impervious at CN = 98, do not average the values).
8. Provide summary table(s) demonstrating compliance with the stormwater design requirements.
9. Provide summary table(s) of basin geometry and outlet structure geometry (key inverts, sizes, etc.)
10. Provide summary table(s) listing peak elevations in stormwater management features, accounting for off-site contributing areas as applicable.
11. Provide summary table(s) listing peak velocities and depths in surface drainage features, accounting for off-site contributing areas as applicable.
12. Provide summary table(s) summarizing storm sewer and culvert outlet velocities.
13. Provide summary table(s) or profile plot(s) summarizing manhole rims, manhole inverts, and manhole 5-year elevations in storm sewers.
14. Provide supporting calculations (in the form of brief but complete model output).
15. Please provide calculations demonstrating that the inlets have the necessary capacity to convey the 5-year event into the storm sewer system (accounting for the allowed ponding).
16. Provide sizing calculations for all drainage features such as culverts, storm sewer, and ditches, accounting for off-site contributing areas as applicable.
17. If off-site contributions are substantial (>50% of the site's contributing area), the Applicant should describe the implications to the stormwater facilities if the upstream areas develop consistent with the requirements outlined in this checklist.
18. Provide a map showing existing conditions topography, existing lot boundaries, subwatershed boundaries, and applicable runoff parameters. For example, when using NRCS methodology include existing NRCS soils and corresponding Hydrologic Soil Group classification, and Times of Concentration (Tc) flow paths.
19. Provide a map showing proposed conditions topography, proposed lot boundaries, roadway ROWs, subwatershed boundaries, and applicable runoff parameters. If using NRCS methodology, as an alternative for computing Times of Concentration flow paths in proposed conditions, the Applicant may use a Tc of 6 minutes.
20. On both the existing and proposed conditions maps, subwatersheds should be labeled with a unique identifier along with the area, percent impervious, and applicable runoff parameters.
21. Describe maintenance guidelines for drainage and stormwater management facilities.
22. Provide an exhibit showing peak 100-yr water surface elevations in ponds and surface drainage features included in easements. For surface drainage features, label the 100-yr elevations at a spacing no greater than one label per 100 feet.

**Drainage and Stormwater Easements**

1. Identify the entity responsible for long-term maintenance of all stormwater management and drainage facilities.
2. Detention pond areas shall include drainage easements or be dedicated as an outlot to the extent of the 100-yr design event elevation.
3. Swales, ditches, and storm sewer shall include drainage easements if not located within the public road right-of-way or outlot.

**Certification**

1. Stormwater Plan shall be certified by a duly licensed Professional Engineer in the State of North Dakota that the design was completed by or under the direct supervision of the Engineer and that the design complies with these guidelines.
2. Record drawings of stormwater and drainage features shall be certified by a licensed Professional Engineer in the State of North Dakota and submitted to the City upon completion of the project. Engineer shall certify that the as-built project is consistent with the design.