Yellow Highlights are for discrepancies between the 2 copies I received from Jones and DeMille.

The blue highlight was on one copy from Jones and DeMille, so I left it in.

10-15D-3-I-

2. Surface Water Disposal

a. Introduction

The following design standards apply to the design of all stormwater and floodplain improvements for areas within Elk Ridge City (the City). All hydrologic and hydraulic evaluations and designs for a proposed commercial or industrial site or multi-house development shall be performed in accordance with sound and accepted engineering practices by a professional engineer, licensed in the State of Utah and qualified to perform such work. The overarching objective of this guidance is to:

1. Eliminate increased peak runoff which naturally occurs with development due to an increase in impervious surfaces (i.e., do not increase downstream flows from pre-development or existing/natural conditions).
2. Implement site-specific solutions for conveyance and detention/retention as required to maintain pre-development flows, thus not creating downstream flooding issues.
3. Formalize the process for the design and review of stormwater calculations, designs, etc. between developers and the City.

To this end, the stormwater system design guidelines are provided as outlined below:

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b. General Design Criteria

1. The overall storm drainage system must be designed to ensure the downstream total peak flowrate does not increase with additional runoff created by the proposed site or development; or in other words, the downstream post-development peak flowrate must be equal to or less than the downstream pre-development peak flowrate for the 10-year 24-hour and 100-year 24-hour storm events.
2. The capacity of downstream infrastructure should be considered. If the downstream conveyance capacity is insufficient, the developer should work with the City to develop a design that reduces flows sufficient to meet downstream capacities (possibly reducing flows less than the pre-development conditions).

3. The stormwater drainage analysis and proposed system should consider on-site and off-site flows. This includes drainage areas upstream of the project site, which drain onto and through the project site. Conveyance and/or storage facilities should be sized to accommodate predicted site drainage as well as historic off-site drainage. Storage facilities do not need to store or retain off-site drainage but must be able to safely pass off-site drainage without affecting the storage of on-site drainage.
4. Components of the storm drainage system shall be sized based on the design frequency in the table below:

   a. **Minor Conveyance – 10-year, 24-hour**
   Facilities which convey on-site flows only, such as culverts, drainage swales, pipelines, channels, & curb inlets. Minor conveyance facilities drain to major conveyance and storage facilities.

   b. **Major Conveyance – 100-year, 24-hour**
   Facilities which convey off-site and on-site flows (mixed water) including culverts, pipelines, and channels.

   c. **Storage Facilities – 100-year, 24-hour**
   All storage facilities are to be designed for the 100-year storm event if they only store on-site flows. Storage facilities are not required to store or retain off-site drainage as long as the storage facility discharge does not exceed pre-development levels.

5. Existing commercial, industrial or residential properties may be evaluated on an individual basis if improvements required by these guidelines would adversely impacting neighboring properties.

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c. Methodology

1. Hydrology calculations which require the peak flowrate and volume shall follow the SCS method as outlined in the NRCS National Engineering Handbook using the Type II distribution.
2. The rational method can be used if only the peak flowrate is needed (only conveyance features are required such as culverts and channels).
3. Precipitation data shall be obtained from NOAA Atlas 14.

4. The time of concentration should be calculated using the NRCS Velocity method as outlined in the Natural Resources Conservation Service Technical Release 55, June 1986 (TR-55).

   a. A minimum time of concentration of 5 minutes shall be used.

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d. Low Impact Development Guidelines

Typical storm drain design consists of collect and convey systems to route runoff through and away from developed areas. Low Impact Development (LID) practices utilize storm drain infrastructure to collect, clean, and infiltrate runoff. There are many benefits to LID practices including reducing downstream discharge, groundwater recharge, reduced pollutants, and infrastructure cost savings.

1. All new developments implement LID design practices to the where feasible as determined by the City Engineer based on site constraints.
2. "A Guide to Low Impact Development within Utah" which was published by the Utah Department of Environmental Quality should be used as a resource to design LID techniques within new development areas. This manual as well as other LID design resources can be downloaded from the following website: https://deq.utah.gov/water-quality/low-impact-development
3. All site and subdivision designs shall control the peak flow rates of storm water discharge associated with design storms specified in this chapter and reduce the generation of post-construction storm water runoff volumes and water quality to pre-construction levels. These practices should seek to utilize pervious areas for storm water treatment and to infiltrate storm water runoff from driveways, sidewalks, rooftops, parking lots, and landscaped areas to the maximum extent practical to provide treatment for both water quality and quantity. Other LID methods are also encouraged.
4. The 80th percentile storm volume shall be retained on site. Areas with high groundwater or poor soil may be exempt from this requirement due to poor infiltration rates. Evidence supporting claims of poor infiltration such as soils testing or infiltration testing shall be submitted for developments where retention of the 80th percentile storm is unfeasible.
5. Field Testing with a single ring infiltrometer is required to confirm adequate infiltration in all basins where infiltration will be used. A supporting report shall be

stamped by a licensed geotechnical engineer and submitted as part of the drainage report.

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e. Conveyance Facilities

All conveyance facilities should be designed to carry the design storms listed in the General Design Criteria section. Special criteria for conveyance facilities are as follows:

1. The minimum size of all culverts and storm drainage pipe diameter is 15 inches to allow for maintenance such as cleaning. This includes driveway culverts.
2. All culverts are to be constructed with an intake apron, for City maintained culverts (under city roadways) a trash grate is required.
3. Main drain lines connecting manholes are to be reinforced concrete pipe class III.
4. Conveyance systems should be evaluated for scour and erosion.
5. Piped conveyance systems should be designed to maintain minimum velocities of 2 feet per second, to allow for flushing of debris and sediment. Open channel conveyance systems should be designed to not exceed a peak velocity of 5 feet per second to avoid scour and erosion. Special cases not meeting this requirement must be approved by the city.
6. Manholes are required every 400 feet for storm drainage pipelines, and at changes in grade or direction.
7. Minimum manhole diameters shall follow the following minimum requirements:

   a. Four (4) foot minimum manhole diameter for main lines less than 18 inches in diameter
   b. Five (5) foot minimum manhole diameter for main lines 18” to 30” in diameter
   c. Six (6) foot minimum manhole diameter for main lines greater than 30” in diameter
   d. The minimum structural leg width (6” minimum) between pipe core holes must be maintained when multiple pipes intersect a manhole
8. Preserve and protect natural flood water conveyance corridors and channels in easements dedicated to the City and with improvements where necessary.
9. Drainage ways that allow infiltration in minor storm events are encouraged.

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f. Storage Facilities

All storage facilities should be designed based on the design storms listed in the General Design Criteria section. Storage facilities can be either retention (stores 100% of flow with no release) or detention (temporarily stores flows and releases at controlled rate) facilities. Special criteria for storage facilities are as follows:

1. Post-developed discharge rates shall not exceed pre-developed discharge rates for the 10-year and 100-year storms. Check both storms and design/size detention pond outlet structures accordingly. In no case shall the storm drain discharge from a development or site exceed 0.20 cfs/acre for on-site runoff. LID practices as described in subsection (d) above shall be implemented.
2. Retention ponds must be sized to capture and contain the entire 100-year event.
3. For detention basins, the entire 100-year storm shall be routed through the principal outlet without activating the emergency spillway. This is typically accomplished with a grate at the top of the outlet structure. The routed 100-year water surface is typically set at the emergency spillway crest elevation.
4. All storage facilities shall be designed to completely drain within 3 days of the end of a storm event (retention facilities must be designed to infiltrate in this time, field testing with a single ring infiltrometer is required to confirm adequate infiltration).
5. Detention basin principal outlet pipes shall be at least 18-inches in diameter to minimize the chance of clogging and to facilitate cleaning. Orifice plates are to be used on the upstream end of the principal outlet pipe to reduce the maximum release flowrate and must be inside a storm drain box to facilitate cleaning.
6. Emergency spillways shall be designed to safely pass the 100-year storm, without endangering life or property downstream, assuming the principal spillway outlet is not functioning.
7. A minimum of 1 foot of freeboard above the emergency spillway design water surface elevation is required (routed 100-year storm assuming principal spillway outlet is clogged).
8. The invert or lowest point of a storage basin must be minimum 12-inches above historic groundwater levels.
9. All storage facility slopes shall have a maximum slope of 3:1 and must be stabilized with rock or planted vegetation to prevent erosion.

10. No part of the bottom of the basin shall have a slope of less than 3% sloped toward the outlet. Within 10-feet of the outlet, the slope of the basin bottom must not be flatter than 5% unless a concrete apron is constructed around the outlet. In this case, the minimum slope for the concrete apron shall be 0.50%.
11. Storage basins should be designed with a maximum water depth of 3 feet. Deeper basin may be permitted as approved by the city but will require at minimum a two-rail perimeter fence. A deeper basin may be permitted if approved by the city and state and may require a more extensive permitting process with additional requirements.
12. Underground systems are not allowed in drinking water source protection zones.
13. Underground systems shall provide adequate access for cleaning and maintenance.
14. If the detention basin is classified as a dam, the facility shall also comply with prevailing dam safety standards as outlined by the Utah State Dam Safety and the Utah Division of Water Rights. See applicable design standards to determine if the pond should be classified as a dam.
15. Field testing with a single ring infiltrometer is required to confirm adequate infiltration in all basins or sumps where infiltration will be used. A supporting report shall be stamped by a licensed geotechnical engineer and submitted as part of the drainage report.
16. If sumps are used to manage storm water runoff, calculations shall be provided showing how the sumps in combination with other drainage features will manage the required runoff volume.

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g. Other Related Permits

Other permits may be required for the proposed development. These permits should be considered as part of the proposed drainage system and be referenced in the documentation. Applicable permits may include:

1. Stream Alternation Permit
2. Floodplain Development Permit (if in FEMA designated floodplain)
3. Small Dam Application (assuming pond is classified as a dam per Utah Dam Safety)

This list is not exhaustive. Additional permitting may be identified and required during the approval process.

h. Drainage Report

All proposed developments are required to submit a drainage report for the Cities review and approval. The report is to include enough detail to provide assurance that the development will control stormwater drainage in a safe manner, and not pose a flood risk to residents downstream or within the development. The following information is required at a minimum:

1. Drainage Report Outline:

    a. Introduction
    b. References
    c. General property description
        1. Include known flooding issues
    d. Off-site and on-site drainage description
        1. Include relevant downstream conveyance facilities
    e. Design runoff computations
        1.Map of drainage basins delineated
        2.Precipitation
        3.Land cover and soil conditions
        4.Runoff curve number and/or rational method coefficient
        5. Time of concentration
        6. Hydrology model results for all drainage basins comparing pre-development and post-development peak flows and volumes, considering on-site and off-site areas
    f. Design of drainage facilities
        1.All hydraulic and hydrologic calculations used to design conveyance facilities
        2. All hydraulic and hydrologic calculations used to design storage facilities
        3. Operation and maintenance considerations
        4. LID design summary and/or limiting factors including retention basin drain times
    g. Other related permits
        1. Indicate implications to streams, wetlands, FEMA designated floodplains, if ponds should be classified as a dam, etc. – and indicate if permitting is needed (e.g., stream alteration permit, Floodplain Development Permit, Small Dam Application, etc.)
    h. Statement of compliance

1. Include stamp by professional engineer

i. Appendix

1. Modeling results, hydrographs, tables, etc.

2. Maps of drainage basin characteristics, existing and proposed contours, including drainage basin delineation, land cover, soils, drainage paths, etc.

3. FEMA floodplain maps, if applicable

4. A supporting report shall be stamped by a licensed geotechnical engineer supporting the infiltration rates used.