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:

---

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.

Commented [TW1]: We would like the table here. I was having formatting problems.

---

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.

---

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.

---

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.

---

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.

---

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.

Existing Code: 10-15D-3-I-2

2. Surface Water Disposal:

~~a. To the maximum extent possible, surface water produced from the subdivision development shall be properly disposed of within the limits of the subdivision. If not possible within the limits of the development, alternative disposal methods off site may be considered as approved by the city engineer.~~

~~b. Pipes, manholes, sumps and other facilities for the collection, transport and disposal of surface water shall be installed where required by the city. The location, size and design of said facilities and any easements relating thereto, shall be in accordance with the city stormwater disposal plans and standards or as directed by the city engineer.~~

~~c. The location of all facilities and easements shall be shown on the plans, plats and engineering drawings, as applicable.~~

~~d. All plans for subdivision or development shall identify the location of all existing natural drainage channels and final plats of subdivision, and similar land development projects shall provide a drainage easement which includes the natural channel.~~

~~e. No structure shall be located less than thirty feet (30') from the boundary of any designated drainage channel and the layout of any subdivision or similar development project which contains a natural drainage channel shall be so arranged to ensure that all required building setbacks can be maintained.~~

~~f. Facilities for stormwater runoff shall be required to be constructed on development sites and according to the following design standards:~~

~~(1) Such facilities shall be the first improvement of facilities on the property. Phasing of drainage facilities may be allowed as approved by the city engineer.~~

(2) All storm drain catch basins, pipes and manholes shall be designed to collect and convey stormwater runoff from the 25-year, 24-hour storm.

(3) In the event that a documented downstream discharge or storage with available capacity is present, detention basins shall be designed to detain runoff from the 25-year, 24-hour storm with a maximum discharge rate equal to the predevelopment discharge rate. In addition, the stormwater plan shall make provisions for the accommodation of flows during a 100-year storm event in a manner that will minimize damage to personal property.

(4) Retention facilities such as sumps and retention ponds shall be designed to retain runoff from the 100-year, 24-hour storm.

(5) The design storm criteria shall be as follows:

TABLE 1

ELK RIDGE CITY 25- AND 100-year

STORM DEPTH AND INTENSITY

Duration	25-year Depth (Inches)	25-year Intensity (Inches/Hour)	100-year Depth (Inches)	100-year Intensity (Inches/Hour)
Duration	25-year Depth (Inches)	25-year Intensity (Inches/Hour)	100-year Depth (Inches)	100-year Intensity (Inches/Hour)
5 minutes	0.372	4.46	0.540	6.48
10 minutes	0.566	3.40	0.822	4.93
15 minutes	0.701	2.80	1.02	4.08
30 minutes	0.944	1.89	1.37	2.74
60 minutes	1.17	1.17	1.70	1.70
2 hours	1.34	0.669	1.91	0.953
3 hours	1.43	0.475	1.98	0.658
6 hours	1.63	0.273	2.15	0.358
12 hours	2.01	0.167	2.51	0.209

24 hours	2.42	0.101	2.94	0.123

g. Multipurpose stormwater storage facilities or ponds which incorporate recreational facilities such as sport fields, playgrounds and gathering areas are encouraged. Such facilities must incorporate underground rock galleries or connected sumps which disperse nuisance waters under the surface of the pond or recreation facility. The pond must also be tiered in such a way that water from a 25-year storm event is contained in a lower tier. Only major storms larger than a 25-year event should reach the upper tier where recreational facilities may be located. All storage facilities whether they incorporate recreational facilities or not must be designed to the following criteria:

(1) Maximum side slope on the inside of a pond to be three horizontal to one vertical (3:1) for ponds up to two feet (2') deep, four horizontal to one vertical (4:1) for ponds three (3) to four feet (4') deep and five horizontal to one vertical (5:1) for ponds over four feet (4') deep.

(2) Ponds over two feet (2') deep must be approved by the city engineer. Safety measures such as fencing may be required as well as additional landscaping.

(3) Maximum slope on the outside of a pond to be two horizontal to one vertical (2:1).

(4) Vehicular access for maintenance shall be provided.

(5) A landscape plan shall be submitted to the city for review and approval. All stormwater facilities are to be landscaped appropriate to the design criteria and surrounding properties.

(6) In case of detention ponds, an emergency overflow spillway shall be incorporated into the design assuming the outlet is inoperable and the inflow exceeds the outlet capacity.

(7) Percolation tests used for design shall be certified by a geotechnical engineer.

(8) All detention and retention basins to be designed to drain within a twenty four (24) hour period.

(9) All ponds to be designed with a minimum of one foot (1') of freeboard or fifty percent (50%) capacity increase, whichever is less.

(10) Each development is unique with varying surfaces and areas. The runoff coefficient for the rational method shall be estimated based on the following values listed in table 2 of this section.

TABLE 2

RATIONAL METHOD RUNOFF COEFFICIENTS

Type Of Drainage Areas	Coefficient
Type Of Drainage Areas	Coefficient
Forested	0.059 - 0.2
Asphalt	0.7 - 0.95
Brick	0.7 - 0.85
Concrete	0.8 - 0.95
Shingle roof	0.75 - 0.95
Lawns, well drained (sandy soil):	-
Up to 2% slope	0.05 - 0.1
2% to 7% slope	0.1 - 0.15
Over 7% slope	0.15 - 0.2
Lawns, poor drainage (clay soil):	-
Up to 2% slope	0.13 - 0.17
2% to 7% slope	0.18 - 0.22
Over 7% slope	0.25 - 0.35
Driveways and walkways	0.5 - 0.85

-

h. Ownership and maintenance of storage facilities will be determined on a case by case basis by the city council. If ponds are proposed to be owned and maintained by the city, they must incorporate recreational facilities and be a minimum of one acre in size. Landowners are encouraged to work with adjacent landowners in a cooperative effort to provide regional ponds which service multiple properties. If a pond is proposed to be privately owned and maintained, a perpetual maintenance plan outlining requirements, responsible party and funding sources must be submitted as part of the approval process.

~~i. All stormwater facilities shall incorporate oil and sediment separators in the system prior to release into a pond or infiltration facility.~~

~~j. Storm drain pipelines shall be located within the public right of way or a minimum fifteen foot (15') wide dedicated easement. Pipelines outside of public rights of way may also require access and maintenance easements as directed by the city engineer. The minimum pipe size shall be twelve inches (12"). Acceptable pipe materials include HDPE, reinforced concrete and nonreinforced concrete.~~

~~k. All proposed development shall submit storm drainage calculations prepared by a licensed engineer in the state of Utah. Acceptable analysis methods include the rational method, TR-55 and HEC HMS.~~

~~l. All drainage facilities shall be designed to divert surface water away from cut surfaces or sloping surfaces of a fill. (Ord. 12-7, 11-27-2012)~~