

SECTION 11

GRADING AND DRAINAGE

STANDARDS

11.1 INTRODUCTION

The proper grading, conveyance, storage and release of storm water is critical to maintain the integrity of the Property. Drainage facilities, including retention and detention basins, stormdrains including inlets, mains and headwalls, channels, drywells and sub-surface storage, shall be designed to minimize impact and disruption to the anticipated tight urban fabric and rural character. As further described in Section 4.1.C, these Grading and Drainage General Development Standards apply to and control development on the Property.

In urban areas designs should minimize land area to reduce voids between adjacent uses. Designs should also encourage other uses in the same space to mitigate the effect of voids (i.e. park spaces, seating areas, sports courts, among others). For example, drainage and stormwater storage may be at the bottom of a stepped wall basin with drywells to drain nuisance water from the recreation area. In rural areas, designs may be similar to urban areas, however when site grading and stormwater management systems are part of the perimeter landscape it should transition to seamlessly blend with the surrounding character of the landscape. The more urban, development environments will require numerous small stormwater storage basins that may be of irregular shape and varied depth. See **Exhibit 11.1- Stormwater Storage Character**.

11.2 DRAINAGE REPORTS

- A. Should the City utilizes a Drainage Master Plan that includes planning within the Property, the City Drainage Master Plan will incorporate the Master Drainage Report for the Property.
- B. Updated Drainage Reports, as required by the City Engineer, shall be provided for specific individual developments to ensure compliance with the Master Drainage Report and to identify significant changes in infrastructure needed to serve the parcel(s).

Exhibit 11.1 – Stormwater Storage Character



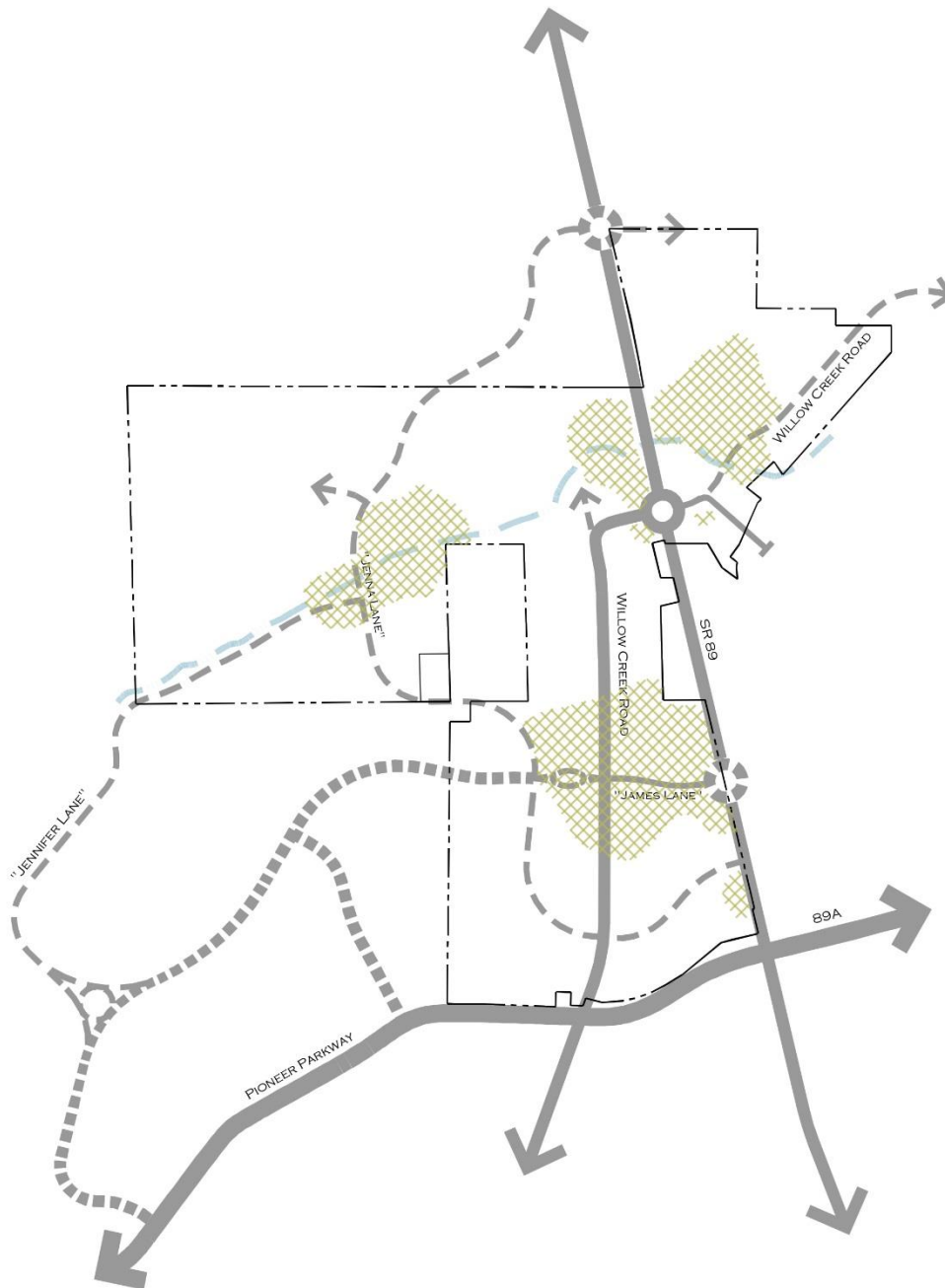
Note: Photos are intended to be representative of the character and quality of the types of urban and rural stormwater management systems and are not intended to express specific design details, colors or materials.

11.3 GRADING, CONVEYANCE AND STORAGE METHODS



This Master Plan permits both decentralized and centralized stormwater basins that receive stormwater from nearby parcels within the Property to create development conducive to a sustainable environment. The conceptual character for stormwater storage facilities is depicted on **Exhibit 11.1 – Stormwater Storage Character**. Conceptual locations for regional stormwater storage facilities are depicted on **Exhibit 11.2 – Conceptual Regional Stormwater Storage Locations**.

- A. Urban development environments may require numerous small stormwater storage basins that may be of irregular shape and varied depth. This may include, but not be limited to, stormwater storage within a parking lot, parking lot landscape area, landscape island, neighborhood park, community park, landscape tract, median, parkway, and plaza space.
- B. The decentralized basin concept allows for storage of stormwater within numerous areas to create an overall storage concept that meets standard stormwater storage requirements, reduces the amount of stormwater being conveyed within streets and reduces the requirements for stormdrain systems that require constant maintenance.
- C. When stormwater storage is centralized, streets, channels, stormdrains and other methods may be used to convey water.
- D. Centralized and decentralized basins may include a combination of small basins and very deep basins. Basin design is subject to soil stability applicable federal, state and county standards.
- E. Active uses are permitted within stormwater storage basins. This may include but is not limited to ballfields, picnic areas, sport courts, dog parks, paths and trails.
- F. Alternative conveyance methods, stormwater storage methods, materials, non-traditional and innovative methods may be approved by the City Engineer when proposed by the Master Plan Administrator with proper justification and analysis.
- G. Stormwater storage basins may be publicly or privately owned and maintained. The City may agree, but is not automatically obligated, to accept ownership or maintenance of a stormwater storage basin.

Exhibit 11.2 – Conceptual Regional Stormwater Storage Locations



LEGEND:

-  Regional Stormwater Storage Areas
-  Bottleneck Wash

*Note: Regional stormwater storage areas shown are conceptual
Actual location, shape, and size may change.*

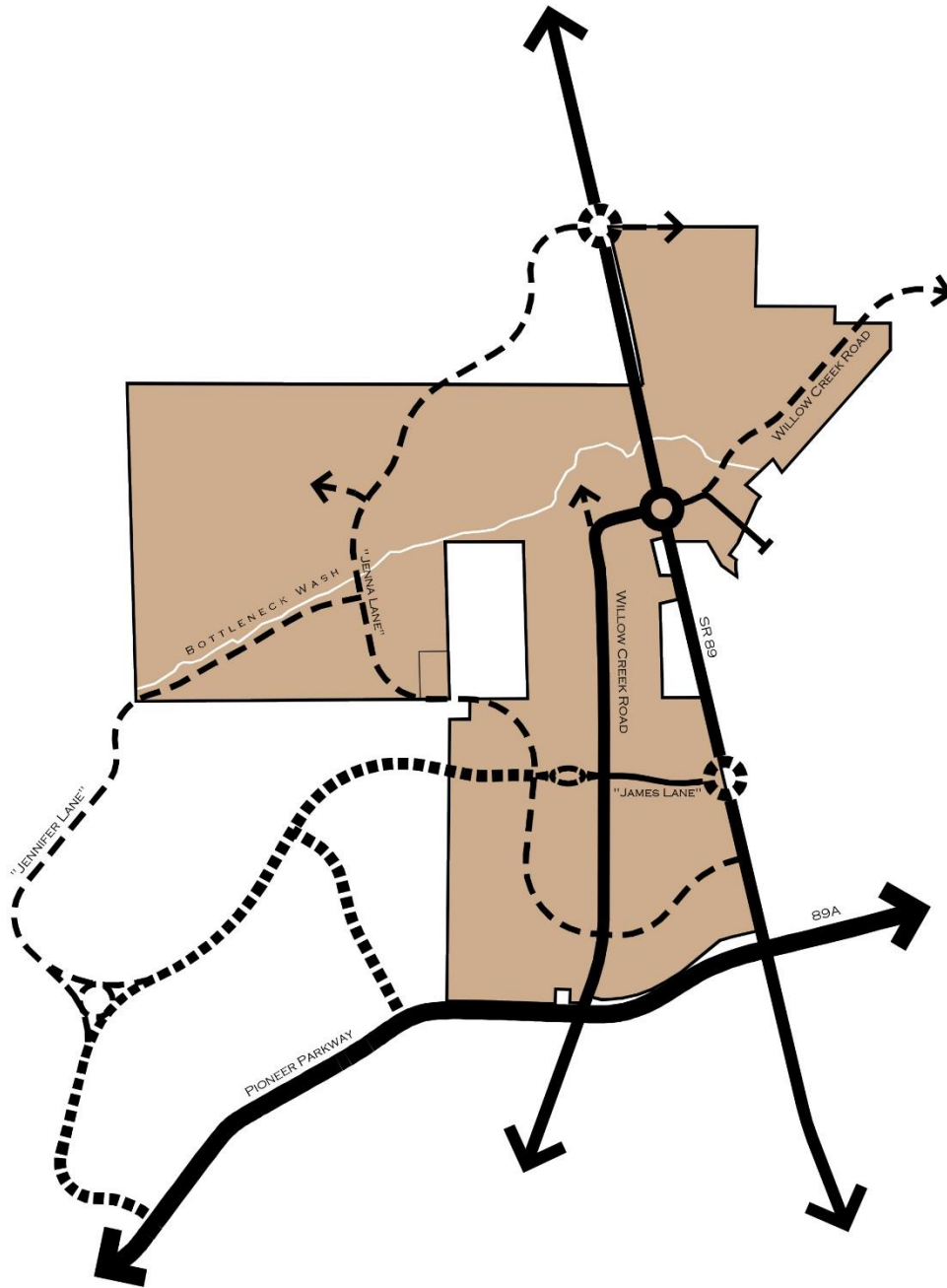
11.4 GRADING STANDARDS

- A. No clearing and/or grubbing of a parcel or site, other than for agricultural related operations, shall occur without first receiving a grading permit. When clearing and/grubbing has commenced, the site shall be continuously worked until all infrastructure, as may be phased, is complete and erosion control measures and slope stabilizations have been completed.
- B. Development shall be restricted to a maximum exposed vertical cut or fill not to exceed thirty-five (35) feet in height when within (150) feet of existing residential homes, at the time of recording of this Master Plan. All other development shall not be restricted in terms of height of cut or fill, subject to soil stability analysis and scarring mitigation.
- C. The length of an exposed vertical cut or fill shall not be limited but are encouraged to take on a naturalized appearance when not a part of a formal landscape.
- D. Top of cut slopes shall be located a minimum five (5) feet inside the Property. Additional setback may be required for drainage facilities, fire or building requirements. Cut slopes may extend beyond a parcel boundary with adjacent owner(s) permission.
- E. Toe of fill slopes shall be set back a minimum of two (2) feet from the Property boundary. Fill slopes may extend beyond a parcel boundary with adjacent owner(s) permission.
- F. The toe of fill slopes shall not extend into ROW unless approved by the City Engineer. Toe of fill slopes may extend into private easements and adjacent property with adjacent owner(s) permission.
- G. Bank stabilization standards, other than those in the Code, shall be permitted when proposed by the Master Plan Administrator with proper justification and analysis and approved by the City.
- H. The City Engineer may waive stabilization requirements, of which authority for, if the needs are met by soil and terrain conditions.
- I. The natural historic drainage patterns shall be maintained at the Property boundary. This includes drainage locations, flows, velocity, sediment transport and yield, and the direction of flow off the Property. Drainage patterns within the Property may be modified per the Master Drainage Report and with necessary approval of agencies outside of the jurisdiction of City.
- J. Fills greater than ten (10) feet require benching, unless the area of fill is incorporated within a grading plan where benching is not practical, based on design and analysis by a registered geotechnical engineer and with the approval of the City Engineer.
- K. Bottleneck Wash includes areas designated as floodplain "Zone A". Grading along Bottleneck Wash related to site plan or subdivision plat approval or to modify the flood plain is permitted with the necessary approvals of State and Federal agencies.
- L. The Property consists of gently sloping grasslands and gradually rolling hills and has no significant natural slope or rock outcropping features. A Disturbable Area Map is provided in **Exhibit 11.3 – Disturbable Area Map**. Disturbance on the Property shall be permitted as related to site plan or subdivision plat approval and with the necessary approvals of state and federal agencies. The extent of site disturbance shall not be limited based on slope steepness or height of manufactured bank, however mitigation of cut and fill scarring is required.

11.5 RETAINING WALLS, SITE WALLS AND FENCES

- A. See Section 10.8 – Retaining Walls, Site Walls and Fences

Exhibit 11.3- Disturbable Area Map



LEGEND:

 Disturbable Area

11.6 ON-SITE STORMWATER MANAGEMENT

- A. The Property will be developed in phases. A stormwater management plan is required for each phase of development rather than the entire development. Changes to any phase may require an update of another phase to insure all phases remain coordinated. The stormwater management plan may be implemented in phases that correspond with development including phasing stormwater storage within a phase of development.
- B. Non-conventional and innovative retention and detention methods of stormwater management and storage (including small decentralized basin systems of varying sizes and depths and subsurface systems) are permitted when proposed by the Master Plan Administrator with proper justification and analysis subject to the approval by the City Engineer of the specific application.
- C. The decentralized retention and detention approach shall be permitted for storage of stormwater within numerous areas to create an overall storage concept that meets standard stormwater storage requirements and reduces the amount of stormwater being conveyed within streets and reduces the requirements for stormdrain systems.
- D. The centralized retention and detention approach shall be permitted for storage of stormwater within numerous areas to create an overall storage concept that meets standard stormwater storage requirements and reduces the amount of stormwater being conveyed within streets and reduces the requirements for stormdrain systems. The on-site stormwater storage may be consolidated into large regional basins including basins in line with the airport runways. These regional basins may be deep, terraced and large in size and volume.
- E. Stormwater management is required for all new subdivisions, commercial and industrial developments, re-development and other development that increases impervious area or identifiably impacts adjoining properties provided the stormwater storage volume necessary has not been provided for the development elsewhere within the Property.
- F. A permanent solution to disposal of stormwater storage may be accomplished by the construction of drywells. The use of a single chamber or multiple chamber drywells will be determined based on the detailed application. Percolation rates for drywells will be based on standards approved by the City Engineer. Drywells must be maintained and refurbished by the owner when they cease to function properly.
- G. Stormwater management systems and structures within natural drainage corridors are permitted with proper justification and analysis subject to the approval by the City Engineer of the specific application and may be designed as an integral part of a neighborhood or regional drainage system modifying the timing and flow rate of stormwater conveyance and storage.
- H. Off-site flows, as depicted in the Drainage Master Report for the Property, may be incorporated into on-site detention and retention systems.
- I. First flush treatment for stormwater quality compliance may be coordinated for numerous properties or provided elsewhere within the Property as part of a stormwater management system prior to discharge into the City of Prescott Municipal Separate Storm Sewer System (MS4) or Waters of the United States.

- J. Common stormwater storage facilities for multiple parcels may be established during the site plan or subdivision plat process.
- K. The detailed design of stormwater storage facilities shall be determined during the site plan or subdivision plat process.
- L. Centralized stormwater storage facilities may incorporate multi-use features into large basins that are functional and aesthetically pleasing while addressing access and safety concerns. Designs may include the use of varying depths and side slopes, walls, terraces, steps and multiple levels that deviate from the Code as approved by the City Engineer.
- M. Walls and stepped conditions shall be permitted within a basin so long as safety concerns are addressed.
- N. Stormwater storage within the ROW (bioswales) shall be permitted and may be used for landscape irrigation. Such storage is intended to function as part of the streetscape, not to satisfy site detention or first flush requirements.
- O. Stormwater storage is permitted within a parking lot provided no more than fifty (50) percent of the required parking spaces are inundated in a 100-year design storm event of which half may be inundated no more than four (4) inches. In no case shall parking stalls be inundated more than six (6) inches unless otherwise approved by the City Engineer.
- P. Individual on-lot storage is permitted within single-family residential developments with lots a minimum of 30,000 square feet each.
- Q. Individual on-lot drainage is not required to drain to the "front" or to the street. For instance, a lot may drain to the rear when along a greenway. A drainage easement may be required.
- R. Stormwater storage basins within the Property may be considered regional serving more than one (1) parcel or subdivision and typically a group of parcels or subdivisions within a drainage basin.
- S. Security barriers with maintenance access gates may be required around basins where water depths are greater than three (3) feet and side slopes are less than three (3) horizontal feet to one (1) vertical foot. The location of a security barrier may be thirty (30) inches below the 100-year water elevation. Security barriers are not required when side slopes are three (3) horizontal feet or greater to one (1) vertical foot.
- T. Runoff entering or exiting a basin may cross a pathway or sidewalk. A drainage crossing or scupper is recommended in urban areas.

11.7 OFF-SITE STORMWATER MANAGEMENT

- A. Off-site stormwater will be conveyed as outlined in the Master Drainage Report.

11.8 STORMWATER DRAINAGE FACILITIES

- A. Non-conventional and innovative stormdrain inlets and outlets shall be permitted by the City Engineer when proposed by the Master Plan Administrator with proper justification and analysis.
- B. Non-conventional and innovative detailed channel designs shall be permitted by the City Engineer when proposed by the Master Plan Administrator with proper justification and analysis provided.
- C. Drainage channels, both natural and man-made, conveying substantial flows are permitted parallel to public roadways outside the right-of-way template.
- D. Natural channels, including the overbank areas within the 100-year floodplain may be altered. They are encouraged to remain in their natural state or be designed to create a rural/natural appearance when practical.
- E. Wet-crossings and low-flow crossings are permitted in lieu of culverts on, District Streets, Neighborhood Streets and Service Lanes when an alternate access is provided without flows of a 25-year design event overtopping a roadway.

11.9 AESTHETIC TREATMENT OF STORMWATER DRAINAGE AND STORAGE ELEMENTS

- A. Stormdrain and stormwater storage area elements shall be aesthetically treated in one of the following manners:
 - 1) an extension of the architecture or urban setting,
 - 2) an integral part of the landscaping theme,
 - 3) a background element that is designed to visually recede or disappear (not draw attention to itself), or
 - 4) a combination of the above techniques.
- B. Aesthetic treatment may be accomplished through materials, color, or custom designed elements.
- C. Stormwater storage elements, including railings and headwalls, should be aesthetically pleasing in urban areas and areas with high pedestrian traffic and visibility.
- D. Material other than riprap around and over the top of a culvert end treatment is acceptable as long as adequate erosion resistance is provided if approved by the City Engineer.
- E. Concrete headwalls may be integral color, painted, or clad with brick or stone when privately maintained. Concrete headwalls may be stained.
- F. Safety rails may be painted to blend with the landscape. Alternative materials may be used reinforcing the urban or rural character in which the rail is located with the approval of the City Engineer.

- G. Stormwater storage basin layout may be one of the following:
 - 1. Irregular in shape, contoured and designed as an integral part of the landscaping theme,
 - 2. Designed in a formal and structured manner as an extension of the architecture or urban setting,
 - 3. A combination of forms if they are appropriate or in intentional contrast to their setting.
- H. Stormwater storage basins may be entirely surrounded by retaining walls and accessed only by steps or ramps in urban areas or urban settings.
- I. Landscaping in the form of vegetation or hardscape shall be provided in all areas of the stormwater storage basin not occupied by structures or parking.
- J. Other types of barrier may be permissible, but must be functional. A landscape buffer, strategic placement of plant material or formal planting edge is permitted in lieu of pedestrian safety rail when, at maturity, the plant material discourages access. A temporary barrier may be required, as determined by the City Engineer, until the landscape buffer provides barrier-like functionality.

11.10 STREET AND SERVICE LANE DRAINAGE

- A. Street drainage and roadways should be designed to maintain a drainage pattern similar to the natural drainage pattern when possible. Within the Property, cross-basin diversions are acceptable provided developed areas, conveyed areas, and receiving off-site watercourses are not adversely impacted.
- B. Surface stormwater conveyance and storage systems within and parallel with roadways are encouraged to reduce the need for stormdrains and irrigate plant material. A series of small decentralized basins, depressed curbs, curb openings scuppers or other alternative inlet are permitted within and along roadways and parking areas.
- C. Inverted crown arterial streets should be avoided. Inverted crown District Streets may be permitted with the approval of the City Engineer when a landscape median is provided. Inverted crown on private streets, Neighborhood Streets and Service Lanes are acceptable.
- D. For Neighborhood Street sections with rolled or vertical curb, runoff from a 25-year design storm must be contained between the curbs of the street. Runoff, including 100-year event design flow, may exceed the ROW under controlled conditions with reasonable protection of flooding for all structures adjacent to the ROW.
- E. A District Street must include at least one (1) travel lane in each direction that remains free from flooding for a 25-year design storm in the ultimate design condition.
- F. For District Streets stormwater conveyance of a 100-year design storm may exceed the ROW. Runoff, including 100-year event design flow may exceed the ROW under controlled conditions with reasonable protection of flooding for all structures adjacent to the ROW.
- G. Tracts, easements or additional ROW may be used in place of or in addition to a subsurface system when excess flows are captured and removed from a street surface (i.e. bioswale).

- H. Valley gutters perpendicular to the flow of traffic should be avoided on a District Street. Valley gutters at intersections may be approved on a case-by-case basis. Valley gutters parallel to the flow of traffic may be used. Valley gutters parallel to the flow of traffic may be used when parking is provided as shown in Section 8 – Circulation Standards.
- I. Catch basins, scuppers, or other capture devices, shall be placed where depth, spread and velocity dictate to remove flow from a roadway for traffic safety. Provided traffic safety is not adversely impacted, catch basins are not required where a road warps or super-elevates (to prevent gutter flow from sheeting across lanes), immediately upgrade of an arterial or District Street intersection or immediately upgrade of a bridge or structured wash crossing. Ponding behind curbs, shoulders and sidewalks is acceptable when part of a stormwater drainage system.
- J. A cattle-guard grate, or similar, shall be considered bicycle friendly when its bars are perpendicular to the direction of travel. Trench drains are encouraged when practical.

11.11 STORMDRAINS

- A. Stormdrain pipe maintained by the City shall conform to the City preferred or alternative materials.
- B. Alternative stormdrain materials and design standards shall be permitted by the City Engineer when proposed by the Master Plan Administrator with proper justification and analysis. HDPE is considered an acceptable alternative material.
- C. Stormdrain manhole spacing shall be as dictated by the actual design requirements.

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