Storm Drain Impact Fee Facilities Plan

Consultant Job No. 001-12-01

January 2014

Prepared for:

City of St. George

Prepared by:

Bowen Collins & Associates, Inc.
CONSULTING ENGINEERS

STORM DRAIN IMPACT FEE FACILITIES PLAN

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Prepared for:

City of St. George
Public Works Department

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INTRODUCTION

In 2009, the City of St. George adopted a new storm drain master plan that provided recommendations and guidelines for existing and future storm drain facilities. The City recently decided to update their storm drain impact fees. Recent changes in the State Legislative Code require municipalities to prepare an impact fee facilities plan that defines the public facilities required to serve development resulting from new development activities.

Bowen Collins & Associates (BC&A) was retained to prepare the Storm Drain Impact Fee Facilities Plan (IFFP). This report is intended to document the public facilities required to serve development resulting from new development activity.

It should be noted that while the City of St. George charges a monthly storm water fee to existing property owners, this fund is used to provide maintenance and upkeep on existing facilities. It is not intended to be used for new facilities that are required as a result of new development. The City relies on impact fees to fund facilities that are required for new development.

DEMAND ANALYSIS

The City desires that their stormwater impact fee be based upon the amount of impervious surface associated with development. The percent of impervious surface that contributes to stormwater runoff varies based on development type and density.

In order to define the existing and future need for stormwater management facilities, various types of information were collected from the City and analyzed using GIS software. That information included zoning maps, contour maps, aerial photography (dated 2011), and a copy of the City's existing impact fee ordinance. Using that information, BC&A worked with City staff to estimate the amount of developed land by land use type. The results of this analysis are presented in Table 1. City personnel estimate that the 9,513 acres of existing developed land will increase by 30 percent over the next 10 years. For the purposes of this study, it was assumed that the existing developed acreage associated with each land use type will each developed by 30 percent over that period. The existing and projected impervious areas by land use type are also presented in Table 1.

Table 1
Existing and Projected Impervious Areas by Land Use Type

Land Use	Existing Developed Land (Acres)	Avg. Units Per Acre	Post Development Percent Impervious	Estimated Impervious Area Associated with Existing Developed Land (Square Feet)	Estimated Percentage of Total Impervious Area by Land Use Type	Estimated Impervious Area in 10 Years Assuming 30 Percent Growth (Square Feet)
Low Density Residential	6,650	3	35%	101,392,540	49%	30,417,762
Medium and High Density Residential	875	8	60%	22,855,941	11%	6,856,782
Commercial/Office	1,268	N/A	95%	52,475,849	26%	15,742,755
Industrial	720	N/A	90%	28,237,334	14%	8,471,200
Totals	**9,513**			**204,961,664**	**30%**	**61,488,499**

Source: Storm Drain Impact Fee Analysis

Figure 1 shows the service area with the zoning in the 2010 Land Use Master Plan that was used for this study. Total developable land was determined using information from the City's ordinances, including the hillside development ordinance, and the zoning map. It should be noted that the City did not define locations for new school district facilities or charter schools for this plan. It is anticipated that these will be considered on a case by case basis as the school facilities are planned and developed.

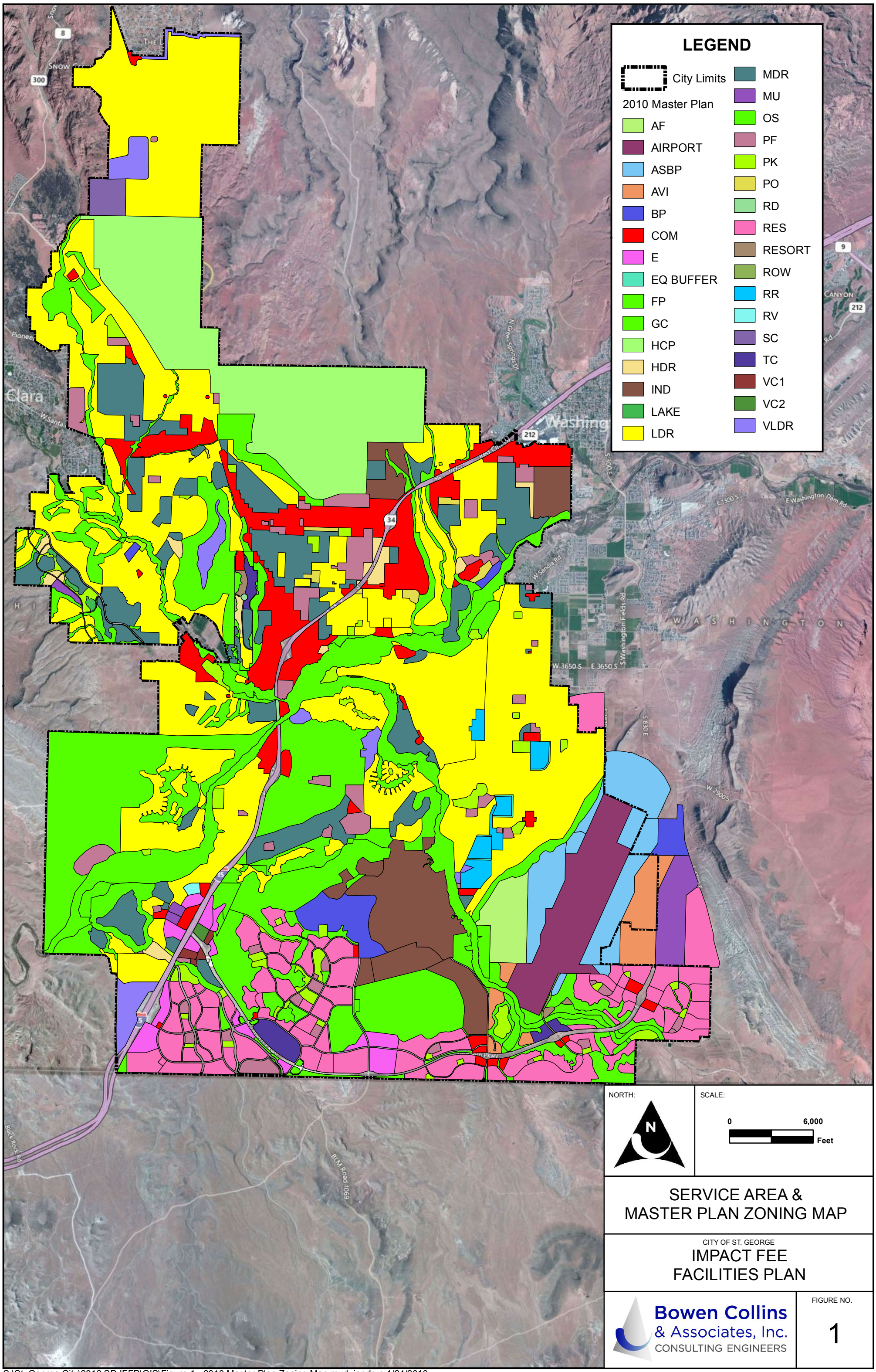
INVENTORY OF EXISTING FACILITIES

In order to determine what areas need improved facilities to handle development, existing storm drain facilities were inventoried. For the purposes of the storm drain impact fee analysis, a storm drain "system improvement" is any existing or future stormwater management facility that serves more than one development and is further defined as follows:

- A storm drain pipe that has an inside diameter equal to or greater than 24 inches.
- Any storm drain catch basin, manhole, or inlet that is directly connected to pipe that has an inside diameter of 24" larger.
- Any stormwater detention or retention facility that serves more than one development.
- Any street that is designed to convey stormwater runoff from a 10-year design storm.
- Any open channel that will convey runoff from a 10-year design storm.

A storm drain "project improvement" is a storm water management facility that is installed as part of a development and does not generally serve areas outside the development. A "project improvement" may include pipes, catch basins, detention or retention facilities, or other stormwater facilities.

Based on these definitions, the City's current GIS database was evaluated to estimate the lengths of existing storm drain pipe and open channel facilities within the City. The results of this analysis are presented in Table 2.



SERVICE AREA &
MASTER PLAN ZONING MAP

CITY OF ST. GEORGE
IMPACT FEE
FACILITIES PLAN

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FIGURE NO.
1

S:\St. George City\2012 SD IFFP\GIS\Figure 1 - 2010 Master Plan Zoning Map.mxd jandrus 1/24/2013

Table 2
Summary of Existing Storm Drain Pipe and Open Channel Facilities

Size	Total Existing Pipe (ft)
24	59,920
30	41,695
36	45,041
42	16,721
48	32,654
54	4,904
60	17,097
66	-
72	21,439
84	-
96	980
108	-
Open Channel	29,505
Total	**269,956**

REVENUE SOURCES

Several revenue sources were considered to pay for the system improvements. Those revenue sources include grants, bonds, interfund loans, impact fees, the general fund, and anticipated or accepted dedication of system improvements. It is recommended that impact fees be used to equitably allocate the costs between future development and existing users.

To meet the requirements of the Utah State Impact Fee Act, an impact fee analysis must identify any excess (available) capacity in existing stormwater facilities that is available to serve future growth. However, the City staff has indicated that they are not interested in including a buy-in component as part of their storm drain impact fee. Therefore an excess capacity analysis was not performed as part of this study.

LEVEL OF SERVICE STANDARDS

Level of Service Standards are defined in the City of St. George Drainage Manual, dated July 2009. Section 3 from that manual has been included in Appendix A. That section defines the standards for all storm drain facilities, including streets, storm drain piping, culverts, bridges, open channels, storage facilities, and floodplains.

In general, the drainage manual addresses the following facilities:

- Streets – Where storm drains are not adequate to convey the 100-year, 3-hour design storm, streets may be used to convey the additional runoff to adequate downstream

conveyance facilities. The 100-year flood flows in streets should be contained within street right-of-way and adjacent drainage easements.

- Storm Drains - Conveyance capacity of storm drain pipes shall be sized for a minimum of the 10-year, 3-hour design flood.
- Culverts - All culvert crossings under a roadway shall be designed to convey the 100-year storm unless otherwise approved. The minimum culvert diameter shall be 24 inches.
- Bridges - Free-span bridges must pass the 100-year event with a minimum of 2.0 feet of freeboard. No significant increases are allowed in upstream water levels.
- Open Channels - All open channels must be designed as permanent in nature and have a minimum freeboard of 1 foot. They must be designed as generally low maintenance facilities and must have adequate maintenance access for the entire length.
- Storage Facilities - Detention facilities will generally be used to prevent local increases in the 10-year, 24-hour and the 100-year, 24-hour peak flows, or the 100-year 3-hour storm, whichever case requires the largest volume.
- Floodplains - Any alteration of the floodplain is not permitted unless the proposed use can be shown to have no significant negative influence on the flood conveyance, the floodplain, or the alteration itself. Hydrologic, hydraulic, erosion, and geomorphologic studies will be required of developments adjacent to floodplains.
- Erosion Control – All drainage that leaves a new development shall be adequately addressed to mitigate all erosion on adjacent properties.
- Irrigation Ditches – In general, irrigation ditches shall not be used as outfall points for drainage systems.

PROPOSED CAPITAL FACILITIES

Using the updated existing facilities plan and the hydrologic analysis from the 2009 Storm Drain Master Plan, existing pipelines were evaluated to estimate the amount of excess capacity available for new development. Several meetings with St. George City staff were also held to determine likely areas of growth during the next 5 to 10 years. Projects were grouped based on geographical location.

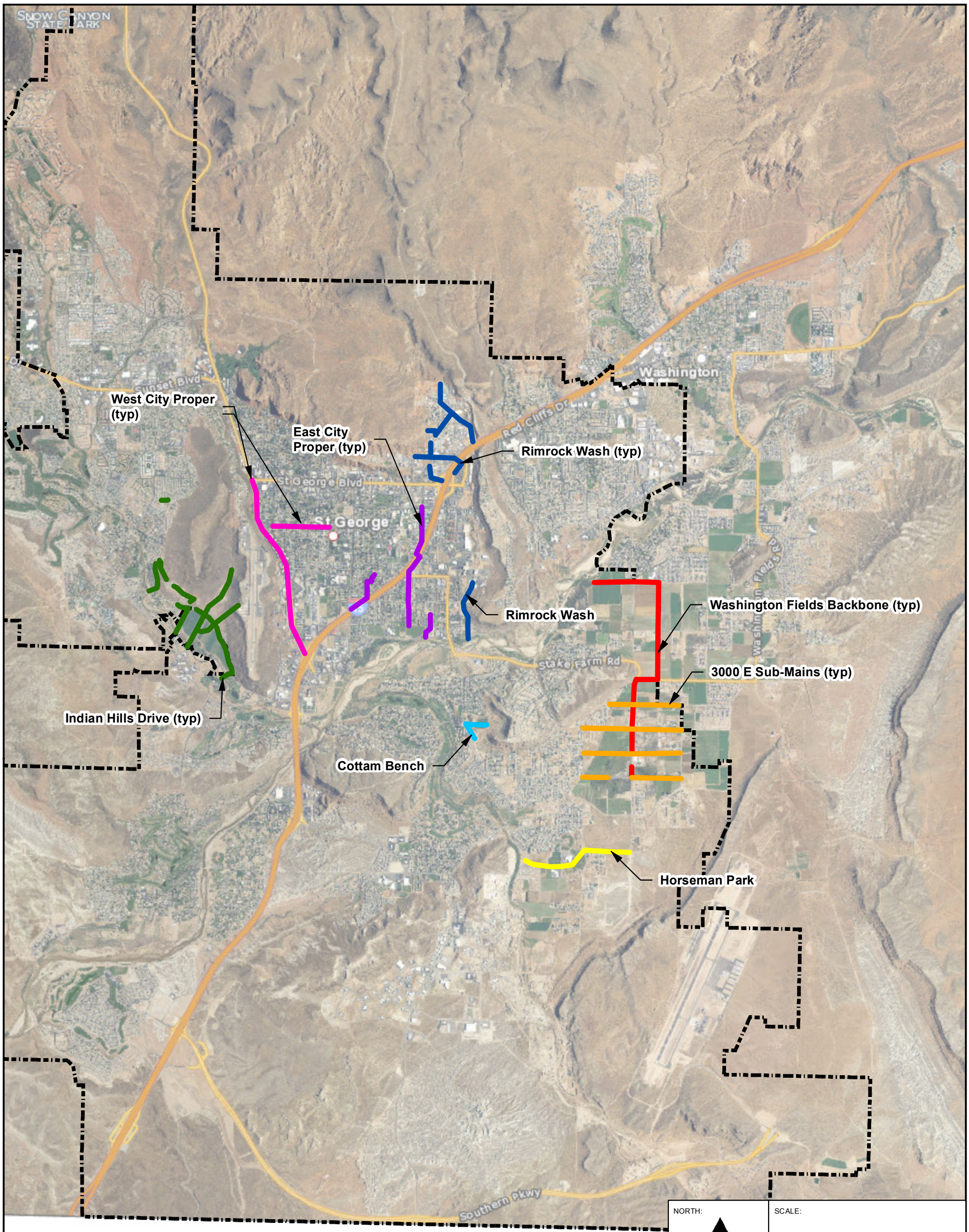
The recommended improvements identified in this IFFP include only major storm drain facilities (system improvements). Local storm drain facilities (project improvements), typically associated with development projects, are not included in the IFFP nor are they eligible for impact fees. This report defines only system improvements for the City's storm drain system. The definition of system improvements and project improvements is presented below.

- **Major Conveyance Facilities** – Major storm drain conveyance facilities (system improvements) include pipelines and improvements to major channels that typically service multiple developments. Local facilities (project improvements) include smaller storm drain conveyance facilities that typically only serve one development and are used to convey storm water runoff from the 100-year design storm to the major conveyance facilities.

- **Regional Detention Facilities –** Based on discussions with City personnel, it was decided to require each development to provide local detention facilities (project improvements) to attenuate peak storm water discharges to the limits stated in the SDMP report. A major regional detention facility (system improvement) will attenuate peak runoff from the 100-year design storm to levels that can be safely conveyed through existing downstream facilities.
- **Developer Related Projects as Needed –** This item covers "system improvements" for any projects that are required due to development, but are not specifically identified in the master plan. An example would be the road expansion project of Riverside Drive near River Road. That project is required due to an increase in traffic on that road, and will require a larger storm drain system to convey runoff from the expanded roadway surface.

Using this information, needed system stormwater management facilities have been identified to serve new development that is projected to occur within the next 10 years. The locations of recommended projects are shown on Figure 2, and are listed in Table 3.

An analysis was performed to identify demands placed upon existing stormwater system facilities by new development activities at the desired level of service. This analysis included estimating the following: existing facility capacity, design storm discharges for existing development, magnitude of existing deficiencies (if any), design storm discharges for projected full build out conditions, and increased discharges to existing rivers and washes. In addition, costs associated with needed stormwater system improvements that will serve areas of projected redevelopment in areas that are currently developed were estimated based on increased impervious area. Recommended projects and costs that can be attributed to development projected to occur in the next 10 years are presented in Table 3.



LEGEND

PROJECTS

- 3000 E Sub-Mains
- Cottam Bench
- Indian Hills Drive
- Washington Fields Backbone
- East City Proper
- Horseman Park
- Rimrock Wash
- West City Proper
- CITY LIMITS

NORTH: N

SCALE: 0 — 5,000 Feet

10 YEAR
PROPOSED PROJECTS

CITY OF ST. GEORGE
IMPACT FEE
FACILITIES PLAN

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FIGURE NO.
2

S:\St. George City\2012 SD IFFP\GIS\Figure 2 - 5 & 10 Year Projects.11.26.mxd tolsen 12/5/2013

Table 3
Proposed Capital Facilities Project (10 Year Plan)

Project	Estimated Total Cost[1]	Percentage of Projects completed within 1-5 Years	Percentage of Projects completed within 6-10 Years	Percent City Cost	Percent Associated with Project	Percent Associated with New Development	Impact Fee Eligible Cost In 1-5 Years	Impact Fee Eligible Cost In 6-10 Years
3000 E Sub-Mains	$3,140,000	38%	40%	30%	50%	20%	$238,640	$251,200
Cottam Bench	$220,000	90%	10%	25%	30%	45%	$89,100	$9,900
Indian Hills Drive	$3,745,000	30%	15%	28%	11%	61%	$685,335	$342,668
Washington Fields Backbone	$8,210,000	30%	15%	12%	8%	80%	$1,970,400	$985,200
East City Proper	$2,130,000	0%	20%	92%	0%	8%	$0	$34,080
Horseman Park	$1,730,000	25%	65%	25%	0%	75%	$324,375	$843,375
Rimrock Wash	$4,014,900	30%	40%	10%	76%	14%	$168,626	$224,834
West City Proper	$2,370,000	0%	20%	90%	0%	10%	$0	$47,400
Developer Matching	$1,000,000	50%	50%	0%	0%	100%	$500,000	$500,000
River & Wash Upgrades	$1,000,000	50%	50%	35%	50%	15%	$75,000	$75,000
						Total Impact Fee Eligible Costs	**$ 4,051,476**	**$ 3,313,657**

1. Costs are in 2012 dollars.
2. Percentages shown in table are average percentages.

IMPACT FEE CERTIFICATION

The analysis contained in this report has been prepared based on growth and system information provided by the City of St. George. Based on the data and growth assumptions provided and assuming the City follows the improvement plan outlined in this report, BC&A certifies that, to the best of our knowledge and in accordance with Section 11-36a-306, this impact fee facilities plan:

1. Includes only the costs for qualifying public facilities that are:
   a. allowed under the Impact Fees Act; and
   b. actually incurred; or
   c. projected to be incurred or encumbered within six years after the day on which each impact fee is paid;
2. Does not include:
   a. costs for operation or maintenance of public facilities;
   b. costs for qualifying public facilities that will raise the level of service for the facilities through impact fees, above the level of service that is supported by existing residents;
   c. an expense for overhead, unless the expense is calculated pursuant to a methodology that is consistent with generally accepted cost accounting practices and the methodological standards set forth by the federal Office of Management and Budget for federal grant reimbursement; and
3. Complies in each and every other relevant respect with the Impact Fees Act.

APPENDIX A

LEVEL OF SERVICE STANDARDS
(Section 3 of 2009 Drainage Design Manual)

SECTION 3
DESIGN CRITERIA

STREETS

Streets are a significant and important component in urban drainage and may be made use of in storm runoff within reasonable limits. The primary purpose of streets is for traffic. Reasonable limits for the use of streets for runoff shall be set by the City Engineer. Design criteria for gutter capacity and associated lane encroachment will depend on the roadway type as shown in Table 3-1. Street designs must include surface drainage relief points (inlets). This is especially important for flat gradient areas, local sumps or depressions and cul-de-sacs. Catch basins should be located on both sides of the street, in general, and the spacing between catch basin locations should not exceed 400 feet.

For pedestrian safety, street flows must be limited such that the product of the depth (feet) and velocity (feet/second) does not exceed six for the 10-year flow and eight for the 100-year flow. Curb overtopping is not permitted in the 10-year event. When street encroachment limits are met, an underground storm sewer system shall be required. Where this underground conveyance is required to limit street flows, it will be designed for the 10-year design storm or greater.

Table 3-1
Street Gutter Capacity for 100-Year Event

Street Classification	Maximum Encroachment
Local (Residential)	No curb overtopping.* Flow may spread to crown of street.
Minor Collector (Residential)	No curb overtopping.* Flow spread must leave one lane free of water.
Major Collector	No curb overtopping.* Flow spread must leave at least two lanes of travel free. (One lane in each direction)
Arterial	No Curb overtopping.* All travel lanes to remain open.
Major Arterial	No Curb overtopping.* No encroachment is allowed on any traffic lane.

*Where no curb exists, encroachment shall not extend over property lines.

Streets must also provide for routing of the 100-year design storm to adequate downstream conveyance facilities. The 100-year flood flows in streets should be contained within street right-of-way and adjacent drainage easements. Provision should be made to allow flows within the street to enter any downstream detention basins or other such facilities.

While the 100-year flow is the largest storm required in this manual, consideration should be given to requiring a flood easement to convey the 500-year storm through the natural lowpoint of

a basin. While this area could be used for roads and recreation type facilities, buildings would not be allowed within this corridor.

STORM DRAINS

Storm drain design conveyance capacity will be sized for a minimum of the 10-year, 3-hour design flood. The storm drain system should be of sufficient capacity to prevent significant damage to property during the 100-year, 3-hour design flood as the streets will most likely not be able to convey the difference between the 10-year and 100-year storms. Inlets must have sufficient capacity to prevent local ponding during the 10-year event, with 50 percent blockage of inlets by debris. Analysis of combined street and storm drain capacity for the 100-year flood must determine maximum ponding depths and water levels and show that these depths are non-damaging. In instances where sufficient combined capacity does not exist, the storm drain size may have to be increased beyond that of the 10-year design.

In areas where underground water is anticipated to be added to the drainage system, the pipe size should be increased accordingly. In general, ground water will not be allowed to flow in streets and gutters and in other overland flow situations.

Design considerations will be given for differences in interception capacity of inlets on a gradient as compared to interception capacity of inlets in sag locations. Inlet spacing and locations will be for continuous grade or sag situations as appropriate. Inlets will be spaced so as to keep the street encroachment of flood waters to the minimum. Sag points may be required to have additional inlets spaced to control the maximum level of ponding. Curb inlets are typically only capable of catching two cfs and should be of sufficient number to allow the pipe to flow full.

All storm drains will be designed by application of the Manning's equation. Minimum design velocity shall be 2.0 feet/second flowing one-half full. The Manning's n value shall represent that value that will be seen during the useful life of pipe which may differ from that of a new pipe. The hydraulic grade line will be shown for all pipe systems. The minimum storm drain diameter shall be 15-inch.

Storm drains shall not be designed for surcharged (pressure) pipe conditions unless otherwise approved by the City Engineer. When storm drains are designed for full pipe flow, or surcharged pipe conditions, the designer shall establish the hydraulic grade line considering head losses caused by flow resistance in the pipe, and changes of momentum and interferences at junctions, bends and structures. The water surface elevation profile and hydraulic grade line will be shown for the 10-year and the 100-year design flood as required in the Drainage Control Plan and Report.

CULVERTS

In general, culverts are used to carry runoff from an open channel or ditch under a roadway to a receiving open channel or ditch. The minimum culvert diameter shall be 24 inches. All culvert crossings under a roadway shall be designed to convey the 100-year storm unless otherwise

approved by the City. No road overtopping will be permitted for culvert crossings under arterial roads. Any overtopping on less critical roads shall be limited by the velocity/depth ratio.

A culvert entrance blockage factor of 50 percent shall be used for culverts with a diameter less than 36" culverts, as well as for culverts placed in drainages with upstream debris as determined by the City. The 100-year design storm water backwater surface upstream will be determined (using HEC-2 or HEC-RAS) unless otherwise not required by the City. The back water must be shown to be non-damaging and be approved by the affected property owner. Potential paths of embankment overtopping flows will be determined and redirected, if necessary, so that no significant flood damage occurs. Entrance and exit structures must be installed to minimize erosion and maintenance. The minimum culvert slope shall be 1 percent unless otherwise approved.

BRIDGES

Bridges consist of major structures crossing major washes or drainages. The roadway facility handled can be any classification of roadway. Low water crossings are generally not permitted. Bridges can consist of free span structures, box culverts, multiple box culverts, multiple precast bridges and others.

Free-span bridges must pass the 100-year event with a minimum of 2.0 feet of freeboard. No significant increases are allowed in upstream water levels. A HEC-2 or HEC-RAS analysis of potential upstream water surface may be required by the City. Local and regional scour analyses are required on the structure, upstream and downstream, and embankments. All potential scour will be mitigated. Appropriate references for this include the UDOT Manual of Instruction for Roadway Drainage; Stream Stability at Highway Structures, Hydraulic Engineering Circular No. 20, Federal Highway Administration; Evaluating Scour at Bridges, Hydraulic Engineering Circular No. 18, Federal Highway Administration; and Bridge Scour and Stream Instability Countermeasures, Hydraulic Engineering Circular No. 23, Federal Highway Administration.

For structures crossing FEMA designated flood plains and drainages, other requirements will be used, as directed by the City.

OPEN CHANNELS

Generally, there are two types of channels: man-made and natural. Natural channels can be further subdivided into several sub-categories such as un-encroached, encroached, partially encroached, bank-lined and others. The 100-year recurrence flood will be used for design for all channels unless otherwise approved by the City. All open channels must be designed as permanent in nature and have a minimum freeboard of 1 foot. They must be designed as generally low maintenance facilities and must have adequate maintenance access for the entire length.

Man-made Channels

Man-made channel side slopes will generally be limited to a maximum slope of 2H:1V. Flatter slopes are generally recommended for maintenance and safety reasons. Safety is a primary concern. A channel should be designed such that a person falling into it could climb out within a reasonable distance. A channel that is shallow in depth or in remote areas, or in areas of restricted right-of-way may, upon approval, have a steeper slope. Maximum velocities will depend on the type of material used for the channel lining. Supercritical velocities are not permitted for any material used. Drop structures and other energy dissipating design may be required to limit velocities to control erosion and head cutting.

Maximum velocities for grass lined channels depend on the type of grass mixture. The designers should consult appropriate design literature for details. It is assumed that grass lined channels will be mowed at least annually and will need to be irrigated. The minimum bottom width of a grass lined channel will be 6 feet unless otherwise approved by the maintenance agency. The minimum bottom width of all man-made channels shall be designed to facilitate access and maintenance.

Natural Channels

The use and preservation of natural drainage ways shall be encouraged. Natural channels for drainage conveyance can reduce long term maintenance costs, can reduce initial costs associated with drainage, and can enhance passive recreation and open space uses. When natural channels are incorporated into the drainage control plan, consideration shall be given to the impact of increased flows due to improvements to upstream drainage basins and areas, adequate access for maintenance and debris removal, long-term degradation and erosion potential, and the need for additional set-backs for structures.

STORAGE FACILITIES

Generally, there are two types of storm water storage facilities: retention and detention. Retention ponds which are normally intended for infiltration of stored water may require extensive subsoil and groundwater studies as well as extensive maintenance requirements and safety concerns and are generally not allowed.

Detention facilities (basins) are used to temporarily store runoff and reduce the peak discharge by allowing flow to be discharged at a controlled rate. The controlled discharge rate is based on either limited down stream capacity, as in regional basins, or on a limit on the increase in flows over pre-development conditions, as in local facilities, and in some instances both.

Regional detention facilities are those identified by the City and will be identified in the Storm Drain Master Plan and other regional studies. Generally, these facilities control flow on major washes or drainage basins, are of major proportion, and are built as part of major development or mitigation plans.

Local detention facilities are usually designed by and financed by developers or local property owners desiring to improve their property. These facilities are intended to allow development of property by protecting a site from existing flooding and/or to protect downstream property from increased runoff caused by development. In small facilities, detention storage volume may be provided in small landscaped basins, parking lots, underground vaults, excess open space, or a suitable combination. In larger facilities, dual functions may be served. These larger facilities are required to reduce existing flooding to allow a development and/or control increased runoff caused by the development itself. These larger facilities may store significant flood volumes and may handle both off-site and on-site flows.

Detention facilities will generally be used to prevent local increases in the 10-year, 24-hour and the 100-year, 24-hour peak flows, or the 100-year 3-hour storm, whichever case requires the largest volume. Post-development discharges must not exceed pre-development discharges or .2 cfs per acre, whichever is less. If downstream facilities lack adequate capacity to handle the flow, lower release rates must be used.

Standard engineering practice shall be used in determining the volume of the required facilities. A minimum of 1 foot of freeboard is required above the maximum water surface elevation. Emergency spillways or overflows will be incorporated into all designs. Structures and facilities shall be design so as not to be damaged is case of emergency overflow. Detention basins must empty within 24 hours of a storm event. The maximum impounded water depth of a basin should be 3 feet unless otherwise approved. Below grade basins are preferred. Partially wet basins may be allowed for recreational or aesthetic purposes, but storage below permanent spillways or low-level outlets cannot be included in control calculations. Groundwater should not be introduced into detention basins without approval of the City. Multi-use (e.g. recreation) should be considered for all detention basins.

Energy dissipation and erosion protection is required at all outlet structures where storm drainage is released into a natural or erodible channel, unless otherwise approved by the City. All basins are required to function properly under debris and sedimentation conditions. Adequate access must be provided to allow for cleaning and maintenance. All basins shall be designed as permanent facilities unless otherwise approved in writing by the City.

FLOODPLAINS

Flood plains are generally classified as FEMA and non-FEMA. Any work in and around FEMA designated and mapped floodplains should refer to the local ordinance governing their use. All work in the FEMA floodplain requires an appropriate permit.

Non-FEMA Floodplains

In general, all building floor levels should be constructed two feet above the 100-year flood level. Encroachments into the 100-year floodplain for natural water courses will not be allowed unless otherwise permitted by the City. All natural drainages, washes, and waterways that convey a developed 100-year flow of greater that 150 cfs will be left open unless otherwise approved. Developments located adjacent to or in floodplains may be required to stabilize the

continual degradation and erosion of the channel by installing grade control structures and/or by other effective means. Any alteration of the floodplain is not permitted unless the proposed use can be shown to have no significant negative influence on the flood conveyance, the floodplain, or the alteration itself.

In the layout and design of new developments, adequate access to floodplains and erosion protection shall be provided. It is preferred that streets be positioned between floodplains and structures. Where not possible or feasible, additional structural setbacks will be required.

Hydrologic, hydraulic, erosion, and geomorpholigic studies will be required of developments adjacent to floodplains.

EROSION CONTROL

Necessary measures shall be taken to prevent erosion due to drainage at all points in new developments. During grading and construction, the developer shall control all potential storm runoff so that eroded soil and debris cannot enter any downstream water course or adjoining property. All drainage that leaves a new development shall be adequately addressed to mitigate all erosion on adjacent properties. Erosion mitigation shall be permanent unless otherwise approved. A comprehensive reference on erosion control is Sedimentation Engineering by the ASCE.

IRRIGATION DITCHES

In general, irrigation ditches shall not be used as outfall points for drainage systems, unless such use is shown to be without unreasonable hazard substantiated by adequate hydraulic engineering analysis.

In general, irrigation ditches are constructed on very flat slopes and with limited carrying capacity. It is obvious, based on experience and hydraulic calculations, that irrigation ditches cannot, as a general rule, be used as an outfall point for storm drainage because of physical limitations. Exceptions to the rule are when the capacity of the irrigation ditch is adequate to carry the normal ditch flow plus the maximum storm runoff with adequate freeboard to obviate creating a hazard to property and persons below and around the ditch. Ditches are seldom for use as a storm drain.

Irrigation ditches are sometimes abandoned in areas where agricultural use has subsided. Provisions must be made for ditch perpetuation prior to its being chosen and used as an outfall for drainage. Use of irrigation ditches for collection and transportation of storm runoff shall be made only when in accordance with the Storm Drain Master Plan.

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