LINE CREEK

LINE CREEK
DEVELOPMENT PLAN

Adopted Dec. 11, 2008
by City Council
ordinance no. 081155

KANSAS CITY
MISSOURI

RESOLUTION NO. 081155

Replacing a portion of the Line Creek Valley Area Plan with the Line Creek Development Plan as a guide for the future development and public investment within the area generally bounded by M-152 Highway on the north, N.W. 68th Street on the south, N. Platte Purchase Road on the east, and N.W. Waukomis Drive/N. Green Hills Drive on the west, with an extension at the southwest portion of the planning area to approximately Overland north and south of N.W. 72nd Street. (206-S-12 and 655-S)

WHEREAS, on December 22, 1976, the City Council by Resolution No. 47178 adopted the Line Creek Valley Area Plan as a guide for development and redevelopment of that area generally bounded by M-152 Highway on the north, city limits of Gladstone on the east, city limits of Weatherby Lake and Parkville on the west, and city limits of Riverside on the south; and

WHEREAS, said Line Creek Valley Area Plan was amended on August 9, 1990, through the adoption of Resolution No. 900147; was amended on March 18, 1999, through the adoption of Resolution No. 990140; and was amended on January 27, 2000, through the adoption of Second Committee Substitute for Resolution No. 991518; was amended on March 21, 2001, through the adoption of Resolution No. 020191; was amended on July 31, 2003, through the adoption of Resolution No. 030759; was amended on April 29, 2004, through the adoption of Resolution No. 040395; was amended on December 16, 2004, through the adoption of Resolution No. 041210; and was further amended on September 7, 2006, through the adoption of Resolution No. 060907; and

WHEREAS, after further review, the City Development Department deemed it appropriate to replace a portion of the Line Creek Valley Area Plan with the Line Creek Development Plan as a guide for the future development and public investment within the area bounded by M-152 Highway on the north, N.W. 68th Street on the south, N. Platte Purchase Road on the east, and N.W. Waukomis Drive/N. Green Hills Drive on the west; and

WHEREAS, the City Plan Commission considered such replacement of a portion of the existing plan and approval of the new plan on October 21, 2008; and

WHEREAS, after all interested persons were given an opportunity to present testimony, the City Plan Commission did on October 21, 2008, recommend approval of the proposed replacement of a portion of the Line Creek Valley Area Plan with the Line Creek Development Plan; NOW, THEREFORE,

BE IT RESOLVED BY THE COUNCIL OF KANSAS CITY:

Section A. That the Line Creek Valley Area Plan is hereby amended by deleting the area bounded by M-152 Highway on the north, N.W. 68th Street on the south, N. Platte Purchase Road on the east, and N.W. Waukomis Drive/N. Green Hills Drive on the west, and replacing this with the Line Creek Development Plan for that same area, which

is hereby adopted. A copy of the Line Creek Valley Development Plan is attached hereto as Exhibit A and incorporated herein by reference.

Section B. That the Line Creek Valley Development Plan is consistent and complies with the FOCUS Kansas City Plan, adopted on October 30, 1997, by Committee Substitute for Resolution No. 971268, and is adopted as a supplement to the FOCUS Kansas City Plan.

Section C. That the Council finds and declares that before taking any action on the proposed plan, all public notices have been given and hearings have been held as required by law.

Authenticated as Passed

Mark Funkhouser, Mayor

Vickie Thompson

Vickie Thompson, City Clerk

DEC 11 2008

Date Passed

CREDITS and acknowledgments

Appointed Steering Committee:

Coby Crowl - Chair
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David Barth
John Barth
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Captain Mark Folsom
Pete Fullerton
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Wes Minder
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Jim Rice
Nelsie Sweeney
Wayne St. Vincent
Dion Walden
Greg Walker/
Jim Bowers
Patricia Wilson

KANSAS CITY
MISSOURI

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The Honorable Mark Funkhouser

CITY MANAGER: Wayne A. Cauthen

CITY COUNCIL:

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Ed Ford .....2nd District-at-Large
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Cindy Circo .....5th District-at-Large
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CITY COUNCIL:
The Honorable Kay Barnes

CITY MANAGER: Wayne A. Cauthen

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"Great Places start with Great Visions..."

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PREPARED FOR:
The City of Kansas City, Missouri

PREPARED BY:
Bucher, Willis & Ratliff Corp., The City of Kansas City, Missouri Planning & Development Department, with assistance from TapanAm Associates, Inc. and ASTRA Communications, Inc.

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EXECUTIVE SUMMARY

In the most attractive developments, land is developed from the outset to minimize environmental degradation and to preserve the natural beauty of the terrain, which is the most important asset and the main reason for building there in the first place. Building lots, roads, utilities, and common areas are designed to minimize loss of trees and native vegetation, minimize unsightly cuts in the hillsides, control erosion and runoff, and protect the public view while still allowing for private reflection.

The Line Creek Valley Development Plan in Kansas City's Northland is a unique opportunity to direct the course of development through a unified planning effort. The Development Plan is as a prototype for future development in Kansas City and stresses "creating quality places". The Development Plan encourages a pattern of growth which respects the existing topography and noteworthy natural features using the recommendations of the Kansas City FOCUS Plan as well as:

- KC-ONE Storm Water Management Plan
- Wet Weather Solutions Program
- Section 5600, KCAPWA – Storm Drainage Systems and Facilities
- Kansas City, MO Development Ordinance (draft)
- Parkway and Boulevard Planning and Design Criteria (draft)

Example of existing road conditions.

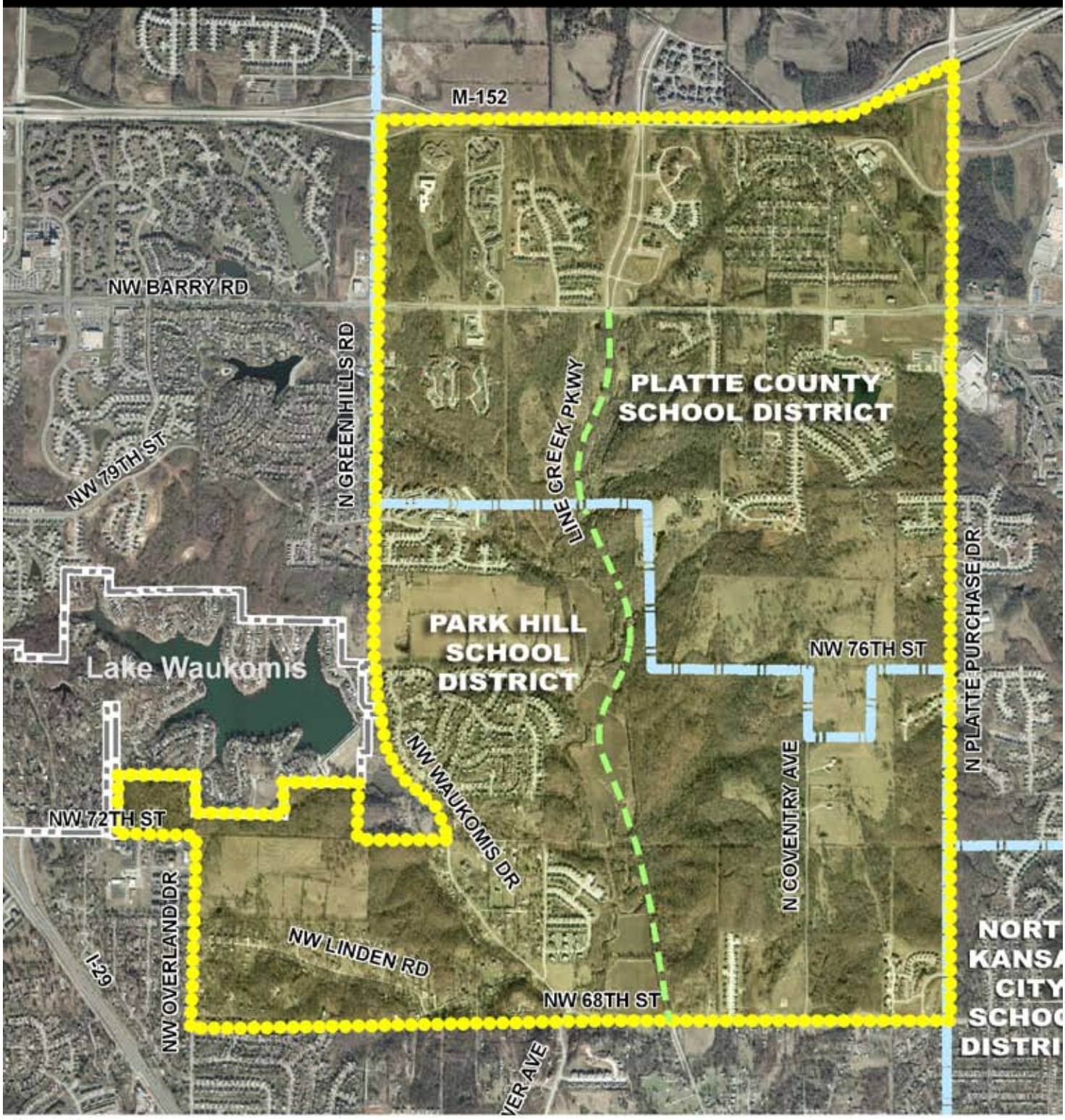
The planning area is bisected by Line Creek and is characterized by steep topography, wetlands, and floodplain lands. The area has incomplete roadway and public utility systems which have contributed to a piecemeal land use pattern in which large tracts of undeveloped land exist side by side with developed properties.

The area is host to several natural streams.

The framework for future development in the Line Creek Valley addresses walkable neighborhoods, mixed-land uses, transportation elements and linkages with appropriate context-sensitive street standards suitable for the topography and the variety of adjoining land uses. Trails and an interconnected street and sidewalk network provide linkages between neighborhoods, nearby parks, and community facilities.

The Line Creek Valley Development Plan provides recommendations for future land use, infrastructure, transportation system, and development design. Future development in the project area will emphasize storm water detention and flood control/mitigation with an approach to environmental stewardship and natural resources preservation. It also serves to integrate components of technical plans from various city departments into one comprehensive document.

Planning Area



INTRODUCTION

Purpose of Plan

This Plan will be used as the adopted policy and plan of record by developers, property owners, business owners, residents, public officials, and city staff as the framework for future development decisions. The Line Creek Valley Development Plan serves as the guide for the development area that:

- Provides a vision for future development while protecting the character of the Line Creek Valley;
- Provides flood control mitigation and storm water management strategies and guidelines to maintain high quality stream courses, while promoting multiple economic, social, and environmental benefits as stated in the City's on-going Wet Weather Solutions Program (Ref Appendix A);
- Guides development in the area with targeted types of development land uses, densities, priorities, and necessary improvements to support development;
- Establishes a framework and guidelines for mixed-use design, pedestrian and transportation systems, and open space;
- Provides a wider and more diverse mix of residential and commercial development opportunities;
- Promotes the citywide initiatives established by the City's Comprehensive Plan, the FOCUS Kansas City Plan, as well as the KC-One Storm Water Management Plan, Section 5600, KCAPWA – Storm Drainage Systems and Facilities, and the Kansas City, MO Development Ordinance (draft); and
- Establishes implementation strategies and a guide to lead the decision-making process involving neighborhoods, developers, City staff, City boards/commissions, the City Council, and other stakeholders.

New construction continues to emerge on the edges of the previously undeveloped terrain.

Proposed roundabouts to handle future traffic growth.

Planning Area

The entire planning area consists of approximately 2,842 acres, with the focus of the Development Plan concentrating on the immediate Line Creek area. The planning area boundary is defined as:

North: M-152 Hwy
South: NW 68th Street
East: N. Platte Purchase Road
West: NW Waukomis Dr. / N. Green Hills Drive, with an extension at the southwest portion of the planning area to approximately Overland north and south of NW 72nd Street.

INTRODUCTION

Corridor Context

The planning area is a sub-portion of the larger Line Creek Valley watershed and the Line Creek Area Plan, which is bisected by Line Creek and is characterized by steep slopes adjacent to stream courses, wetlands, and floodplain lands. The planning area has incomplete roadway and public utility systems that have contributed to a piecemeal land use pattern in which large tracts of undeveloped land exist side by side with development in growth corridors. The Line Creek planning area is served by two school districts. The boundary between the Platte County R-3 School District and the Park Hill School District jogs roughly through the middle of the area and has no relationship to the rough topography or a logical future street pattern (Ref Planning Area Map).

Past active rail line.

Interurban rail line through the valley.

Line Creek Valley proper has a long development history. From 1913 to 1932 an interurban rail line operated through the heart of the valley providing service from downtown Kansas City, MO to St. Joseph, MO. There were multiple stops in the valley providing local service which allowed early development to occur. The "Milton" area centered in the region of NW 64th Street and NW Waukomis Drive is an example.

In addition to the early development in the area that was ultimately annexed by Kansas City in 1962, there were numerous small incorporations that occurred in the mid-1900s. These included Lake Waukomis, Platte Woods, Riverside, and Northmoor. In 1952, Kansas City constructed a 24-inch water line to TWA's Mid-Continent Overhaul Base (later to become KCI Airport). In the section between NW 56th St. and Tiffany Springs Road this line was run in the Waukomis Road right-of-way. Most development in the I-29 corridor was enabled by this 24-inch water line.

The planning area proper has development opportunities involving numerous large parcels of undeveloped or minimally developed land which in some locations offer wonderful views of downtown Kansas City. It also has the challenges of unique terrain, steep slopes, and very few public street rights-of-way providing property access. The valley has had steady residential development for the last three decades and its undeveloped areas continue to represent contiguous northward development opportunities with a relatively short travel time to downtown.

Technical committee and steering committee members attended the kickoff meeting, including a bus tour of the area.

Development Area Inventory

A preliminary investigation and inventory of the development area was undertaken. The results formed a compilation of background data and information summarized in a separate document entitled the Line Creek Valley Development Plan Data Book. This supplemental resource includes:

- Natural Resources
- Existing Land Use
- Existing Zoning
- Existing Utilities
- Ownership Patterns
- Adopted Plans and Policies
- Flood Control and Storm Water Management Issues, and
- Transportation Network Issues

Community participation gave useful input on the plan.

The Participation Process

In order to engage the community in the development planning process, the City of Kansas City established a participation structure with stakeholder groups, landowners, neighborhood leaders, and members of the public at-large to provide input and build agreement on principles and specific recommendations for the plan.

- A mayoral appointed citizen-based Steering Committee was formed to articulate overall directions and review principles and concepts as they were developed.
- The project Technical Advisory Committee consisting of staff from the City of Kansas City, the Mid America Regional Council, and the Economic Development Corporation of Kansas City, provided background and guidance related to their fields of expertise.

Workshops with the public and the appointed committees were held throughout the planning process to help stakeholders and residents shape the vision of the Development Plan. In addition, stakeholder meetings were conducted with owners of four of the largest properties in the planning area (accounting for approximately 30% of the planning area). These stakeholder meetings with the landowners gave the project consultants and city staff supporting documentation about their properties and input about how to best preserve and develop in the valley – if development occurs.

Workshops focused the citizens' thoughts into concepts.

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GUIDING PRINCIPLES

Building on the meaningful public input during the planning process, the following Guiding Principles were prepared to serve as the basic framework for the Line Creek Valley Development Plan.

ENVIRONMENTAL STEWARDSHIP

- Preserve open space, clean air and water, and natural features.
- Use a comprehensive strategy to manage storm water generated by development.
- Plan and construct infrastructure projects to harmonize with natural systems.

CIVIC AND OPEN SPACES

- Use linear parks to bind developments into cohesive interrelated districts.
- Integrate stream buffer, floodplains, green spaces, woodlands, and parks as part of the urban landscape and create linkages between neighborhoods, schools, nearby businesses, and employment centers.
- Create a unique and lasting identity for the area.
- Embrace Line Creek Parkway as a linear park and community space.

INTEGRATED LAND USE

- Provide a well designed realm of vibrant neighborhoods, parks and open spaces, and civic institutions within walking distance of shops, services, jobs, and transportation.
- Integrate an interconnected mix of land uses, ample green space, and building designs that harmonize with the natural environment and permits development on the ridge tops.
- Target city infrastructure investments, including arterial roadways, east-west street connections, pedestrian/bicycle paths, and transit to support all uses.

NEIGHBORHOOD DEVELOPMENT

- Create neighborhoods that are compact, pedestrian-friendly, preserve natural resources, and include a mix of uses within walking distance.
- Provide a range of quality housing choices.
- Provide an interconnected network of streets, sidewalks, and trails serving existing neighborhoods and future development.
- Establish a framework and guidelines to promote quality development that respects the natural environment and is visually pleasing.
- Provide convenient access to public transit.

Wet detention can also allow for amenities like fountains.

Greenways and trails create connectivity.

Mixed-use development provides pleasant living/ shopping experiences.

Sidewalks and street trees create a visually pleasing and pedestrian friendly environment that connects one neighborhood destination to another.

DEVELOPMENT intensity and LAND USE

Future land use and development characteristics in the Line Creek valley and along Line Creek Parkway are based on a geographical cross-section of environments. The planning area ranges from undeveloped areas preserved in their natural state to moderate and higher intensity urban mixed-use neighborhoods. The following descriptions conceptually identify how a range of development intensities may occur in the planning area and along Line Creek Parkway. Development planning for areas along Line Creek Parkway must be based on the final design of Line Creek Parkway and the desired future development pattern.

CONSERVATION AND LIMITED RESIDENTIAL | **RESIDENTIAL MEDIUM-HIGH** | **URBAN MIXED USE NEIGHBORHOOD**

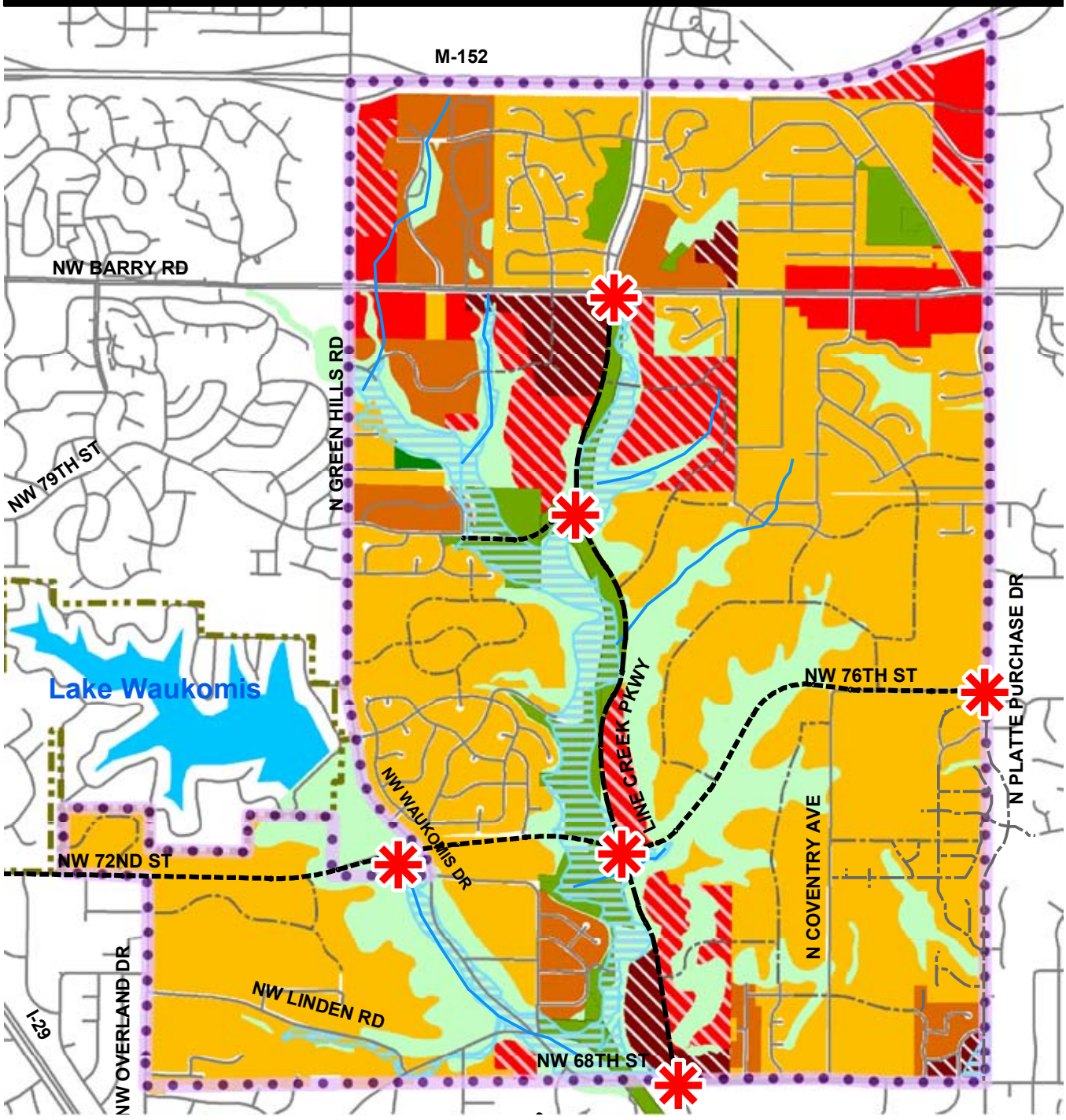
Conservation and Limited Residential areas include parks, stream buffers and woodland areas. In addition, limited low density and clustered residential housing may be incorporated where appropriate. Plantings are naturalistic and building setbacks relatively deep. Blocks tend to be larger and roads more irregular to accommodate natural conditions.

Residential Medium-High development areas consist of a mix of residential uses with primarily an urban fabric and more intense development than found in the limited lower density residential areas. This Zone has a wide range of building types: single-family, clustered development, and moderate density attached multi-unit residential buildings such as townhomes and rowhouses. Setbacks and landscaping are variable but generally less than Sub-Urban Zones. The supporting street network provides medium-sized blocks.

Urban Mixed Use Neighborhoods consist of higher intensity mixed-use building types that accommodate retail, offices, and attached multi-unit residential buildings. It has a tight network of supporting streets, with wider sidewalks than lower density areas, and buildings set closer to street frontages.

Future Land Use Map

Line Creek Valley Development Plan



Legend

- Study Area - 2,841.3 Acres
- KCMO City Limits
- Future Parkway Alignment
- Future Arterial Streets
- Future Neighborhood Street Connections
- Existing Streets
- Streams

Future Land Use

- Residential Medium-High Density
- Residential Medium Density
- Mixed Use Neighborhood
- Mixed Use Community
- Commercial
- Park
- Open Space / Potential Stream Buffer
- * Open Space Development and Conservation Development may apply throughout entire Planning Area

- Water Bodies
- 100-Year Floodplain
- Gateways

Miles
0 0.15 0.3

DEVELOPMENT intensity and LAND USE

Future Land Use Plan

The Future Land Use Map serves as a guide for the direction and magnitude of future growth and at the same time accommodates changes in market demand. The Future Land Use Map is but one aspect of the Line Creek Valley Development Plan. The entire Development Plan, including the Guiding Principles and the Development Framework and Guidelines, should be referenced and considered when viewing the maps and when judging the appropriateness of the land uses they may display.

The Future Land Use Map identifies the generalized location for land use classifications and development intensities in the planning area. The Map is not intended to identify the precise boundaries of each land use designation since areas classified as mixed use are intended to accommodate gradual transition from one land use to another. The Development Plan encourages the integration of compatible land uses, rather than a strict segregation of different land uses.

LAND USE CLASSIFICATIONS

The following land use categories and their definitions are used in the Future Land Use Plan Map.

Open Space/Buffer:
This category consists of private or public lands approximating a wilderness condition, including lands unsuitable for development. It may include creeks and streams, floodplains, woodlands, severe slopes, and buffer zones around such natural resources (areas difficult for development due to topography, hydrology, aged woodlands, archeological findings, etc.). These areas may be used for interpretive trails and/or passive recreation. Open Space/Buffer areas may also include public and private lands, such as parks or private common open space tracts, which are in some way either temporarily or permanently reserved from development.

Parks:
This category consists of public or private land reserved for parks and parkways and is intended to accommodate active and passive parklands, trails, recreation uses, environmentally sensitive areas, or any other lands reserved for permanent open space purposes.

Open Space Development and Conservation Developments:
This category can be applied over the other entire area. This Open Space and Conservation Category is intended to encourage flexibility in design standards (example: reduced lot sizes or increased density) to provide additional open space and recreational amenities for residents, while preserving environmentally sensitive resources. These areas are intended to develop design options that allow greater flexibility in exchange for the provision of a greater amount of common open space than required in conventional developments. Development form must comply with the minimum site area and minimum open space standards of 80-110-6-B (Sec. 80-410 of the Development Code. See table 110-2).

Residential Medium (Up to 8.7 dwelling units per acre):
This category accommodates residential development primarily characterized by single-family detached dwellings and may include large estate lots or cluster single family developments including zero lot line dwellings, cottage houses, or attached single-family (two-unit dwellings) with preserved open space to maintain an overall low net density. This category is also appropriate for planned public and semi-public


Natural streams are part of the open space that exists.


Neighborhood parks with good walkability is proposed.


Suggested future residential development with open space preserved.

uses considered compatible with residential uses, such as schools, religious institutions, and civic uses. Net density will be lower in locations where land is severely restricted by slopes, significant vegetative cover, or other significant natural features. This category corresponds with the "R-5", "R-6", "R-7.5" and "R-10" zoning categories within the new Zoning and Development Code.

Residential Medium-High (Up to 17.4 dwelling units per acre):
This category accommodates small lot single-family development, and attached residential development primarily consisting of attached houses, two-unit houses, multi-unit houses, multiplexes, and apartment/condo dwellings which may be intermixed throughout the neighborhood. This category is appropriate for planned public and semi-public uses considered compatible with residential uses, such as schools, religious institutions, and civic uses. Net density may be lower in locations where land is severely restricted by slopes, significant vegetative cover, or other significant natural features. This land use classification corresponds with the "R-2.5" zoning category within the new Zoning and Development Code.

Mixed Use Neighborhood:
This category is primarily intended to accommodate and promote a wide variety of moderate density residential building types including single-family detached dwellings, zero lot line dwellings, cottage houses, attached houses, two-unit houses, multi-unit houses, multiplexes, apartment/condo dwellings, with limited neighborhood serving retail sales or services uses, all of which may be intermixed throughout the neighborhood. Development form may include vertical mixed-use development with a variety of business and residential choices, which enhance the pedestrian environment of the community.

Residential densities may vary throughout the neighborhood and are generally higher than conventional single-family subdivisions. This category is appropriate for planned public and semi-public uses considered compatible with residential uses, such as schools, religious institutions, and civic uses. Limited nonresidential uses including live-work, small offices, and limited retail stores (not including automotive-oriented uses and free-standing pad sites) providing services to nearby neighborhoods may be permitted in this category under strict architectural and land use controls including the provisions of the Development Framework and Guidelines. This land use classification associates with the MPD (Master Planned Development) zoning category within the new Zoning and Development Code.

Mixed Use Community:
This category promotes a mixture of neighborhood-serving office and retail services, institutional, civic, and medium to higher density residential uses intermixed through compatible site planning and building design. Development form includes mixed use development with a mix of business and residential that enhances the pedestrian environment of the community. Residential uses may be located on upper floors of a building's business use, or may include attached or multi-unit houses, multiplexes, or apartment/condo buildings commingled nearby to promote diversity and a successful pedestrian environment. Non-residential uses are limited to compact, pedestrian/ neighborhood-oriented services rather than large-scale or automotive-oriented uses. Given close proximity to residential uses, all business developments must be well-planned and designed in accordance with the Development Framework and Guidelines. This land use classification corresponds with the "MPD" zoning category within the new Zoning and Development Code.

Commercial:
This category is primarily intended to accommodate "more intense" commercial activities, automotive-oriented uses, and/or outdoor operations that are not found in or compatible with mixed-use or neighborhood oriented environments. Uses typically include offices and retail establishments, medium-to-large scale businesses, and automotive-oriented uses including drive-through facilities. This land use classification will correspond with the "O", "B1", "B2", "B3" and "B4" zoning categories within the new Zoning and Development Code.


Medium residential housing choices proposed.


Medium-high residential housing choices proposed.


Mixed-use community center proposed.


Retail-commercial with office proposed.

DEVELOPMENT intensity and LAND USE

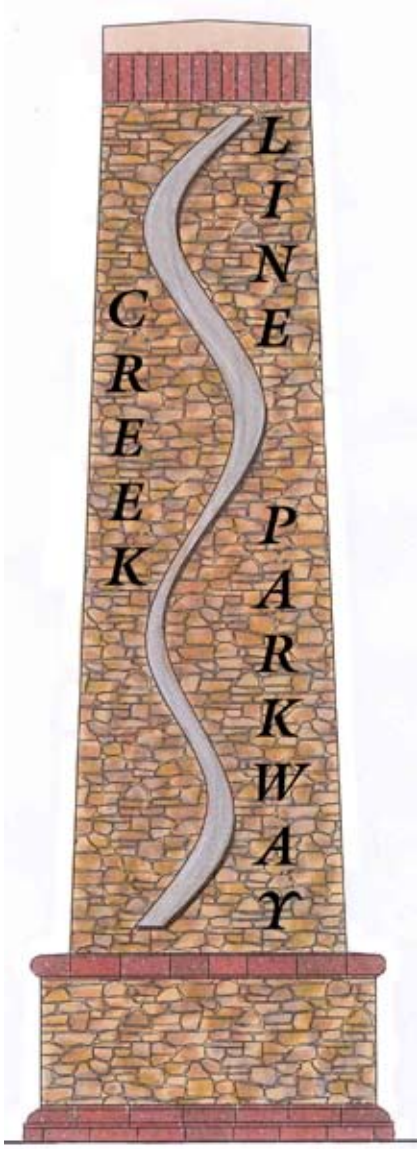
Gateways

Gateways are designated on the Future Land Use Map at prominent locations that serve as major points of arrival into the Line Creek Valley area and establish an identity for the area through noteworthy public space features and development design. Public and private improvements in gateway areas are subject to the urban design provisions in the Development Framework and Guidelines, as well as gateway urban design plans addressing public art, signage, decorative street lighting, and landscaping improvements to be placed in the public right-of-way.

GATEWAYS DESIGN FEATURES

Gateway design features in the public right-of-way should be established with an urban design plan prepared concurrently with preliminary engineering for Line Creek Parkway. The scale of these features should be appropriate for both the pedestrian and vehicular environments in which they area located and should include:

- A prominent feature such as large-scale public art, statuary, fountains or water features, gardens or park-like settings, or prominent public plaza space;
- Vertical four-sided monument marker shafts constructed of durable materials such as pre-cast concrete, brick, or stone. Markers may include accents such as steel, limestone, stucco, ceramic tile, pre-cast concrete caps, bronze plaques, pre-cast concrete coping, or concrete masonry units.
- Signage to clearly identify entrance into the Line Creek Valley. Brick, stone or other high-quality materials, with the City and Parks and Recreation Department logos incorporated; and
- Landscaping to accent the surrounding area and prominent features.



Conceptual design of gateway features.

Examples of intersections proposed in the Line Creek Development Plan.

environmental and stormwater

MANAGEMENT

Environmental Design

Future development in the Line Creek Valley planning area should be designed to respect the natural environment and coexist in harmony with existing natural features. Development planning should attempt to avoid engineering techniques, such as significant cut and fill to force-fit development into the environment. Instead, natural physical features should be incorporated into the overall development design, with drainage areas and other natural features left in their natural state.

A comprehensive approach for environmental and storm water management will be implemented in the Line Creek Valley planning area to increase water "quality" and to reduce storm runoff "quantity". This approach is consistent with the goals and objectives of the City's Wet Weather Solutions Program and will:

- Provide a system-wide series of regional storm water facilities to reduce downstream flood damage.
- Provide localized storm water infiltration and detention in new development areas to protect the regional facilities and the streamways.
- Provide stream buffer setbacks.
- Provide areas of slope protection adjacent to streamway buffers.
- Protect environmentally and culturally sensitive areas.

Environmental Approach

Future development in the planning area will be encouraged to retain its natural infrastructure and visual character derived from topography, woodlands, streams, and riparian corridors. If found, environmentally sensitive areas will be protected by establishing stream buffer areas in accordance with the stream buffer ordinance, with permanent public or private parks and common open space. In most instances, these areas to be protected are located within stream setbacks in accordance with the provisions of Section 5600 KCAPWA – Storm Drainage Systems and Facilities (Ref. Appendix B). The buffer areas are represented on the Environmental and Storm Water Management Map.

Line Creek as it exists today.

STREAM BUFFER ZONE:

Streamside buffers are located along Line Creek and stream tributaries with this zone generally measuring 150-feet in width from each side of the stream. This zone varies and is wider in areas with wider floodplains or in areas with the presence of slopes greater than 15%, subject to the requirements of the stream buffer ordinance.

Much of the middle buffer zone in the planning area is located in the 100-year floodplain. Activities in this zone are limited to vegetation management and stream bank stabilization, where required and other activities identified in the stream buffer ordinance. These areas consist of native vegetation and may also be used for parklands, trails, and storm water facilities.

Conservation development proposed.

Cluster Development:

A form of planned residential development that concentrates buildings on a part of the site (the cluster area) to allow the remaining land (the open space) to be used for recreation, common open space, or preservation of environmentally sensitive areas. The open space may be owned by either a private or public entity.

OUTER BUFFER ZONE:

Outer buffer zones could have variable width, but at this time the maximum width is 150 feet. Slopes greater than 15% and woodlands could be located along stream buffer zones. Areas designated as an outer buffer zone will retain their existing woodlands and native vegetation. Development encroachment will be limited in such areas through the use of cluster development and by establishing no-build lines on future platted property except as otherwise permitted by the stream buffer ordinance.

WOODLAND AREAS:

Portions of the future development area located outside of the identified conservation areas are heavily wooded and are designated as Woodland Areas on the Environmental and Storm Water Management Plan map. A sensible balance must be employed with future development in these areas when providing for preservation of existing noteworthy environmental features. Areas with woodlands protection should use enhanced measures in development design to preserve significant trees or tree masses where possible. These measures may include:

- Cluster development design with flexible development standards such as reduced lot sizes and setbacks and alternative street designs to concentrate buildings on a part of the site (the cluster area) and allow the remaining land to be preserved as open space.
- It is the recommendation that tree surveys should be requested with all development applications in accordance with the Line Creek Valley Development Framework Guidelines. Applicants may voluntarily submit tree surveys and/or identify trees to be preserved with development. The tree surveys will identify trees to be preserved as well as mitigation measures for these trees over 10 inches in caliper that are to be removed by construction. Such mitigation may include planting a similar species of trees and should involve working with the City Forester.
- Consider revising the Zoning and Development Code to require the submittal of tree surveys with development applications

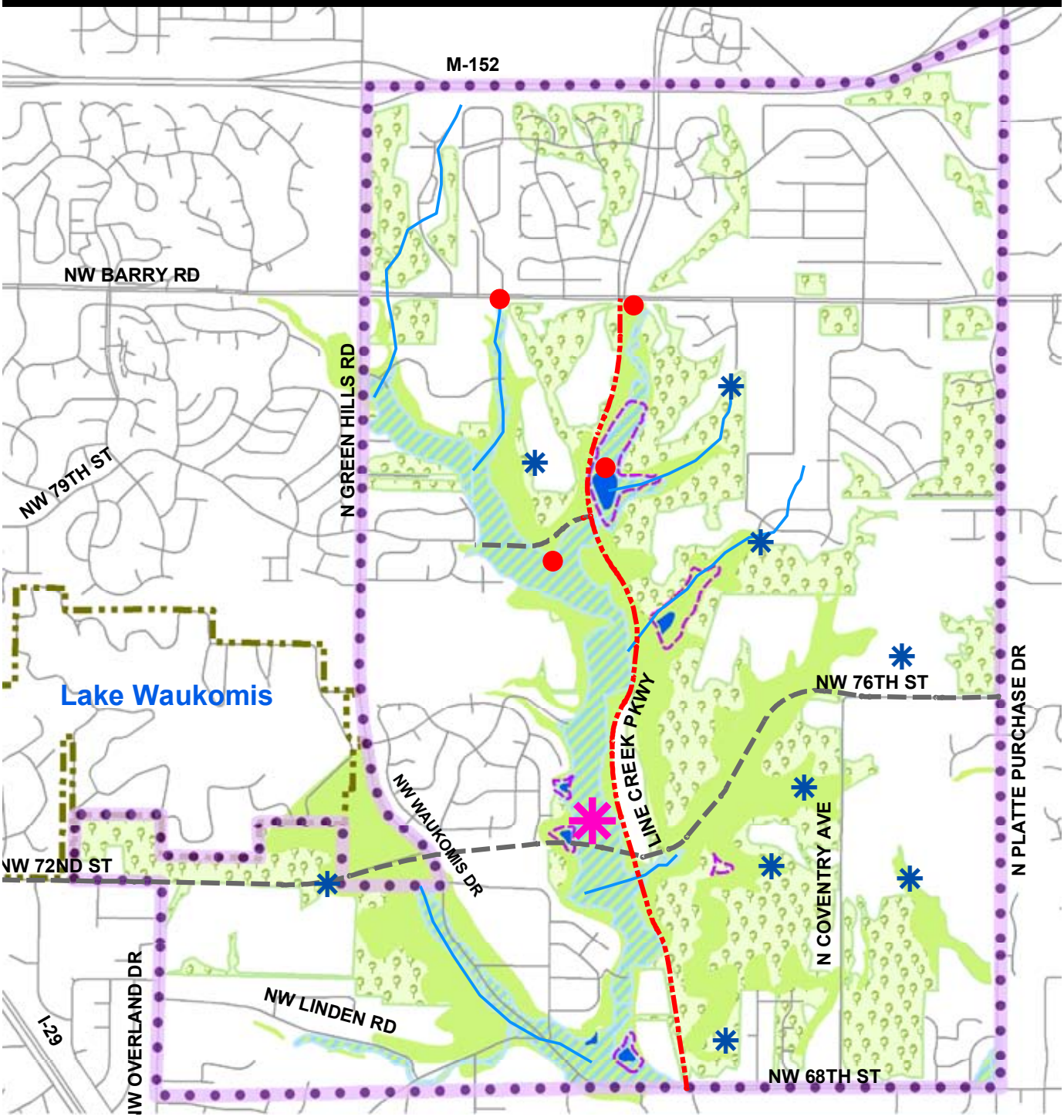
CULTURAL RESOURCES:

The area north of the Missouri River has a rich history dating back to a period before the arrival of European settlers. Native cultures, both pre-historic and historic, left many artifacts and relics throughout the northland, both unknown and known. Sites located south of the planning area in Line Creek Park were listed on the National Register of Historic Places in 1970. Those Line Creek Park sites are significant for the artifacts relating to the Hopwell, who inhabited the area around the Line Creek Valley from 200 B.C. to 400 A.D.

The identification and preservation of traditional cultural sites in areas with development potential have become a priority to many residents and Native American groups in the area. Given the likelihood of cultural sites in the planning area, particularly along Line Creek, a cultural resources survey (106, Assessment Study) should be conducted and an archeological mitigation plan developed in accordance with federal laws. Such survey(s) and mitigation plan(s) may need to occur prior to or concurrent with future development plan applications or preliminary engineering for public infrastructure improvements such as roadway projects.

Environmental and Storm Water Management Map

Line Creek Valley Development Plan



Legend

- Study Area - 2,841.3 Acres
- KCMO City Limits
- Future Parkway Alignment
- Future Arterial Streets
- Existing Streets
- local detention
- Regional Detention
- Retention Boundary
- Streams
- 100-Year Floodplain
- Woodland Areas
- Potential Stream Buffer Area
- Optional Large Regional Storm Water Structure as identified in the Line Creek Watershed Study
- Possible wetland locations as identified on the National Wetland Inventory Map

Miles
0 0.15 0.3

Existing stream corridor.

WETLANDS:

Potential jurisdictional wetlands have been assessed for the Line Creek Valley planning area. The wetland investigation was conducted using information provided from National Wetland Inventory (NWI) and U.S. Geological Survey (USGS) mapping.

The following wetland categories are found in the planning area primarily in the Line Creek floodplain and are generally located on the Environmental and Storm Water Management Map.

- PF01A – Palustrine, forested, broad-leaved deciduous, temporarily flooded;
- PEM/F01A – Palustrine, emergent, forested, broad-leaved deciduous, temporarily flooded;
- PUBFh – Palustrine, unconsolidated bottom, semipermanently flooded, diked /impounded.

Discharges of dredged or fill material in waters of the United States, including wetlands, require prior authorization from the U.S. Army Corps of Engineers (USACE) under Section 404 of the Clean Water Act (33 USC 1344). Additionally, Executive Order 11990 requires all federal agencies to minimize impacts to wetlands when conducting specific activities.

Line Creek banks overflowing after a heavy rain.

Storm Water Management Approach

OVERALL SYSTEM DESIGN

An overall system design approach will address the key adverse impacts of storm water runoff by:

- reducing pollutant loading from new developments;
- reducing downstream stream bank and channel erosion;
- reducing downstream overbank flooding; and
- safely passing or reducing the runoff from extreme storm events.

This approach relies on the use of regional storm water facilities combined with localized detention and Best Management Practices (BMPs) to route storm events in all three flood categories. The use of multiple smaller localized storm water storage areas constructed in conjunction with private development, instead of larger regional detention facilities, will improve the overall water quality and reduce the area and volume required for regional detention facilities. A system of smaller retention ponds will also aid in the preservation of local streams by decreasing water velocities during storm events. The location of possible detention facilities are identified on the Environmental and Storm Water Management Map.

Typical Best Management Practices (BMPs)

OPEN SPACE

Native Vegetation
Vegetated Open Space
Disconnect Impervious Surfaces
Phasing Development Grading

SOURCE CONTROL

Infiltration Trenches
Filter Strips
Pervious Paving
Rain Gardens
Construction Management
Storm Drain Maintenance

SOURCE FILTRATION

Bioretention
Regional Storm Filters
Dry Swales and Channels
Sediment Basins
Localized Retention

REGIONAL RETENTION

Wet Ponds
Constructed Wetlands
Extended Retention Ponds

STORM WATER RUNOFF QUANTITY

All large and small detention/retention facilities should be designed for multiple frequency storms. A downstream hydrologic analysis should be performed to determine if there are peak flow increases or downstream flooding based on individual development plans, as compared to pre-development runoff rates for the same area. The analysis should be done for the 1-year, 2-year, 5-year, 10-year, 25-year and 100-year return frequency, 24-hour duration storm events, at the outlet(s) of the site, and downstream at each tributary junction to the point(s) in the conveyance system where the area of the portion of the site draining into the system is less than or equal to 10% of the total drainage area above that point. Impact reduction must be performed as follows:

Channel Protection Volume: (1) Stream channel protection must be provided by 24-hour extended detention storage of the 1-year, 24-hour return frequency storm event; (2) erosion prevention measures such as energy dissipation and velocity control; and (3) preservation of stream buffers.

Overbank Flood Protection: Downstream overbank flood protection must be provided via the control of the peak discharge rate from a site to the pre-development peak discharge rate from the same site for the 1-year, 2-year, 5-year, 10-year and 25- year return frequency, 24-hour duration storm events.

Extreme Flood Protection: Attenuating the 100-year storm event such that the 100-year floodplain elevation is not increased. This will prevent flooding from infrequent large storm events and effectively "freeze" floodplains. Further, all drainage systems shall be designed to insure that no habitable finished floor elevations are flooded for the 100-year flood event.

environmental and stormwater MANAGEMENT

Possible stormwater dention facility can also be a beautification amenity.

Proposed stormwater solution with architectural feature.

Using native plantings in landscape design.

REGIONAL STORM WATER FACILITIES:

The construction of multiple smaller "off-line" regional storm water facilities on tributaries of Line Creek or along Line Creek Parkway is the preferred storm water management approach in the planning area. These facilities will be maintained by the public-at-large and will vary in size, capacity, and design with a combined overall storage volume of approximately 160 acre-feet. The facilities are designated for areas generally not considered developable, such as floodplains and stream buffers, or they may be located within the parkway right-of-way.

The specific location and capacity of the various facilities should remain flexible until preliminary engineering studies are completed to determine the most cost effective options with the least environmental impact. For example, the size of the regional facility proposed southeast of NW 72nd Street and Line Creek Parkway may be reduced if it is more desirable to construct one or more facilities north of 72nd Street on the east side of Line Creek Parkway. Capacity requirements for the facilities are provided in Appendix C.

Each regional facility should be:

- Designed in a manner to serve as an amenity and/or gateway feature for the development area, while accommodating the storage necessary for regional detention and improving water quality.
- Designed to include "retention" of storm water thus providing a visual water feature, which may include a series of smaller detention facilities with pumps to recirculate water between them.
- Constructed prior to future development in the upstream watershed of the given facility.

Should land acquisition or construction cost considerations limit the locations for multiple facilities, another option may include combining multiple storm water facilities into a single large facility. However, this option results in lower water quality due to less infiltration and the tendency for larger facilities to retain more pollutants.

LOCALIZED STORM WATER MANAGEMENT:

New developments in the planning area are responsible for providing and maintaining localized storm water infiltration and detention to achieve flood protection (for the impacts generated by specific development) in the channel protection, overbank flood protection, and extreme flood protection events. This may be provided by a combination of detention, retention, and/or Best Management Practices (BMPs).

Storm water management will be enhanced in the planning area by implementing a series of Best Management Practices (BMPs) that achieve the following goals:

- Increase infiltration (water absorbed by the soil) of storm water runoff while in the basin;
- Increase the amount of time for storm water runoff to reach its receiving stream;
- Reduce the potential amount of sediment/pollutants that can be carried off by storm water runoff from rainfall; and
- Treat storm water runoff before it reaches the receiving stream.

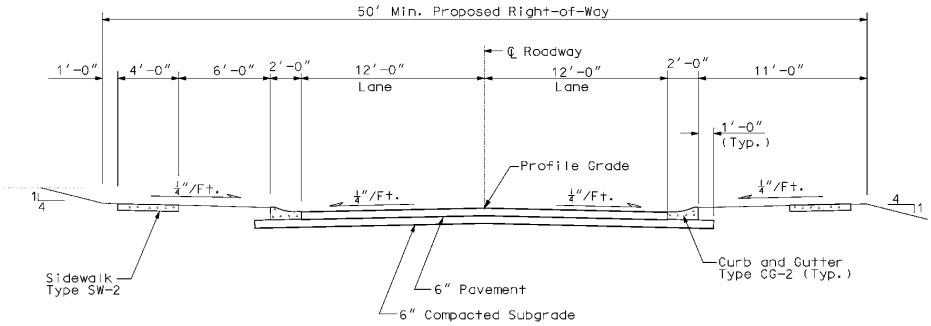
To improve water quality, BMPs should be designed and located so runoff is routed though a chain of successive treatments that remove pollutants and increase water quality as much as possible before entering the streams of the Line Creek watershed. BMPs used in the planning area should meet the minimum requirements set forth in the Manual of Best Management Practices for Storm Water Quality, September 2003 prepared by the Mid-America Regional Council and the American Public Works Association. Developers should submit storm water studies that demonstrate the effectiveness of proposed BMPs in lieu of localized detention facilities.

Careful consideration of the placement of BMPs throughout the watershed must be given to ensure water quality. Most BMPs implemented to improve storm water "quality" will also reduce the storm water "quantity". This reduction in water "quantity" will also reduce the amount of detention storage required for the development, which in turn will reduce development costs. Potential reductions in development cost are true for many of BMPs that could be implemented in the watershed. The use of natural buffers and native vegetation will reduce the need for grading and the need for larger enclosed pipe systems which reduces up front development costs, as well as long-term maintenance needs of the City.

Localized storm water management may also be incorporated into the design of local and collector residential streets, Line Creek Parkway, and alternative parking lot designs. Swales may be used in place of curbs and gutters along streets and within parking lots. Alternative street designs may also include reduced pavement widths with a concrete apron rather than raised curbs, as well as vegetated swales with plantings similar to rain gardens in lieu of enclosed storm water pipe systems. Such alternative designs may result in reduced construction costs and achieve the objective of reducing the quantity of runoff while increasing infiltration and the quality of runoff.

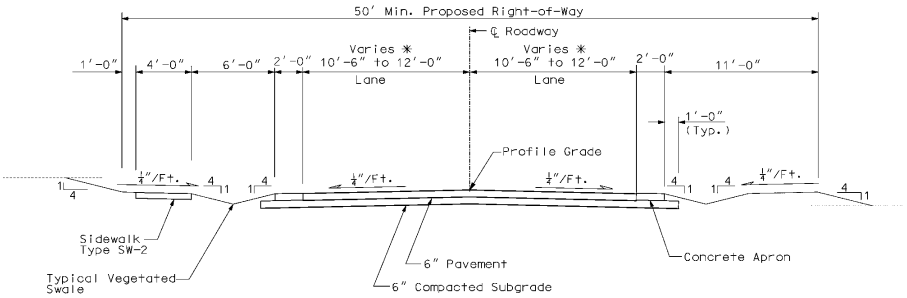
Options to street standards allow flexibility for runoff.

CONVENTIONAL ROADWAY DESIGN



Standard street with curb and gutter with necessary storm water system.

ALTERNATIVE RESIDENTIAL ROADWAY DESIGN



* Lane Width Varies
Residential Access use 10'-6" Lanes
Residential Local use 11'-0" Lanes
Residential Collector use 12'-0" Lanes

Example of alternative street cross-section without curbs and using small ditches to filter pollutants and allow for rain gardens and native materials to line the ditches for better water quality.

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TRANSPORTATION

Parkway Network

The segment of Line Creek Parkway running through the planning area is part of a larger network of parkways designated by the City's Major Street Plan. The entire length of Line Creek Parkway extends from Englewood Boulevard on the south to NW 108th Street where it bends eastward and merges with Shoal Creek Parkway. The Line Creek Parkway corridor in the planning area generally follows Line Creek from NW 68th Street to M-152.

One segment of Line Creek Parkway has been improved to date, between NW Barry Road and its intersection with Old Stagecoach Road located just north of M-152. The improved segment of the parkway is constructed as a 4-lane divided roadway with a varying width median generally ranging from 100-feet to 200-feet. The right-of-way for the improved 4-lane divided segment ranges from 150-feet to 350-feet in width. The right-of-way width is approximately 150-feet at the Barry Road intersection.

Large median and row - typical for parkways

Travel Demand Analysis

Based on the January 2006 Roadway Capacity Study for the Line Creek Valley Area, the Development Plan recommends improvements to the arterial street network ranging from 2 to 4 travel lanes to serve the ultimate build out of the planning area. The recommended ultimate number of travel lanes for the street network is reflected on the Proposed Street Map.

The arterial street improvement recommendations from the Roadway Capacity Study are based on the use of a future traffic signal at the Green Hills Rd. and NW 72nd St. intersection and roundabout intersection controls at the intersections identified on the Proposed Street Map. The roundabout identified at Waukomis and NW 72nd Street is most appropriate if NW 72nd Street does not cross Line Creek, but should be reviewed if 72nd Street is constructed to cross Line Creek and connect with the Parkway.

The Roadway Capacity Study determined only 2-lanes are necessary for Line Creek Parkway between NW 68th Street and NW Barry Road to accommodate full build out of low-intensity development. The Capacity Study did not consider the impact of possible higher intensity development proposed at NW 68th Street and therefore such development may generate the need for additional roadway improvements which will need to be addressed by a future traffic study.

The Board of Park and Recreation Commissioners must approve the final design of the parkway and a 2 to 4-lane parkway may ultimately be constructed. The design options of the parkway may be influenced by the following:

- Future development of commercial mixed-use centers at NW 68th Street and at NW Barry Road at moderate to high intensities may require a parkway with greater traffic capacity;
- Development areas that front the parkway may need to incorporate on-street parking lanes.

One initiative of the plan is to preserve greenways with improved street sections and minimum right-of-way.

TRANSPORTATION

Streets preserve green space and follow topography.

Street Connectivity

Due to the challenging terrain, the existing east-west street network is limited and there are no existing east-west street connections between NW 68th Street and NW Barry Road. Future street connectivity will be enhanced by providing the extension of arterial roadways including NW 72nd Street, NW 76th Street, and NW 79th Street. Connectivity in the planning area will be further enhanced by providing several collector and local streets to provide linkages between existing and future neighborhoods. The Proposed Street Map identifies conceptual locations of such roadways. The actual alignment of the roadways must consider issues such as slopes, floodplain, cultural resources, and mature woodland areas through the design and development application review process.

Possible transit corridor.

Neighborhood transit stop discussed.

Example of light rail.

Rapid Transit Corridor

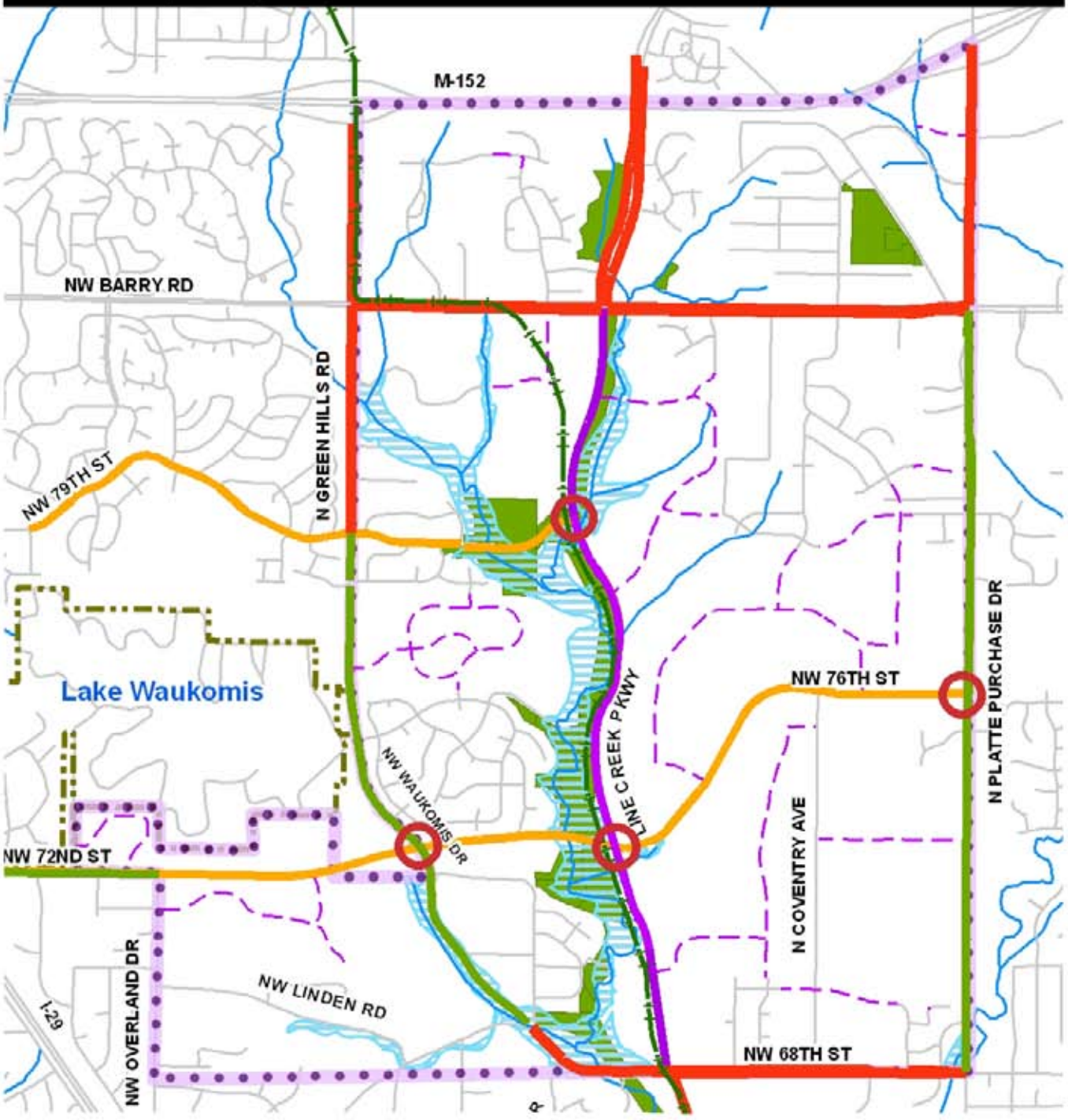
The City's Major Street Plan currently identifies the route of a "Special Purpose Rapid Transit Corridor" from downtown Kansas City to the KCI Airport which extends along Line Creek Parkway through the heart of the planning area. This designated alignment is consistent with the route of the interurban rail line that operated from downtown to St. Joseph, Missouri from 1913 to 1932.

The feasibility of such a future route was questioned by residents and the project Steering Committee during the planning process given the actual development pattern along the corridor and throughout much of Kansas City north of the Missouri River, including the low density development expected in the planning area. In November 2006, a light rail initiative was passed by voters of Kansas City, MO which included a designated route to the KCI Airport following the former interurban rail line alignment and NW Barry Road through the planning area. However, it was repealed by City Council in 2007.

- The feasibility of the voter approved light rail alignment to KCI Airport requires additional study and until a comprehensive study is completed, including possible revisions to alignment that may be presented for voter approval, the transit corridor must be preserved within the planning area.
- It was the recommendation of the mayor-appointed steering committee that the "special purpose rapid transit corridor" be removed from the valley area and along a better studied route (like I-29).
- It was also a recommendation of the mayor appointed steering committee that a more intense study to address the final alignment of the corridor needs to be complete to determine a final alignment.
- The transit corridor is identified in the Line Creek Development Plan (along future Line Creek Parkway), due to the existing Major Street Plan showing the special purpose rapid transit corridor. However, in the document the transit alignment is recommended, by the Mayor-appointed steering committee, to be removed out of the valley and a new alignment should be considered. The new KCATA Alternative and Analysis (AA) review and/or the regional master plan study, along with review of MARC smart moves plan, should examine the Line Creek Development Plan recommendations when deciding the ultimate alignment for the future transit corridor, which is required by the Federal Government.

Proposed Street Map

Line Creek Valley Development Plan



Legend

- Study Area - 2,841.3 Acres
- KCMO City Limits
- Future Neighborhood Street Connections
- Streets
- Streams
- 4 or more lanes
- 2-4 lanes parkway with optional parking lanes
- 3 lanes
- 2 lanes
- Roundabout
- Proposed Rapid Transit Corridor Alignment
- Parks and Open Space
- 100-Year Floodplain

Miles
0 0.15 0.3

TRANSPORTATION

Line Creek Parkway Design Features

The terrain of the Line Creek Valley and its associated floodplains and steep slopes on both sides of the valley create constraints for the alignment of Line Creek Parkway layout as a 4-lane roadway. The design of the Line Creek Parkway, as well as the character and intensity of adjacent development along the parkway, will vary between NW 68th Street and NW Barry Road and must consider issues that play a significant role in its ultimate design:

- Preservation of natural resources
- Floodplains
- Woodlands and the location of specimen trees
- Slopes and topography
- Rock
- Drainage and storm water management
- Future Rapid Transit Corridor
- Native American items

Parkway section

Future Parkway design standards would require cross-sections to be consistent with the current Parks and Recreation Boulevard and Parkway Standards Plan (not approved by Council at time of Line Creek adoption). A minimum of 200 ft. ROW to be set aside for a future Parkway. However, the Steering Committee recommended that opportunities exist, due to the constraints of the valley; floodplain, severe slopes, woodlands and the location of specimen trees, preservation of natural resources, rock, future rapid transit corridor, traffic study, and Native American artifacts, should be considered to study alternatives for a 4-lane divided Parkway and preserve the valley. Steering Committee discussed 2, 3 and 4-lane Parkways, with smaller divided median and/or no median, with all the preservation contained on the inside/outside of the Parkway ROW.

The overall width of the parkway right-of-way and the parkway median will meander throughout the area primarily due to the unique characteristics of the terrain and opportunities to preserve significant natural resources and the natural beauty of the valley. In order to minimize the amount of cut and fill in various locations, the right-of-way and median width may meander and the travel lanes may be placed at different vertical alignments. In areas with significant changes in slope, the parkway is expected to incorporate variations in the vertical alignment of the northbound and southbound travel lanes.

Generally north of Robinson Park to Barry Road the parkway parallels the Line Creek floodplain and floodway, with such lands considered suitable for either active or passive recreation in a continuous linear park. Such lands are considered appropriate for dedication to the Parks and Recreation Department for park and parkway purposes. In various locations along the floodplain the parkway design may widen to incorporate the parkland in a wider median. The ultimate parkway design should follow the Parks and Recreation Department's design criteria manual and be based on the following characteristics:

- 4 travel lanes with a width of 10.5 to 12 feet each lane.
- 200 to 300-feet right-of-way (minimum). Right-of-way may vary based on preliminary engineering and necessary design characteristics to minimize requirements for cut and fill while providing the best alternative that preserve the existing environment.

- Varying median width generally at least 40 feet wide.
- Varying between natural and formal treatments.
- Design speed 45 mph (maximum).
- Posted speed 35 mph (maximum).
- Drainage – roadside collection swales for naturalistic storm water approach (in open space/buffer areas), and curb and gutter (in developed areas).
- Storm water retention facilities with water features placed in various locations along the side of the parkway, or in the parkway median where feasible, to create the appearance of a lake or a series of ponds.
- Multi-use meandering trail 10 foot wide (minimum).
- Planting strip 7-20 feet in width with street trees along side the street curb.
- Sidewalks parallel to parkway when multi-use trail not located nearby.

Opinions of probable cost and conceptual cut and fill earthwork volumes for a 4-lane parkway with median and a 2-lane parkway without a median were prepared based on the conceptual parkway alignment and are detailed in the Public Infrastructure Funding section of this report. The probable cost of the two conceptual parkway design options vary significantly, with a large difference related to the amount of necessary earthwork. The conceptual 4-lane design requires earthwork of approximately 72,500 cubic yards contractor furnished (borrow), while the conceptual 2-lane design results in approximately 24,000 cubic yards of contractor waste (haul off).

Typical parkway section (north of Barry Road).

Parkway Development Zones

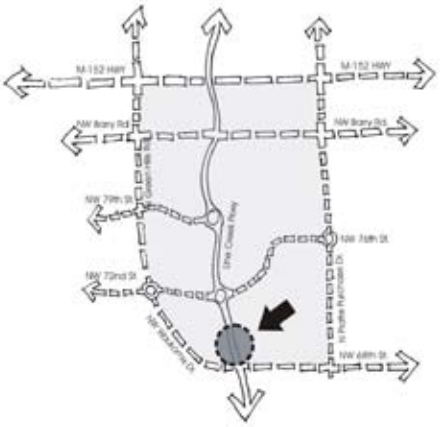
The Line Creek Parkway development design strategy recommends the use "planned zoning" (i.e. Master Plan Development) for all development applications in the planning area to:

- preserve the character of Line Creek Parkway and the nearby terrain;
- implement the urban design provisions of the Line Creek Valley Development Plan; and to
- implement the parkway design and land use standards in the Parkway and Boulevard Planning and Design Criteria as adopted by the Board of Park and Recreation Commissioners.

Existing terrain in Line Creek to be preserved as much as possible.

Due to the variable design of Line Creek Parkway and the terrain, five development zones are identified along the parkway from NW 68th Street to NW Barry Road based on the land uses designated by the Future Land Use Map. Each development zone includes different design characteristics that range from natural settings to developed conditions. The following descriptions and graphics should be considered conceptual in nature and intended as a guide for preliminary engineering of Line Creek Parkway and land development planning near the parkway. The ultimate design of the development areas must be based on the final design of Line Creek Parkway and the desired future development pattern. All development zones are subject to the provisions of the Development Standards and Guidelines.

TRANSPORTATION



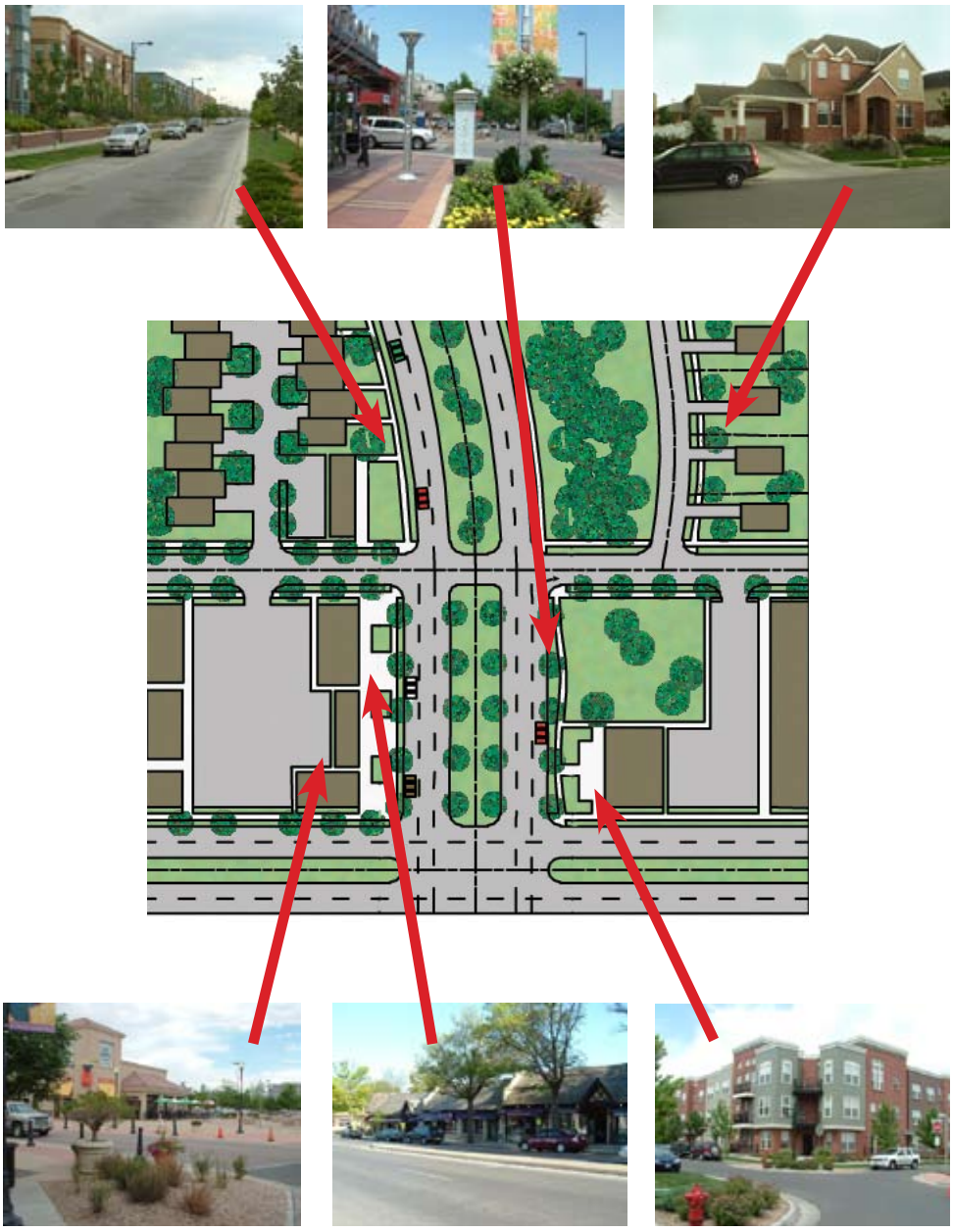
Development Zone (A)

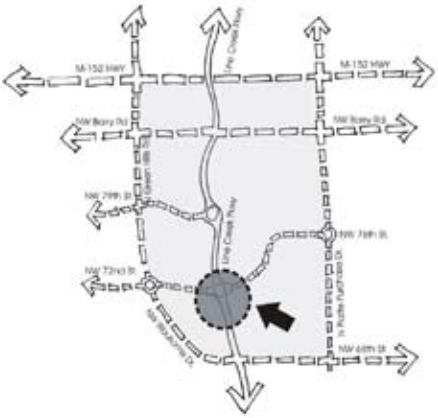
NW 68th Street to generally
NW 70th Street

This segment of the parkway extends through a neighborhood mixed use area with possible uses including a mixed variety of office, limited retail, and higher density residential uses. Key design features include:

- Gateway features at the NW 68th Street intersection.
- 4-lane divided roadway with a minimum 40-foot wide median.*
- 200-300 foot right-of-way width (minimum).
- Buildings may front the parkway when at grade with the roadway.
- On-street parking provided on the sides of the parkway where development fronts the roadway.
- May accommodate possible transit corridor right-of-way.

* see page 24 for parkway alternatives





Development Zone (B)

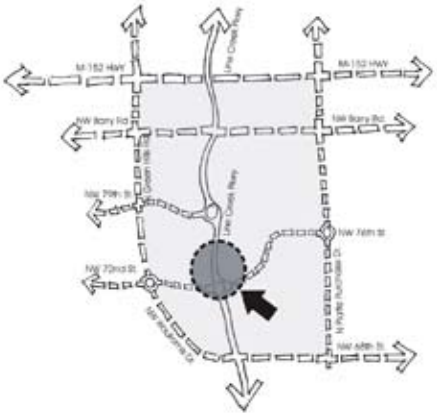
Generally NW 70th Street to NW 72nd Street

This segment of the parkway parallels parklands and will accommodate a mix of lower and moderate density residential development fronting on one side of the roadway. Key design features include:

- Gateway features at NW 72nd Street roundabout.
- 4-lane divided roadway with a minimum 40-foot meandering median widening* where practical to incorporate parklands.
- 200-300 foot right-of-way width (minimum).
- Residential driveways limited on the parkway. Garage and driveway access predominately from the rear. Direct residential driveway allowed to the parkway only if limited to a minimum spacing of 100 feet.
- On-street parking lane provided on the east side of the parkway adjacent to residential development.
- On-street parking lane may be provided along parkway where adjacent to parkland.
- May accommodate possible transit corridor right-of-way.

* see page 24 for parkway alternatives

TRANSPORTATION



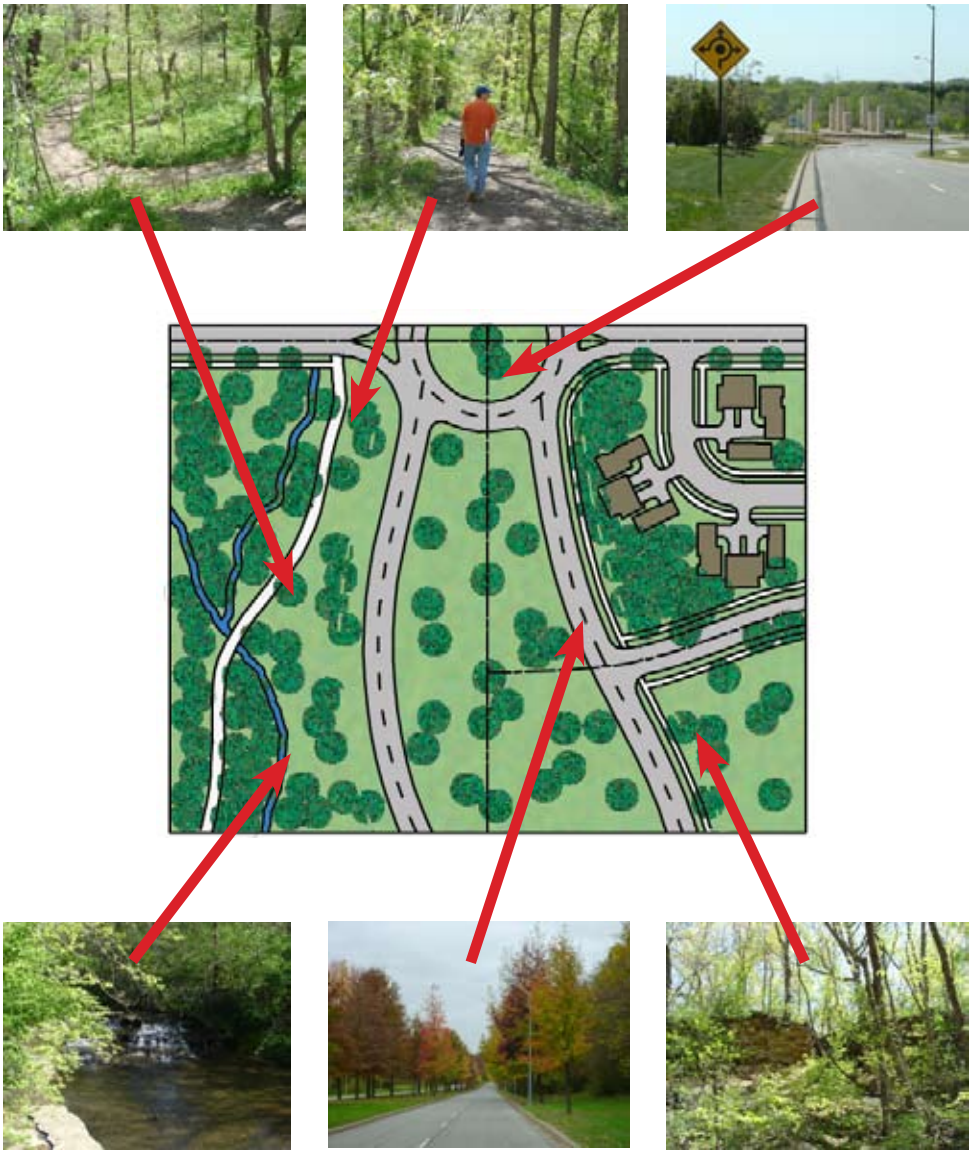
Development Zone (C)

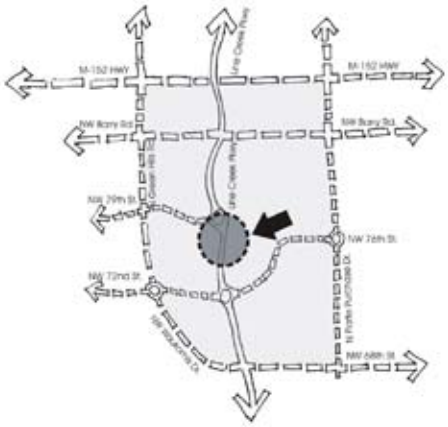
Generally NW 72nd Street to NW 76th Street

This segment of the parkway will parallel parklands and will accommodate a mix moderate density residential structures fronting on one side of the roadway. Key design features include:

- 4-lane divided roadway with wide meandering median widening where practical to incorporate parklands.*
- 200 to 300 foot right-of-way width (minimum) which will incorporate existing dedicated parklands as much as possible.
- Residential development may front onto the parkway with all garage and driveway access provided from the rear.
- Local street intersections with the parkway with a minimum spacing of 660 feet.
- On-street parking lane provided on the east side of the parkway adjacent to residential development.
- On-street parking lane may be provided along parkway where adjacent to parkland.
- Nearby or adjacent regional storm water retention facility.
- May accommodate possible transit corridor right-of-way.

* see page 24 for parkway alternatives





Development Zone (D)

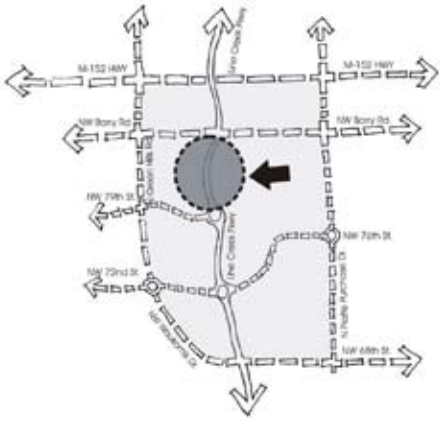
NW 76th Street to NW 79th Street

This segment of the parkway will parallel stream buffer and slope protection areas. No development will be adjacent to the parkway. Key design features include:

- Gateway features at the NW 79th Street roundabout.
- 4-lane divided roadway, possibly with varying vertical profiles.*
- 200 to 300 foot right-of-way width (minimum).
- Local street intersections with the parkway have a minimum spacing of 660 feet.
- Adjacent regional storm water retention amenity.
- Clustered residential on the bluff above the parkway.
- May accommodate possible transit corridor right-of-way.

* see page 24 for parkway alternatives

TRANSPORTATION



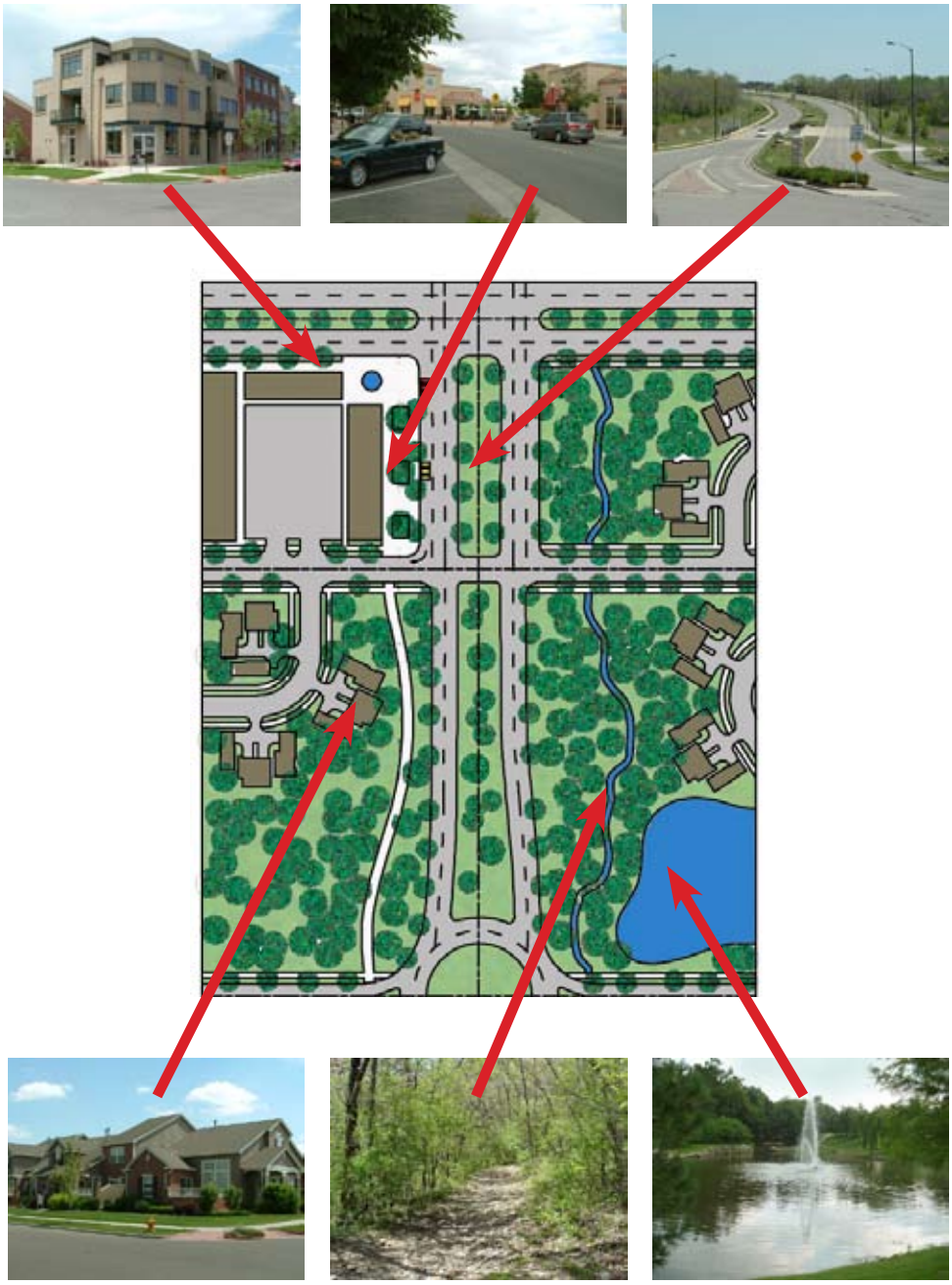
Development Zone (E)

NW 79th St. to NW Barry Rd

This segment of the parkway transitions from a meandering roadway design to a formal roadway design as it approaches the Barry Road intersection. The parkway will provide access to a residential mixed use and commercial mixed use on the west side, while bordering a conservation area to the east. Development characteristics are similar to Zone (A). Key design features include:

- Gateway features at the NW Barry Road intersection.
- 4-lane divided roadway with a minimum 40-foot wide median.*
- 150 to 300 foot right-of-way width (minimum).
- Development may front onto the parkway when at grade with the roadway.
- On-street parking provided on the side of the parkway where development fronts onto the roadway.
- May accommodate possible transit corridor right-of-way.

* see page 24 for parkway alternatives



PARKS, RECREATION and OPEN SPACE

The Parks, Recreation, and Open Space Map provides for well defined natural and developed open space and public places. Open space areas are intended to:

- bind various developments into cohesive interrelated districts;
- provide recreational amenities and trail connections for area neighborhoods;
- preserve natural resource areas; and
- accommodate storm water management facilities as amenities.

Linear Park System

Recreation trails and a linear park will provide connections between neighborhoods and public places. A linear park will be provided along Line Creek and Line Creek Parkway consisting of existing park lands and greenways to which additional greenways, floodplain lands, and woodland areas with significant trees worthy of preservation should be added. The linkages between park facilities will create a linear system connecting one park to another through an environmental buffer around streams and slope protection areas, and along the parkway. The floodplain lands in the planning area offer an opportunity to connect several park land areas into a continuous greenway system. Such floodplain lands are appropriate for dedication to the City by land owners and developers for linear park purposes. Where such floodplain lands are not dedicated to the City, public access easements should be provided where appropriate for extension of regional and local trails.

- A recommendation in the Line Creek Valley is the consideration that a future assessment of the valley be considered to create a continuous green/park-like corridor. Future discussions could warrant acquiring or a donation of the ground, for preservation of a large park for the Northland.

Trails connect greenways.

Trails for passive and active recreation.

Park Amenities

In addition to several neighborhood parks in the planning area, the linear park system along Line Creek will allow opportunities to incorporate neighborhood-scale recreational uses and storm water retention facilities as water features. These parks may also serve as gateway markers for the area. The stream buffers along Line Creek will remain primarily natural in character. However, the large relatively flat park land along Line Creek located in the floodplain north of NW 72nd Street would allow for a variety of low impact recreational uses ranging from a large grass field to formal athletic fields. Recreational uses in this area should remain in character with future residential development that will front onto the east side of Line Creek Parkway adjacent to the NW 72nd Street linear park area.

Proposed neighborhood parks.

PARKS, RECREATION and OPEN SPACE

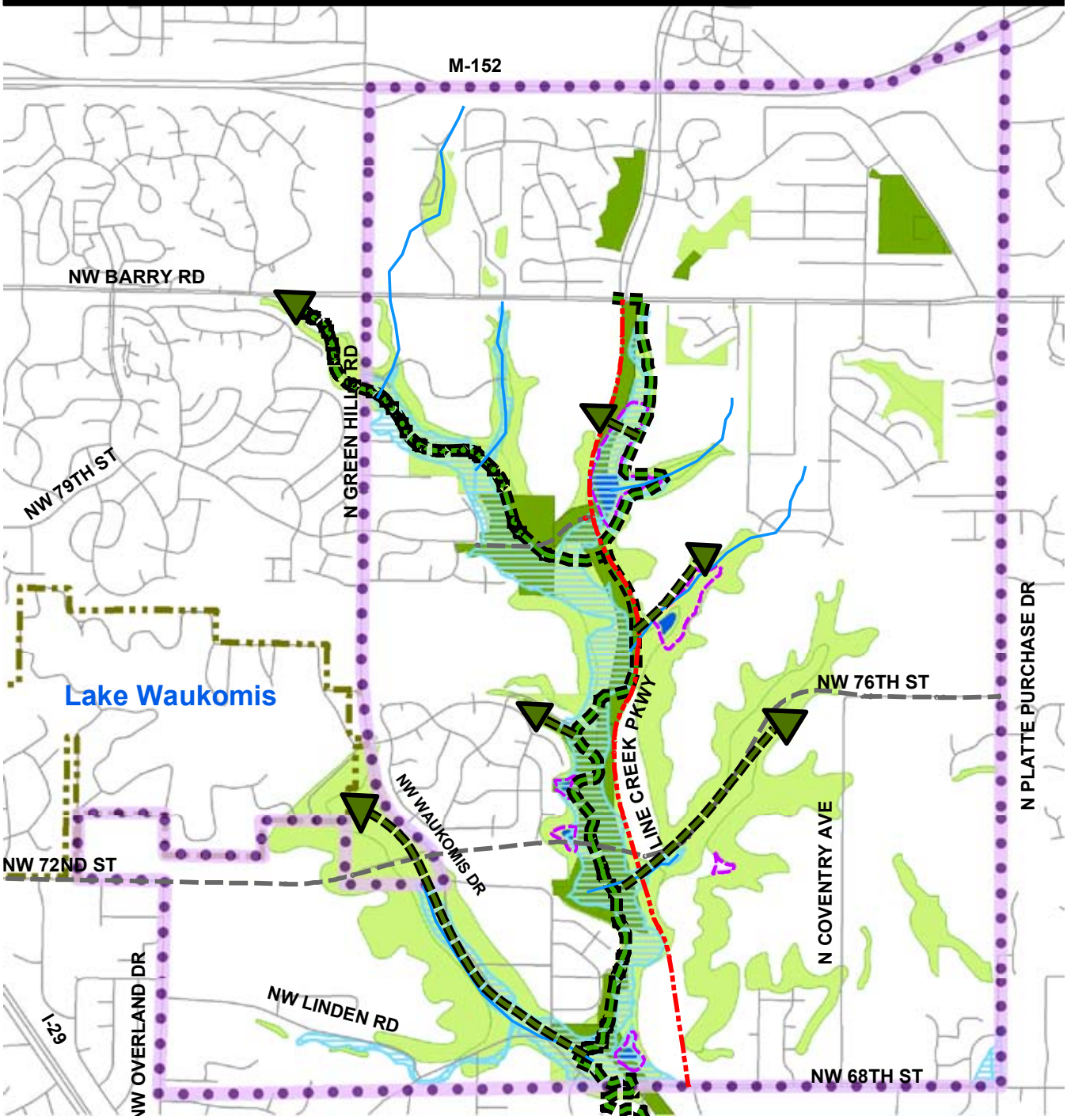
Line Creek Multi-Use Regional Trail

The Development Plan provides a regional trail generally along Line Creek that will in the future extend south to the Missouri River and north to a future trail along Tiffany Springs Parkway. A hard surface off-road regional trail will meander along Line Creek and along Line Creek Parkway. The first segment of the regional trail has been constructed as a 10-foot wide hard surface trail parallel to the west side of the developed portion of Line Creek Parkway from Stagecoach Road to Barry Road.

Following the new Trails KC Plan, for a regional trails system in Kansas City, Missouri, a 10-foot wide trail will continue south of Barry Road and meander along the east side of Line Creek Parkway to a point south of NW 79th Street where it will cross to the west side of Line Creek and meander to parklands located north and east of the Platte Brook North Subdivision. The trail will continue southward along Line Creek through parklands and floodplains to an area generally near the intersection of NW 68th Street / Gower / and NW Waukomis. At that location the trail will cross under the roadway and continue generally south of the planning area along Mayview Road and further southward while following an alignment that meanders in the vicinity of Line Creek.

Parks, Recreation and Open Space Map

Line Creek Valley Development Plan



Legend

- Study Area - 2,841.3 Acres
- KCMO City Limits
- Future Parkway Alignment
- Future Arterial Streets
- Existing Streets
- Trail
- Local Trail Spurs
- Streams
- Potential Stream Buffer Areas
- Parks and Parkways
- 100-Year Floodplain
- Regional Detention
- Retention Boundary

Miles
0 0.15 0.3

PARKS, RECREATION and OPEN SPACE

Proposed trail system.

Trail Connectors

The Parks, Recreation, and Open Space Map identifies recommended trails spurs and sidewalk connections to provide linkages from neighborhoods and business areas to the regional Line Creek trail corridor. In addition, sidewalks along streets will provide east-west connections to the regional trail and trail spurs. Two major trails and/or sidewalk spurs are envisioned to connect with the regional Line Creek Trail in the planning area.

- A trail spur will run in the floodplain of a tributary to Line Creek beginning at a point generally located south of Line Creek and NW 79th St and extend to the north-west near the intersection of Green Hills Rd and Line Crest Drive. The trail spur would continue west of Green Hills Rd along the creek tributary to Barry Road.
- Sidewalks will be provided along both sides of Line Creek Parkway for areas where the regional Line Creek Trail is not in close proximity to the roadway. This will include sidewalks, or a trail spur, along Line Creek Parkway south of NW 72nd Street to the intersection with NW 68th Street / Waukomis.
- Local trail spurs and/or sidewalk connections will be provided in various locations to existing subdivisions in proximity to the regional Line Creek trail, as well as along extensions of NW 72nd Street and NW 79th Street.

Trails sensitive to existing conditions.

Bicycle Routes

In addition to off-road multi-use trails, on-street bike routes will be provided as part of future road improvement projects. Bike routes may take the form of dedicated bike lanes on major arterial streets or may be designated by bicycle route signage on lower volume roadways.

- Green Hills/Waukomis Dr. north of NW 68th Street
- NW 72nd Street
- NW 79th Street
- N. Platte Purchase Rd. / NW 76th Street/ N. Coventry Avenue
- NW Barry Road
- NW Old Stagecoach Road

Example of incorporating a dedicated bike lane to future road improvements.

development

FRAMEWORK and GUIDELINES

The development guidelines are intended to act as the guide for public and private investments made in each land use district recommended by the Line Creek Valley Future Land Use Map on page 9. The overall goal of the Line Creek Valley Development Plan is to provide a well designed realm of vibrant neighborhoods, parks, and institutions within close proximity of businesses, transportation, and recreation. All areas should be accessible through a pleasant walking and driving experience.

INTENT STATEMENTS:

Intent statements set forth the goals for development in the Line Creek Valley development area. The Development Framework and Guidelines provide direction as to how the goals may be achieved.

FRAMEWORK:

Development framework is objective criteria that provide specific direction to achieve the intent statements. The term "may" to indicate that compliance should be encouraged. The standards set forth in the new Zoning and Development Code are the standards that will control once it is adopted by City Council.

GUIDELINES:

Design guidelines provide further considerations that promote the goals defined by the Intent Statements. Guidelines use the term "should" to denote that they are considered pertinent to achieving the stated intent but allow discretion based on site and project conditions.

Example of possible mixed-use centers at 68th Street, at Barry Road, and at Line Creek Parkway.

development

FRAMEWORK and GUIDELINES

Principle: Environmental Management

Environmental Management protects the natural resources such as stream corridors, floodplains, woodlands, and steep slopes and integrates them into the fabric of new development.

INTENT (ENVIRONMENTAL MANAGEMENT)

- Protect the existing environmental assets of the area and ensure future development in harmony with existing stream corridors and natural features.
- Use public education to promote activities that improve the quality of storm water runoff entering the streams.
- Improve water quality by maximizing the use of retention in detention areas.
- Protect mature woodlands and environmentally and culturally sensitive areas.
- Provide alternate subdivision design that is more efficient and provides more open space and greater natural resource protection than conventional development designs.
- Implement stream buffer standards to mitigate the adverse environmental impacts that development can have on streams and associated natural resource areas.

The topography in the Line Creek Valley includes steep hills and valleys, bluffs with large imbedded stone, and dense trees and ground cover.

FRAMEWORK (ENVIRONMENTAL MANAGEMENT)

- Developments in Woodland Areas may comply with the standards of the City's Open Space and Conservation Development regulations and could be permitted modifications to the lot and building area standards to allow more compact development designs and to provide more open space.
- Development to retain the natural and visual character derived from topography, woodlands, streams, and riparian corridors.
- Greenway corridors to preserve natural drainage areas, floodplains, and wooded areas to define and connect neighborhoods.

- Use the stream setback requirements established by Section 5200 KCAPWA and as designated by the City's Stream Buffer regulations.
- Encourage no-build areas on slopes that exceed 15% adjacent to stream setbacks.
- Reduce non-point source pollution in existing developed areas.
- Determine procedures and obtain approvals for operating in sensitive areas by coordinating with governing agencies including the Department of Natural Resources (MDNR), Department of Conservation (MDC), U.S. Army Corps of Engineers (USACE), and the State Historic Preservation Office (SHPO).
- Future Parkway design standards would require cross-sections to be consistent with the current Parks and Recreation Boulevard and Parkway Standards Plan. A minimum of 200 ft. ROW to be set aside for a future Parkway. However, the Steering Committee recommended that opportunities exist, due to the constraints of the valley; floodplain, severe slopes, woodlands and the location of specimen trees, preservation of natural resources, rock, future rapid transit corridor, traffic study, and Native American artifacts, should be considered to study alternatives for a 4-lane divided Parkway and preserve the valley. Steering Committee discussed 2, 3 and 4-lane Parkways, with smaller divided median and/or no median, with all the preservation contained on the inside/outside of the Parkway ROW.

GUIDELINES (ENVIRONMENTAL MANAGEMENT)

- Use retention facilities within detention areas where possible.
- Limit encroachment into protection areas through the use of cluster development with smaller lot sizes or by establishing no-build lines on future platted property.
- Educate neighborhood residents how to reduce non-point source pollution.
- Coordinate development planning with city staff for determine the most appropriate method to preserve noteworthy trees.
- Provide tree surveys for the Woodland Areas that locate, identify by common name, and indicate caliper size of each tree greater than 10-inch caliper, unless otherwise specified by city staff. Use symbols or other methods to clearly indicate trees proposed to be saved and those proposed for removal.
- Provide mitigation of trees over 10-inches in caliper in the Woodland Areas to be removed by construction. Such mitigation may include planting a similar quantity and similar species of trees and should involve working with the City Forester.
- Existing trees and vegetation to be saved should be protected from all construction activities, including earthwork operations, movement and storage of equipment and materials and dumping of toxic materials. Establish a minimum protection zone by installing temporary fencing around existing vegetation to be preserved, placing the fencing no closer to the trees than their drip lines, and maintaining fencing throughout the construction period.
- Consider enacting a woodland preservation ordinance.

Line Creek stream flow.

Woodland tree preservation proposed.

Principle: Storm Water Management

Storm Water Management reduces storm runoff quantity and increases water quality throughout the region through a system wide, comprehensive strategy for managing storm water within the study area.

Proposed water features.

Proposed rain gardens to help with water runoff.

Proposed drainage swales.

INTENT (STORM WATER MANAGEMENT)

- Develop a system-wide network of regional detention to reduce flood damage downstream of the development area.
- Implement practices in future developments that increase storm water infiltration.
- Protect regional detention by providing localized detention in new developments.

FRAMEWORK (STORM WATER MANAGEMENT)

- Provide regional "off-line" detention areas along Line Creek designed for multiple frequency storm events (i.e. 2-year, 10-year, 100-year storms).
- Design detention areas as amenity features.
- Limit storm water runoff from new developments to pre-development levels.
- Adequately treat storm water runoff from a site before discharge.
- Enforce the City's standard erosion control practices to reduce sediment loads in storm water runoff.

GUIDELINES (STORM WATER MANAGEMENT)

- Use graduated spillways on detention facilities.
- Provide detention, retention, and/or Best Management Practices (BMPs) in new developments as identified in Section 5200 KCAPWA.
- Provide a storm water management study outlining the effectiveness of BMPs when used to limit storm water runoff in new development.
- Use BMPs to reduce the total suspended solids (TSS) load by 80% from storm water exiting new development sites.
- Use non-structural site design practices to promote the preservation of natural and connected open space within and between developments, and provide non-structural storm water treatment.
- Utilize erosion prevention and sediment control practices during construction or during any land disturbance activities in accordance with Section 5100 KCAPWA.

Principle: Open Space and Public Places

Open Space and Public Places contribute to the use and enjoyment of residents and should be provided in useful, quality spaces integrated purposefully into the overall development design.

INTENT (OPEN SPACE AND PUBLIC PLACES)

- To utilize well defined natural and developed open spaces as features that serve as the focus of block, lot, and circulation patterns.
- To utilize open space to bind various developments into cohesive interrelated districts.
- To supplement public open space such as parks and drainage corridors with privately developed open space that completes linkages.
- To use developed open spaces that serve as prominent amenities.
- To encourage small developed open spaces embedded in the pattern of streets, blocks, and lots serve as an amenity and creates value.

FRAMEWORK (OPEN SPACE AND PUBLIC PLACES)

- Provide public access to all public open space, natural and developed, directly from the public street or sidewalk system.
- Preserve areas of significant natural features, such as floodplains and drainage channels, mature woodlands and vegetation, stream corridors, wetlands, prominent bluffs and steep slope areas.
- Provide a neighborhood green (park) in areas of higher intensity residential development if located more than one-quarter mile walking distance from an existing or planned park.
- Provide site amenities such as public plazas or open landscaped gathering spaces in areas of business development. Such amenities may include public plaza with seating, landscaped mini-park/neighborhood green/or square, water feature, and a public art feature or clock tower.
- Integrate site amenities into the overall development design, rather than placing them on undevelopable remnant parcels or unusable perimeter buffers.

GUIDELINES (OPEN SPACE AND PUBLIC PLACES)

- Use open space to enhance the value and amenity of surrounding development and limit the amount of non-usable or inaccessible open space.
- Create streets, blocks, lots, and building patterns that respond to views, landscape, and recreational opportunities when in proximity to natural open space.
- Encourage fronting lots and buildings on public and private open spaces rather than secluding open space behind buildings.Preserve areas of significant natural features through private common open space or public dedication.
- Design open storm drainage and detention areas as an attractive water feature amenity or focal point.
- Set back buildings, parking areas, and grading from significant natural features a sufficient distance to ensure their continued quality and natural functions.
- Design neighborhood greens (parks) to remain open and visible to residents rather than secluded behind buildings or surrounded by parking lots. Buildings adjacent to a green should front onto the space and include entrances and windows rather than black walls or rear facades.
- The perimeter of a neighborhood green should front entirely to the street / drive curb on at least two sides, with buildings abutting on no more than two sides.
- Incorporate amenities in neighborhood greens such as walkways, plazas, seating, recreational facilities, gazebos or other similar decorative shelters, pedestrian scale lighting, or other similar features for the use and enjoyment of residents.
- Smaller urban common areas should be accessible, well lit, and maximize visibility into the area from adjacent streets.

Future park amenities.

Future architectural elements.

Art in the landscape proposed.

Preservation zones proposed.

Proposed mixed-use areas.

development

FRAMEWORK and GUIDELINES

Preservation with development

Architectural focal points

Open space with passive options

Pocket parks

Mixed use areas

Principle: Neighborhood Development

Neighborhood Development provides a range of housing opportunities integrated within proximity to activities of daily living.

INTENT (NEIGHBORHOOD DEVELOPMENT)

- To provide locations for upscale "estate" housing.
- To provide a broad range of housing types and price levels that allow for a mix of residents with diverse ages, races, and incomes.
- To provide pedestrian-friendly neighborhood designs with a "sense of place" is seamlessly integrated with the natural environment, and includes a fine-grained mix of uses where no single use monopolizes a large area.
- To provide neighborhoods with a defined "center", such as neighborhood green (park), plaza, or neighborhood retail center public space.
- To provide a variety of residential, commercial, institutional, civic, and personal activities of daily living within close proximity and within a five minute walking distance of residents.

FRAMEWORK (NEIGHBORHOOD DEVELOPMENT)

- Provide flexible development standards for lot sizes and setbacks, street design and layout, and storm water management to minimize environmental impacts.
- Provide interconnected networks of streets wherever possible to encourage walking and reduce the number and length of automobile trips.
- Design mixed use neighborhood areas to promote pedestrian activity and connections to adjoining land uses and neighborhoods.

GUIDELINES (NEIGHBORHOOD DEVELOPMENT)

- Coordinate private development design efforts with city staff to integrate alternative development techniques and modifications to conventional development regulations to enhance the area and preserve open space.
- Locate estate lots and lowest density residential uses in areas where more intense development would negatively impact the terrain and existing woodlands.
- Locate higher building densities and more intense land uses within and around mixed use neighborhood centers.
- Provide streets parallel to open space or looped streets with neighborhood greens to create a "sense of place" when through streets connections are not desirable due to topographic features.
- Provide neighborhoods with close access to open space lands or a range of parks, such as tot-lots, neighborhood greens, and community gardens.
- Locate civic buildings and public gathering spaces on prominent sites and design them with distinctive form to create a sense of community identity.

Principle: Community Streets

Community Streets establish a logical system of arterial, collector, and local streets to provide direct and fully interconnected access throughout the planning area.

INTENT (COMMUNITY STREETS)

- To provide a balanced interconnected system of streets, building layouts, sidewalks, and trails in a pattern that disperses traffic and provides multiple travel routes.
- To allow variations on street standards and provide alternative street designs that minimize the amount of impervious surfaces, conserve open space, and protect natural features and water quality.

FRAMEWORK (COMMUNITY STREETS)

- Layout streets to follow existing landscape and to minimize the impact on the natural terrain.
- Incorporate alternative street designs that reduce the quantity of storm water runoff
- Limit dead-end streets such as cul-de-sacs to areas where not practical for direct street connections and where most appropriate with the existing terrain.
- Private alleys shall be designed to minimize alley width, especially at the intersection of the alley and a public street. Alley flares should be the minimum width possible to accommodate public safety and maintenance equipment.

GUIDELINES (COMMUNITY STREETS)

- Prohibit direct driveway access to Line Creek Parkway, except for estate lots or in limited locations. Use rear drives or private alleys to provide access to properties fronting onto the Parkway. Work with the City's Parks and Recreation Department for final layout.
- Provide on-street parallel parking in Mixed Use Neighborhood and Mixed Use Community areas.
- Use streets to define the boundaries of natural or developed open space.
- Allow curb-to-curb widths of local streets as narrow as practicable while accommodating expected traffic and pedestrians.
- In mixed use areas, use alleys as a means of concealing parking and service areas, for locating utilities, and for minimizing curb cuts.
- In residential areas, allow alternative local and collector residential street designs that may include reduced pavement widths with a concrete apron rather than raised curbs, and include vegetated swales with plantings similar to rain gardens in lieu of enclosed storm water pipe systems along the roadways.

Community Connections

Frontage to parkway

Opportunities to have a variety of street sections


Neighborhood Connectivity


Mixed-use


Water features

Principle: Pedestrian and Bicycle Circulation

Pedestrian and Bicycle Circulation must be safe and convenient for all users and provide connectivity within and between developments.

INTENT (PEDESTRIAN AND BICYCLE CIRCULATION)

- To provide a safe, convenient, inter-connected, and visually pleasing system of pedestrian walks, bikeways, and bike routes.
- To provide a pedestrian/bicycle network. Design the experience for pedestrians and bicyclists with the same or higher priority as that of the automobile.

FRAMEWORK (PEDESTRIAN AND BICYCLE CIRCULATION)

- Development shall provide pedestrian circulation from public walks to parking areas, building entries, plazas, transit stops, and open spaces. Walkways shall be provided to separate pedestrians and vehicles, and link ground level uses.
- Pedestrian and/or bicycle connections shall be made between residential neighborhoods, business centers, and open space systems. Pedestrian, bicycle, and visual connections shall also be provided wherever automobile connections are not feasible.
- A direct pedestrian connection to the building entry shall be provided from the public sidewalk.
- Design and locate pedestrian walkways and sidewalks in a manner that encourages their use. Review City zoning ordinance for other requirements.
- Provide bicycle access between bicycle lanes or trails and on-site bicycle parking areas.

Pedestrian scale streetscape

Neighborhood trail connectors

Neighborhood linkages

GUIDELINES (PEDESTRIAN AND BICYCLE CIRCULATION)

- Provide pedestrian walkways and sidewalks along all internal streets/drives and extend them to the boundaries of each individual development area to link with sidewalks along perimeter streets and with adjoining developments.
- Minimize street crossing distances. Alternatives may include refuge medians for pedestrians or pedestrian crossings the colored pavement or pavers to create a mixture of pattern and texture.
- Provide pedestrian walkways and sidewalks that link with adjacent or future parks, greenways, trails, schools, and civic spaces.
- Setback sidewalks from street and include an 8-foot or wider tree lawn between the curb and the sidewalk.
- Allow sidewalks closer to the street curb in commercial mixed-use areas and incorporate tree planters and landscape when sidewalks are adjacent to the curb.
- Primary sidewalks in mixed use community district areas should be as wide as practicable but no less than eight (8) feet wide. Secondary sidewalks should be a minimum five (5) feet wide. Increase sidewalk width when adjacent to on-street parking and include a "transition zone" of pedestrian amenities along the street including street trees, landscape planters, pedestrian lighting, and other streetscape amenities.
- Walkways extending through parking areas should be incorporated into linear landscape strips, at least 17-feet in width to accommodate vehicle overhangs and landscape planting areas between the sidewalk and the curb.
- At each point where a sidewalk / walkway crosses a paved area in a parking lot or internal street or driveway, the crosswalk should be clearly delineated by a change in paving materials distinguished by color, texture, or height.
- Bicycle circulation should connect and align with pre-existing and planned off-site bicycle routes (Bike KC and Trails KC plans).
- Provide bicycle parking or storage near destinations, particularly in business areas.
- Locate bicycle parking in visible, active, and well lit areas; near building entries, convenient to primary bicycling access, and not encroaching on pedestrian walkways; and where from inside adjacent buildings.

Accent crossings

Greenway preservation

Mixed-use linkages

Raised crossings

development

FRAMEWORK and GUIDELINES

Neighborhood trail connectors

Building character

Proposed streetscapes

Landscape improvements

Principle: Site Planning

Appropriately sited buildings will greatly enhance the formation of public streetscape and provide a "sense of place" for all users.

INTENT (SITE PLANNING)–ALL RESIDENTIAL AND COMMERCIAL DISTRICTS

- To utilize building placement and open space to establish uninterrupted views in the Line Creek Valley and of the downtown skyline.
- To ensure streets are treated as development frontage.
- To set standards of high quality architecture and site layout to ensure long term value and connected spaces.
- To ensure building placement and orientation is consistent with pedestrian orientation development, topography, sight lines, and the vision of the area.
- To provide for compatibility of use, access, and circulation between adjoining properties within the public realm.
- To provide special definition of streets, especially at key locations such as arterial street intersections or district gateways.
- To maximize the positive character of streets and buildings through continuity of architecture and landscape frontage, and to minimize the visual impact of parking lots and structures along streets.

FRAMEWORK (SITE PLANNING)–ALL RESIDENTIAL AND COMMERCIAL DISTRICTS

- Front buildings onto a street or major access drive to create a clear street edge and to provide physical definition of roadways as it relates to the public realm.
- No development permitted to place or orient buildings, parking, circulation, or service facilities on a lot in such a way as to treat Line Creek Parkway or primary street frontage(s) as a rear lot line. For purposes of this standard "rear" shall be defined to mean a portion of the property lacking public access and containing a predominance of service functions that significantly diminish the architectural or landscape quality of the development.
- Provide exceptional architectural design, a vertical architectural feature, public art, and/or exceptional designed public plaza or landscape at corners of major street intersections and around gateway areas, and that still creates continuity throughout the area.

GUIDELINES (SITE PLANNING)–ALL RESIDENTIAL AND COMMERCIAL DISTRICTS

- Design new development to relate with adjoining properties to minimize incompatible conditions, to maximize useful inter-connections, and to enhance the appearance of the properties from the street.
- Parking areas should not be located within a minimum 200-foot radius of the center point of a major street intersection or gateway, unless located behind a building.

FRAMEWORK (SITE PLANNING)– ALL RESIDENTIAL DISTRICTS

- Create a hierarchy of interconnected streets and drives that respect the natural contours of the land and is designed to pedestrians, bicyclists, and automobiles movements.
- Do not locate parking and vehicular circulation between the building and street, except for single-family detached dwellings and cluster single family developments consisting of zero lot line dwellings, cottage houses, or two-unit dwellings.
- Provide rear alley/rear garage access for attached residential structures in higher density residential areas and mixed use areas.
- Residential properties fronting onto Line Creek Parkway, except for residential estate lots, shall not have direct driveway access. Garages and/or parking lots shall be located and accessed from the rear.

GUIDELINES (SITE PLANNING)– ALL RESIDENTIAL DISTRICTS

- Allow reduced front yard and side yard building setbacks for the habitable portion of residential buildings, provided any street oriented garages maintain the minimum building setback required by the underlying zoning district.
- Common open space and recreational facilities should be centrally located where most conveniently accessible to a majority of residents.
- "T" intersections should be used in locations where it is desirable to highlight important public spaces or open space areas.
- Private drives serving cluster or multi-family development areas should be designed similar to public streets with detached sidewalks and planting strips between the curb and sidewalk, street trees, and lighting. Internal drives should not be designed with directly accessing angled or perpendicular parking stalls. However, parallel on-street parking may be incorporated where appropriate.

FRAMEWORK (SITE PLANNING)– ALL COMMERCIAL DISTRICTS

- In mixed use areas provide a tight network of streets, wide sidewalks, regular street tree plantings, buildings oriented toward the street with close setbacks, and accommodate on-street parking in addition to parking behind buildings.
- Locate buildings in mixed-use areas along a build-to-line, with no parking or vehicular circulation allowed between the building and street.
- In commercial (general office and retail) areas, limit the amount of parking and vehicular circulation located between the building and the street.
- For medium or large scale retailing (larger than 30,000 square feet) along Barry Road and Green Hills Road, no more than 60 percent of total surface parking shall be located between buildings and arterial streets.

GUIDELINES (SITE PLANNING)– ALL COMMERCIAL DISTRICTS

- Nonresidential freestanding buildings should be clustered to define the street edge and create plazas or usable public gathering spaces between buildings. The even dispersal of freestanding buildings in a widely spaced pattern is not desirable.
- Frame and enclose parking areas with buildings on at least three sides. A majority of the frontage along an arterial street or other major roadway should be occupied by buildings or other structures such as decorative architectural walls (not to exceed 3-feet in height) or by landscaping.
- Parking areas between buildings and the street, when permitted, should use special paving materials to create parking courts with a higher level of pedestrian amenity and create the "sense of place".

Frontage to roads

Mixed housing stock

Mixed-use centers

Pedestrian zones

Plaza configurations


Streetscape store fronts


Landscape screening


Mixed housing

Principle: Architectural Character

Architectural Character and treatment of buildings plays an important role in the identity of the Line Creek Valley and in creating a built environment in scale and character with pedestrian oriented activities.

INTENT (ARCHITECTURAL CHARACTER)– ALL RESIDENTIAL AND COMMERCIAL DISTRICTS

- To ensure that the form and scale of buildings reinforces the character of streets and open space, and accommodate the movement of pedestrians.
- To encourage landscape screening and maintenance and to provide materials of quality, durability, and scale appropriate to pedestrian activity and contact.
- To minimize and use landscaping to buffer negative visual impacts leading to service areas on adjoining streets, public spaces, and adjacent property.
- To identify the location of a business with signage that is unobtrusive, as well as integrated with the buildings and/or landscape design.
- To minimize the dominance of garages on residential streets by providing a variety of street facing facades and garage locations.

Streetscape pedestrian zone

Architectural elements for building

ALL RESIDENTIAL AND COMMERCIAL DISTRICTS

- Design and place buildings on a site to define roadways as civic spaces.
- All building frontages visible from a street or a residential area could have the equivalent treatment of the primary building facade, with all service and loading facilities completely screened.
- Design buildings to relate directly to the street and reinforce the pedestrian scale and quality of street, civic, and open spaces using the following techniques:
  - Shifts in building massing, variations in height, profile, and roof form that provide human scale while maintaining a consistent relationship of overall building form to the street edge;
  - Minimize long expanses of wall at a single height or in a single plane;
  - Vary floor heights to follow natural grade contours if significant variation is present.
- Design buildings to provide human scale, interest, and variety using the following techniques:
  - Building form variation with recessed or projecting bays;
  - Expression of architectural or structural modules and detail;
  - Diversity of window size, shape, or patterns that relate to interior functions;
  - Emphasize building entries through projecting or recessed forms, detail, color, or materials;
  - Variations of material, material modules, expressed joints and details, surface relief, color, and texture to break up large building forms and wall surfaces. Such detailing could include sills, headers, belt courses, reveals, pilasters, window bays, and similar features.
- Provide variation in building form, unless the area is designed in a manner that relies on uniformity to establish an architecturally pleasing pattern.
- Provide a primary entry for building facades facing arterial streets, or a facade treatment of comparable architectural, material, and detailing quality. Corner buildings need only provide public entry on one street facade.
- Connect primary building entries to the street sidewalk by the most direct route.
- Provide signs compatible with the character of the surrounding area and adjacent architecture in terms of scale, color, materials, and lighting levels.
- Any freestanding signs shall be monument style in appearance. Prohibit the use of pole signs and billboards.

Community gathering space

Architectural store front

Store front options

development

FRAMEWORK and GUIDELINES

On-street parking

GUIDELINES (ARCHITECTURAL CHARACTER)–
ALL RESIDENTIAL AND COMMERCIAL DISTRICTS

- Provide human scaled architectural features in areas where pedestrian activity occurs or is encouraged and use the highest level of architectural detail close to pedestrian areas, near streets and entries, and around the ground floor.
- Provide windows, doors, plazas, and so forth on building facades adjacent to open space to encourage pedestrian activity and provide visual oversight.
- Use the highest architectural building design standard when located along Line Creek Parkway or within 500 feet of a major intersection with the Parkway.

FRAMEWORK (ARCHITECTURAL CHARACTER) – ALL RESIDENTIAL DISTRICTS

- Residential dwellings throughout a neighborhood may include a variety of garage placements and orientations to avoid monotonous rows of garage doors visible from the street.
- Buildings with two or more dwelling units could have no more than one garage per building oriented toward a street. Building designs with alternative garage types and locations shall be used to accommodate garages for other units (i.e. side and rear loaded garages).
- Cluster housing developments may include housing designs in which front and side loaded garages are recessed behind the forward-most enclosed area of the residence, not including window bays; or front facing garages occupy less than 33 percent of the front elevation may be flush with the forward-most enclosed area of the residence not including bay windows.

GUIDELINES (ARCHITECTURAL CHARACTER) – ALL RESIDENTIAL DISTRICTS

- Provide residential dwelling designs with alternatives to street oriented garages, such as a mixture of rear and side loaded garages, attached and detached garages, carports, and porte cocheres.
- Minimize the prominence of garage doors viewed from the street by such methods as subdividing them into multiple doors to reduce the scale, incorporating doors into the architectural character of the primary structure, placing other architectural features such as porches, bays and upper floor forward of the garage, deeply recessing front loaded, attached garages, or orienting the garage to the side or rear.

FRAMEWORK (ARCHITECTURAL CHARACTER) – ALL COMMERCIAL DISTRICTS

- Limit the size of nonresidential uses in commercial-mixed use areas to less than 25,000 square feet of gross floor area on any single floor, except food stores (groceries) may include up to 40,000 square feet of gross floor area on a single floor.
- Locate and design large non-residential buildings to minimize the impact of windowless walls and service areas on public streets.
- Provide ground floor retail with direct pedestrian entries oriented toward public streets, parks, or plazas. Primary entries must be easily and directly visible from a street.
- Include a repeating pattern on building facades that includes no less than three of the elements, with at least one of the elements repeating horizontally.
  - Color Change
  - Texture Change
  - Material Change

Store front architecture

- Limit the use of outside commercial sales, storage, or display areas. However when permitted, such areas shall be screened with landscaping or enclosed with materials integral to the building architecture.

GUIDELINES (ARCHITECTURAL CHARACTER) – ALL COMMERCIAL DISTRICTS

- Provide a clear and consistent street edge with at least 50% of the building's "active wall" oriented toward the street. An "active "wall is the side of the building containing the majority of the storefronts, customer entrances, and windows.
- Incorporate a substantial proportion of transparent glazing at all occupied levels of building facades adjoining or oriented toward streets and pedestrian areas.
- Provide arcades, display windows with vision glass, spandrel glass (not to exceed 50% of the total glass on any on façade), entry area, awnings, or other such features along no less than 60% of their horizontal length of ground floor facades facing public streets.
- Provide no less than 20% window to solid wall area for portions of a building façade above the ground floor.
- Provide a roof form and other related elements such as roof material, color, trim, and lighting as an integral part of the building architecture. Roofs should not serve as attention-getting devices for signage or as an identifiable corporate image.
- Locate drive-through facilities (order stations, pick-up windows, bank teller windows, money machines, etc.), when permitted, on the side or rear of a building away from a street. Drive-through lanes may be allowed along a street if buffers are provided to screen such activities from the roadway.

Architectural style

Architectural style

Architectural style

Estate lot with tree preservation

Principle: Landscape Design

Landscape Design contributes to common usable open space that is of mutual benefit to surrounding property owners, businesses, and residents.

INTENT (LANDSCAPE DESIGN)

- To promote high quality landscape design, compatibility between uses, water conservation, and a well maintained appearance.
- To soften and mitigate the impacts of large buildings and paved areas.
- To provide transitions between developed and natural areas, and buffers between incompatible uses.
- To provide for the coordination of design and location of walls and fences to maximize the positive interrelationship of buildings, public streets, and open space.
- To create and enhance the connectivity of neighborhoods, mixed use and recreation developments by the layout and implementation of thoughtful and meaningful landscapes throughout the area.

Streetscape possibilities with community connections

Commercial landscaping

FRAMEWORK (LANDSCAPE DESIGN)

- Encourage hiring a registered landscape architect for all landscape plans.
- Implement a street tree planting plan along all public streets.
- Maintain a continuous landscape treatment along arterial street frontages to the greatest degree possible.
- Preserve existing healthy trees to the greatest extent practicable, and protect such trees by removing existing damaged, decayed, or diseased trees.
- Coordinate with City staff, the design and materials for walls and fences for principal buildings in terms of color, quality, scale, and detail.

GUIDELINES (LANDSCAPE DESIGN)

- Provide automatic sprinkler systems with rain sensors for new landscape areas, or provide a hose bib network approved by City staff.
- Provide street tree species approved by the City that maximize the cohesiveness of each block without creating monocultures susceptible to disease.
- Provide street trees at a maximum spacing of approximately 40-feet on-center, while maintaining at least 25 feet separation from street lights.
- Provide foundation landscaping (not including street trees plantings) for residential dwellings equal to at least 0.5 percent of the structure value stated on the building permit.
- Provide transition from developed and irrigated landscape areas to any areas bordering natural open space with prairie land forms and vegetation.
- Use landscaping to define and enhance the sense of arrival at appropriate site locations, and to visually frame buildings and buffer parking, garage, and service areas.
- Limit fences within a setback area along a public street to a maximum 4 feet in height.
- Where chain link or similar forms of security fencing are required, screen such fencing from view along adjoining streets and development. Final approval of fencing material will be determined by City staff.
- Refer to the City zoning/landscape ordinance for other requirements.
- Use existing vegetation and/or topography for landscape and enhancement of landscape plans submitted for review. Xeroscape and native plantings recommended.

Street landscaping

Neighborhood landscaping

Streetscape landscaping

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FUNDING

Opinions of Probable Cost

The following provides opinions of probable costs in 2006 dollars for public infrastructure improvements in the Line Creek Valley planning area. Prior to determining phasing, a preliminary design for the recommended improvements must be developed. Although individual improvements can be separated out or combined to create smaller phases, the timing and cost of the phases will be greatly influenced by the scope and submittal of the preliminary design plans.

Given the possibility of a variable design for Line Creek Parkway, opinions of probable costs were prepared for both a 4-lane design and a 2-lane design (no median) between NW 68th Street and NW Barry Road. The two design options provide a separate line item for storm water conveyance (i.e. storm water piping, catch basins, etc.) since possible parkway designs may include a naturalistic approach, such as roadside collection swales that would reduce the amount of necessary storm water infrastructure and the overall line item expense.

Note: (1) The tables represent conceptual cost estimates based on a Conceptual Study of the planning area which will need to be refined based on the preparation of preliminary design plans. No preliminary or final engineering has been performed. (2) Opinions of probable cost assume that any improvements related to the future Rapid Transit Corridor will be determined by future studies and other funding sources.

Line Creek Parkway (4-lane design)

Item	Unit	Quantity	Unit Cost (including 5% Mobilization)	Item Cost	10% Administrative Cost	8% Design Cost	25% Project Contingency	Total Cost
Line Creek Parkway (4 lanes divided from NW 68th St. to NW Barry Rd.)	Lin. Ft.	10,922	$1,481	$16,170,021	$1,617,002	$1,293,602	$4,042,505	$23,123,130
Line Creek Parkway Storm Water Conveyance	Lin. Ft.	10,922	$677	$7,396,925	$739,692	$591,754	$1,849,231	$10,577,602

4-LANE PARKWAY DESIGN ASSUMPTIONS

- 4-lane divided roadway with varying width median and undulating vertical profile.
- 8 major cross road storm sewer structures.
- Installation of streetlights along both sets of travel lanes.
- 72,498cy Contractor Furnished (Borrow) earthwork: 427,762cy (total cut volume) - 488,177cy (total fill volume) = 60,415cy (raw need) x 1.2 (shrink / swell factor)

4-LANE PARKWAY STORM WATER CONVEYANCE ASSUMPTIONS

- 2 storm water trunk systems due to varying street profiles.
- Consists of curb inlets and associated storm water piping.
- Alternate designs may consist of roadside collection swales which may reduce line item cost.

FUNDING

Line Creek Parkway (optional 2-lane design)								
Item	Unit	Quantity	Unit Cost (including 5% Mobilization)	Item Cost	10% Administrative Cost	8% Design Cost	25% Project Contingency	Total Cost
Line Creek Parkway (2 lanes grading and construction from NW 68th St. to NW Barry Rd.)	Lin. Ft.	10,922	$861	$9,403,842	$940,384	$752,307	$2,350,961	$13,447,494
Line Creek Parkway Storm Water Conveyance	Lin. Ft.	10,922	$373	$4,071,118	$407,118	$325,694	$1,017,794	$5,821,781

2-LANE PARKWAY DESIGN ASSUMPTIONS

- 2-lane undivided roadway.
- Earthwork for only 2-lane roadway.
- 8 major cross road storm sewer structures (less length).
- Installation of 1 set of streetlights.
- 24,113cy Contractor Waste (haul off) earthwork: 259,918cy (total cut volume) – 239,842cy (total fill volume) = 20,094cy (raw need) x 1.2 (shrink / swell factor)

2-LANE PARKWAY STORM WATER CONVEYANCE ASSUMPTIONS

- 1 storm water trunk system.
- Consists of curb inlets and associated storm water piping.
- Alternate designs may consist of roadside collection swales which may reduce line item cost.

Transportation Facilities (additional improvements) within the Line Creek Valley Planning Area								
Item	Unit	Quantity	Unit Cost (including 5% Mobilization)	Item Cost	10% Administrative Cost	8% Design Cost	25% Project Contingency	Total Cost
NW 79th St. extension to Line Creek Pkwy.	Lin. Ft.	1,660	$746	$1,237,530	$123,753	$99,002	$309,383	$1,769,668
NW 79th St. extension to Line Creek Pkwy. (storm water conveyance)	Lin. Ft.	1,660	$383	$636,195	$63,620	$50,896	$159,049	$909,759
Roundabout at NW Waukomis & NW 72nd St.	Each	1	$787,500	$787,500	$78,750	$63,000	$196,875	$1,126,125
Roundabout at NW 72nd St. & Line Creek Pkwy.	Each	1	$787,500	$787,500	$78,750	$63,000	$196,875	$1,126,125
Roundabout at NW 76th St. & N. Platte Purchase Rd.	Each	1	$787,500	$787,500	$78,750	$63,000	$196,875	$1,126,125
Roundabout at NW 79th St. & Line Creek Pkwy.	Each	1	$525,000	$525,000	$52,500	$42,000	$131,250	$750,750
Bus Shelter and Amenities (custom design)	Each	5	$78,750	$393,750	$39,375	$31,000	$98,438	$563,063

STREET AND ROUNDABOUT DESIGN ASSUMPTIONS

- 79th Street designed as a collector roadway.
- Roundabouts include storm water conveyance consisting of curb inlets and associated storm water piping.
- Installation of streetlights.

Storm Water Facilities (multiple facility design) within the Line Creek Valley Planning Area								
Item	Unit	Quantity	Unit Cost (including 5% Mobilization)	Item Cost	10% Administrative Cost	8% Design Cost	25% Project Contingency	Total Cost
79th & Line Creek Pkwy.	Each	1	$2,036,029	$2,036,029	$203,603	$162,882	$509,007	$2,911,521
78th & Line Creek Pkwy.	Each	1	$1,163,295	$1,163,295	$116,330	$93,064	$290,824	$1,663,512
72nd & Line Creek Pkwy. (2 ponds northwest)	Lump Sum	1	$399,486	$399,486	$39,949	$31,959	$99,871	$571,264
72nd & Line Creek Pkwy. (southeast)	Each	1	$164,536	$164,535	$16,454	$13,163	$41,134	$235,285
68th & Line Creek	Lump Sum	1	$599,511	$599,511	$59,951	$47,961	$149,878	$857,300
Aeration Fountains	Each	7	$12,600	$88,200	$8,820	$7,056	$22,050	$126,126

STORM WATER FACILITIES ASSUMPTIONS

- Retention ponds are 7-10 feet in depth.
- Aeration facilities located in each retention facility, and may consist of riffles, fountains, recirculation pumps, lighting, and electrical services.

Storm Water Facilities (optional large regional facility design)								
Item	Unit	Quantity	Unit Cost (including 5% Mobilization)	Item Cost	10% Administrative Cost	8% Design Cost	25% Project Contingency	Total Cost
72nd & Line Creek Pkwy. (1 large facility northwest) - Retention structure identified in Line Creek Watershed Study	Each	1	$4,609,500	$4,609,500	$460,950	$368,760	$1,152,375	$6,591,585

STORM WATER FACILITIES ASSUMPTIONS (OPTIONAL DESIGN)

- See Line Creek Watershed Study.

FUNDING

Parks, Trails, and Amenities within the Line Creek Valley Planning Area								
Item	Unit	Quantity	Unit Cost (including 5% Mobilization)	Item Cost	10% Administrative Cost	8% Design Cost	25% Project Contingency	Total Cost
Asphalt Trail (10-ft wide NW 68th St to NW Barry Rd.)	Lin. Ft.	12,650	$53	$664,125	$66,413	$53,130	$166,031	$949,699
Asphalt Trail spur (10-ft wide from west of N Green Hills Rd to Line Creek Pkwy)	Lin. Ft.	5,300	$53	$278,250	$27,825	$22,260	$69,563	$397,898
Benches (1 per ¼ mile of trail)*	Each	17	$2,625	$44,277	$4,428	$3,542	$11,069	$63,316
Trail Head Kiosks with Amenities (N Green Hills Rd)	Each	1	$31,500	$31,500	$3,150	$2,520	$7,875	$45,045
Trail / Pedestrian Bridges for creek crossings	Each	3	$1,050,000	$3,150,000	$315,000	$252,000	$787,500	$4,504,500
Wayfinding Trail Signage Allowance*	Each	1	$31,500	$31,500	$3,150	$2,520	$7,875	$45,045
Lighting along Trail (1 per 50 ft.)*	Each	445	$4,200	$1,870,260	$187,026	$149,621	$467,565	$2,674,472
Pocket Park along Trail with Amenities	Each	1	$21,000	$21,000	$2,100	$1,680	$5,250	$30,030
Concrete Crosswalks for Trails (10-ft. wide)	Each	350	$63	$22,050	$2,205	$1,764	$5,513	$31,532
Decorative Sidewalk Crosswalks along Line Creek Pkwy (10-ft. wide)	Lin. Ft.	1,500	$84	$126,000	$12,600	$10,080	$31,500	$180,180
Street Trees along Line Creek Pkwy with supplemental maintenance and water device (40-ft. on-center)	Lin. Ft.	1,524	$630	$959,931	$95,993	$76,794	$239,983	$1,372,701
Line Creek Pkwy Landscape Treatment Allowance	Each	1	$682,500	$682,500	$68,250	$54,600	$170,625	$975,975
Gateway Features-Secondary (roundabout streetscaping)	Each	4	$52,500	$210,000	$21,000	$16,800	$52,500	$300,300
Gateway Features- Primary	Each	4	$262,500	$1,050,000	$105,000	$84,000	$262,500	$1,501,500
Neighborhood Banners and Mounting Brackets (1 per 150 ft. along Line Creek Pkwy-NW 68th to Old Stagecoach Rd)*	150 Lin Ft.	203	$735	$149,323	$14,932	$11,946	$37,331	$213,531

**Trail amenities such as lighting, banners, benches to be installed along a 22,265 linear feet of trails consisting of the future Line Creek trail from NW 68th Street to Barry Road (12,650 linear feet), the existing trail from Barry Road to Old Stagecoach Road (5,300 linear feet), and a future trail spur from NW 79th Street and Line Creek to a trail head at Green Hills Road (4,315 linear feet).*

PRIMARY GATEWAY FEATURES ASSUMPTIONS

- Vertical four-sided monument markers constructed of durable materials such as pre-cast concrete, brick, or stone. Markers may include accents such as steel, limestone, stucco, ceramic tile, pre-cast concrete caps, bronze plaques, pre-cast concrete coping, or concrete masonry units.
- Lighting and landscaping beds.
- 2 markers per each intersection at Line Creek Pkwy & Barry Rd. and Line Creek Pkwy & 68th St.

SECONDARY GATEWAY FEATURES ASSUMPTIONS

- Landscaping and brick pavers in roundabouts.
- Brick crosswalks around roundabouts, 10-feet in width.
- Roundabout medians may include monument markers, public art features, or fountains. The installation of fountains requires additional financial resources which may be reallocated from other roundabout locations in the planning area.

PARKWAY LANDSCAPE TREATMENT ASSUMPTIONS

- Applies to the parkway median, adjacent parkland, and disturbed land area from parkway construction
- Turf, natural grasses, shrubs, and may include planting beds in areas of formal treatment.
- Opportunities for public art not included in the line item cost.

STREET TREES ASSUMPTIONS

- Street trees to be located along both sides of each direction of traffic along Line Creek Parkway from NW 68th Street to Old Stagecoach Rd. with 40-foot average spacing.
- Street trees located in the median can be reconfigured to reflect variation in the planting scheme (formal vs. naturalistic).
- 2.5-inch caliper or greater at installation.
- Supplemental maintenance and water device consisting of water bags, gel pack irrigation supplement, drip irrigation, etc.

TRAILS AND PEDESTRIAN BRIDGES ASSUMPTIONS

- 10-foot wide asphalt construction, including clearing, grubbing, grading, and seeding for trail.
- Trail right-of-way assumed to be dedicated.
- Pedestrian bridges over Line Creek will require intermediate piers in the floodplain, hydrologic studies, and regulatory permits.

SIDEWALK AND TRAIL CROSSINGS ASSUMPTIONS

- Decorative pedestrian sidewalk crosswalks at every intersection along Line Creek Parkway.
- Pedestrian crossings may be brick or stamped and stained "brick" asphalt 10-feet in width.
- Trail crossings are concrete and 10-feet in width.

POCKET PARK ASSUMPTIONS

- 1 park located along Line Creek trail.
- Recreation uses include child swings and play area equipment with safety fall zone surface.
- Amenities include 2 benches, 1 trash receptacle, 1 wayfinding park sign, landscaping, and lighting.

BANNERS ASSUMPTIONS

- The use of aluminum or plastic banners with a life of 10 years or greater.
- Banners are assumed to be placed on street light poles, generally an average of 1 per 150 feet.

BENCHES ASSUMPTIONS

- Benches are to be constructed of durable materials and anchored in place.
- Benches are projected to be placed generally 1 per ¼ mile along Line Creek trail from 68th Street to Old Stagecoach Road and along the trail spur from the Line Creek trail westward to the trail head at Green Hills Road.

PEDESTRIAN LIGHTING ASSUMPTIONS

- Pedestrian lighting along Line Creek trail may consist of pedestrian or bollard lights with 50-foot average spacing.
- Line item includes controls and wiring.

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FUNDING OPPORTUNITIES

Capital improvements for the permanent addition to the city's physical assets including infrastructure (sewer and water lines, streets) and other public facilities (such as parks and playgrounds) are funded from a variety of sources including dedicated taxes, enterprise revenues, general municipal funds, and debt instruments. Capital improvement projects are authorized after a process that includes extensive input by the Public Improvements Advisory Committee (PIAC), citizens appointed by each City Council member. The PIAC may recommend funding of a "neighborhood" project from money equally divided by Council Districts or from "citywide" projects considered significant enough that they are of citywide interests.

It may be difficult to receive funding in the short term for most public improvement projects in the Line Creek Valley planning area. This is primarily due to the existence of established high priority projects in the Northland and the City Council 2nd District, and the magnitude of funding needed to construct public infrastructure in the planning area which would require "citywide" funding. Therefore, supplemental funding sources for public infrastructure projects should be considered. Possible funding opportunities may include the following:

Special Taxes and Taxing Districts

SALES TAX

A City or County sales tax could be proposed to implement parks and recreation and storm water control projects. For example, voters in Platte County passed a one-half cent sales tax in August 2000 parks and recreation and storm water control. Since approval of the sales tax, Platte County has implemented a number of projects throughout the county including projects in the City of Kansas City. A future renewal of the Platte County sales tax could include possible projects designated for the Line Creek Valley.

STORM WATER MANAGEMENT DISTRICT

A Storm Water Management District may be established by the City to implement special impact fees from new development, current property owners, or future property owners for purposes of funding storm water improvement projects within the district. Such a district could be established for all or a portion of the Line Creek watershed and would serve as a fee supported entity to address all storm water management issues within the district boundaries. As a fee supported district, this approach would allow the implementation of a comprehensive capital improvement, operations, and maintenance program without placing burden on the municipal budget. By including a larger area of the watershed in the district, there would be greater opportunity to provide regional benefits and to mitigate downstream damage, as well as a larger number of properties to spread the fees thus resulting in fewer dollars per capita. A larger district also allows for additional mitigation placement options such as regional detention downstream to mitigate the effects development upstream within the watershed.

FUNDING OPPORTUNITIES

TAX INCREMENT FINANCING ("TIF")

Tax Increment Financing allows future real property taxes and other taxes generated by new development to pay for the costs of construction of public infrastructure and other improvements required to make the project feasible. It therefore, stimulates redevelopment of a project or a designated redevelopment area (may be blighted, substandard and/or economically under-utilized area) that otherwise would not occur.

This program is a financing/development tool that allows for Payment In Lieu Of Taxes (PILOTs), of an amount equal to the tax abatement granted, to be used to pay for approved project related costs, infrastructure, and capital improvements. The program also allows the use of Economic Activity Taxes (EATs). Projects are allowed to use 50% of new EATs to reimburse eligible project expenses.

TRANSPORTATION DEVELOPMENT DISTRICT ("TDD")

The Transportation Development District Act, RSMo. §238.200 - 275, provides for cooperation between a locally established special purpose district and a political subdivision and the Missouri Highways and Transportation Commission ("MHTC") to fund, promote, plan, design, construct, improve, maintain, and operate one or more transportation related improvements or infrastructure. In particular, MHTC encourages applications by TDDs for the Missouri Department of Transportation's Innovative Finance program for development and maintenance of approved projects. To fund proposed projects, TDDs may levy special assessments, or property taxes and sales taxes, subject to approval of voters within the district. See RSMo.§238.227-235. Additionally, TDDs may borrow funds, enter into lease-purchase arrangements, or issue bonds, notes or similar obligations. The TDD may secure the obligations by pledging district property or income. See RSMo. §238.240.

Formation of a TDD requires a petition to the applicable circuit court by fifty (50) registered voters within the proposed district, by all of the property owners within the district if the proposed TDD contains no registered voters, or by the governing body of any county, city, town, village, or any similar entity. See RSMo.§238.207. Specific requirements for the petition are set forth in RSMo. §238.207.4. Within thirty (30) days of filing, the Circuit Court Clerk must serve a copy of the petition upon respondents who shall include MHTC and any other public entity having jurisdiction over any transportation improvement or service within the proposed district. Respondents have thirty (30) days after receipt of service to file an answer stating agreement with or opposition to the creation of the TDD. If the Circuit Court determines after the hearing, the petition and the proposed method of funding are lawful, the Court then certifies the question of district creation and project funding for voter approval. The Court may additionally order

a public hearing on the question. See RSMo. §238.212.4. Alternatively, if the owners of record filed the petition, the Court may declare the TDD organized and, as required, certify the proposed funding methods for voter approval. See RSMo. §238.210.2.

SPECIAL BUSINESS DISTRICTS ("SBD")

A Special Business District may be established by the City to make improvements within its designated boundaries. The District may tax real property and businesses within the district to fund improvements, and it may issue bonds. See RSMo. §71.800. The taxes and fees may be used for the purpose of maintaining and improving public facilities in the district and also for the purchase, construction and operation of buses, parking facilities, child day-care as well as for other purposes detailed in RSMo. §71.796(1) - (14). Discretion as to expenditures remains with the local governing body, which appoints a commission or advisory board to make recommendations as to expenditures and uses.

COMMUNITY IMPROVEMENT DISTRICT ("CID")

A Community Improvement District or CID provides another class of special purpose, self-taxing district. Once established, CIDs enjoy broad authority to levy and collect special assessments and/or sales taxes to fix and collect fees for use of CID properties, to construct and maintain a variety of public improvements, to support business activity and economic development within district boundaries, and to issue tax exempt revenue and general obligations. See RSMo. §67.1461, 67.1491. A CID is established upon receipt of a petition signed by owners of real property representing more than fifty (50%) percent of the assessed valuation within the proposed CID boundary, which must be contiguous, and over fifty (50%) percent per capita of all property owners within the CID. See RSMo. §67.1421. Establishment procedures and requirements are set forth in RSMo. §67. 1421-1431.

A CID may be organized as either a political subdivision or as a non-profit corporation. See RSMo. §67.1411. Non-profit corporation CIDs enjoy the same authority as their political subdivision counterparts with the exception of the power to levy voter approved real property taxes. Like political subdivision CIDs, however, non-profit CIDs may levy special assessments by petition and may issue bonds and similar obligations. See RSMo. §67.1491-1501, 67.1521. Notably, the non-profit corporation governance structure preserves the rights of non-resident property owners to a voice in CID fiscal matters, such as the levying of special assessments. This alternative may be attractive to communities composed of a large percentage of businesses or absentee owners.

FUNDING OPPORTUNITIES

Grants and Programs

Several funding sources may be applicable for environmental projects in the planning area, many of which provide matching funds of up to 75 percent of the project value, and may provide up to $100,000 to develop a study for the funding. Federal and State agencies such as the United States Army Corps of Engineers (USACE), the Environmental Projection Agency (EPA), and the Missouri Department of Conservation (MDC), and others have limited funds available for environmental projects. In recent years the global war on terrorism has used much of the funding available from USACE, while other programs suffer from limited annual budgets. Potential projects must identify funding programs early to coordinate with the respective agencies and proceed through the required processes to establish a place in line for funding. Potential environmental funding sources and programs that may apply to the planning area include:

THE MISSOURI DEPARTMENT OF CONSERVATION (MDC)

- The MDC may provide up to $50,000 in seed, plant, and seedling materials only, to be used for urban habitat development and ecosystem restoration.

IN-LIEU-FEE PROGRAM

- In addition to the funding and grant programs, an in-lieu-fee program could be formed to manage the planning area or the entire Line Creek watershed. These programs are intended to repair and restore streams and wetlands by forming a conservation district that serves as an exchange bank. An in-lieu-fee program is an agreement between a regulatory agency (state, federal, or local) and a single sponsor, generally a public agency or non-profit organization. Under an in-lieu-fee agreement, the mitigation sponsor collects funds from an individual or a number of individuals who are required to conduct compensatory mitigation required under §404 or another state or local wetland regulatory program. The sponsor may use the funds pooled from multiple permittees to create one or a number of sites under the authority of the agreement to satisfy the permittees' required mitigation. In-lieu-fee mitigation is generally categorized as mitigation conducted after permitted impacts have occurred.

  The program works by building new wetland, habitat, or stream restoration projects inside the established conservation district to replace damage caused by other projects in the surrounding counties. For example, if a new road project crosses a stream, the damage can be mitigated by paying a fee to the conservation district, which will, in turn, fund a stream restoration project within the conservation district. This replacement, or exchange, serves as the mitigation plan for the new road project.

ENVIRONMENTAL PROTECTION AGENCY (EPA)

- The EPA provides Section 319 Grants with a 75 percent match to be used for habitat and stream restoration (primarily habitat and demonstration projects). Under section 319, State, Territories, and Indian Tribes receive grant money which support a wide variety of activities including technical assistance, financial assistance, education, training, technology transfer, demonstration projects, and monitoring to assess the success of specific nonpoint source implementation projects.

UNITED STATES ARMY CORPS OF ENGINEERS (USACE) FUNDS

- **Section 1135 Funds** provide up to a 75 percent match to be used for habitat and stream restoration. The USACE has the authority to make modifications in the structures and operations of water resources projects constructed by the Corps or funded jointly with other federal agencies to improve the quality of the environment. The primary goal of these projects is ecosystem restoration with an emphasis on projects benefiting fish and wildlife. A non-Federal sponsor must contribute 25 percent of the cost of planning, design, and construction, and 100 percent of the cost of operation and maintenance. The entire non-Federal cost share is provided after the feasibility study and project plans and specifications are complete. The sponsor receives a credit for the value of real estate necessary to implement the project. Up to 80 percent of the non-Federal share of the project cost may be credited as work in kind, but, to receive credit, the services must be provided after a formal Project Cooperation Agreement is signed, usually during the construction phase.

- **Section 206 Grants** from USACE fund local government projects to restore aquatic ecosystems. Projects are evaluated to determine if they benefit the environment through restoring, improving, or protecting aquatic habitat for plants, fish and wildlife. Proposed projects are also reviewed to determine if they are technically feasible, environmentally acceptable, and provide cost effective environmental benefits. Each project must be complete within itself and not part of a larger project. The maximum federal expenditure per project is $5 million – this includes both planning and construction costs. Project costs are shared 65 percent and 35 percent non-federal. Costs of lands, easements, and rights-of-way are non-federal and are credible towards the 35% nonfederal cost share. Section 206 also allows credit for certain works in-kind, including design work, provision of materials, and construction activities. Contributions, such as volunteer labor, can also be accepted to reduce the overall project cost. The non-federal sponsor must assume responsibility for operation and maintenance of the project upon completion.

- The **Planning Assistance to States (PAS) Program** provides funding to address water resources issues, such as water quality and environmental conservation / restoration. The PAS Program is funded annually by Congress and provides federal allotments for each State or Tribe from the nation-wide appropriation, limited to $500,000 annually, but typically is much less. Individual studies, of which there may be more than one per State or Tribe per year, generally cost $25,000 to $75,000. These studies are cost shared on a 50 percent Federal-50 percent non-Federal basis. Typical studies are only planning level of detail; they do not include detailed design for project construction. The studies generally involve the analysis of existing data for planning purposes using standard engineering techniques although some data collection is often necessary.

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IMPLEMENTATION

The work plan for implementation is summarized in the following matrix elements which provide a generalized actions steps, responsibilities, and time frame to achieve the vision of the Line Creek Valley Development Plan. The implementation matrix includes:

- Action Steps – First steps in implementing Development Plan recommendations.
- Implementation Responsibilities – Key groups and partnerships needed to work on the project. These may include:
  - City: Includes various City Departments, Boards, and Commissions;
  - Agencies: May include Federal, State, and County departments and agencies;
  - Private Sector: May include developers and land owners;
  - Neighborhoods: May include homes associations, neighborhood groups, and homeowners;
- Time Frame – A general phasing of actions over which the action is to occur, expressed in the following terms:
  - Short-term, 1 to 3 years;
  - Medium-Term, 3-5 years;
  - Long-Term, over 5 years; and
  - Ongoing

ACTION STEPS	IMPLEMENTATION RESPONSIBILITY				TIME FRAME			
Environmental Management	City	Agencies	Private Sector	Neighborhoods	Short Term (1-3 Years)	Mid Term (3-5 Years)	Long Term (5+ Years)	Ongoing
Conduct a cultural resources survey and develop archeological mitigation plan if required.	●	●	●		●			
Obtain 401/404 Permits from the US Army Corps of Engineers for public infrastructure. Prepare mitigation plans based on the location of identified federally designated wetlands.	●	●				●		
Monitor construction for compliance to storm water pollution prevention plans.	●	●	●	●				●
Implement a public awareness plan to reduce non-point source pollution.	●	●		●		●		
Encourage tree surveys and mitigation plans in accordance with the Development Framework and Guidelines for new development applications in areas designated for Woodland Areas.	●		●					●
Limit development encroachment into stream buffer areas by establishing no-build lines at the time of platting.	●		●					●

IMPLEMENTATION

ACTION STEPS	IMPLEMENTATION RESPONSIBILITY				TIME FRAME			
Storm Water Management	City	Agencies	Private Sector	Neighborhoods	Short Term (1-3 Years)	Mid Term (3-5 Years)	Long Term (5+ Years)	Ongoing
Adopt and provide education for the revised KC Metro APWA Sections 5200 and 5600, the city's new Development Ordinance, the KC-One Storm Water Management Plan, and the Wet Weather Solutions Program.	●		●					●
Design plans for regional storm water facilities.	●	●	●		●			
Construct regional detention facilities prior to future development in the upstream watershed.	●	●	●			●		
Design plans for localized multiple frequency detention facilities through the development approval process.			●					●
Prepare development drainage studies to demonstrate the effectiveness of localized BMPs through the development approval process.			●					●
Use academic research to monitor and rate the effectiveness of BMPs.	●	●	●	●				●

ACTION STEPS	IMPLEMENTATION RESPONSIBILITY				TIME FRAME			
Land Use, Zoning, Site Planning and Urban Design	City	Agencies	Private Sector	Neighborhoods	Short Term (1-3 Years)	Mid Term (3-5 Years)	Long Term (5+ Years)	Ongoing
Require "planned zoning" (i.e. Master Plan Development) to implement the recommendations, framework and guidelines of the Line Creek Valley Development Plan.	●		●					●
Use the Parkway Development Zone concepts in the development planning and approval process for areas along Line Creek Parkway.	●		●					●
Allow greater flexibility for lot and setback standards for planned developments in exchange for preservation of a greater amount of open space and woodland areas.	●		●					●
Require buildings to front onto the parkway when located at grade with the roadway.	●		●					●
Prepare urban design plans for public art, signage, decorative street lighting, and landscaping improvements to be placed in the public right-of-way at gateway locations as part of preliminary engineering for Line Creek Parkway.	●		●		●			
Require private developments in gateway areas to provide focal points in accordance with the Development Framework and Design Guidelines and with public improvement urban design plans.	●	●	●					●
Encourage landscape plans for commercial development to be prepared by registered landscape architects, with the City arborist to review and approve the street tree and parkway planting plans.	●		●					●

ACTION STEPS	IMPLEMENTATION RESPONSIBILITY				TIME FRAME			
Parkway and Transportation Network	City	Agencies	Private Sector	Neighborhoods	Short Term (1-3 Years)	Mid Term (3-5 Years)	Long Term (5+ Years)	Ongoing
Identify primary funding for the development of Line Creek Parkway and other major roadway improvements.	●	●			●			
Identify supplemental funding sources for additional local roadway and neighborhood street improvements.	●	●					●	
Prepare preliminary engineering for Line Creek Parkway.	●		●		●			
Identify the most suitable alignment for the Special Purpose Rapid Transit Corridor.	●	●	●		●			
Amend the Major Street Plan to reclassify both NW 72nd Street and NW 79th Street east of Waukomis / Green Hills Rd from an arterial street to a collector roadway.	●				●			

ACTION STEPS	IMPLEMENTATION RESPONSIBILITY				TIME FRAME			
Parks, Open Space, Trails	City	Agencies	Private Sector	Neighborhoods	Short Term (1-3 Years)	Mid Term (3-5 Years)	Long Term (5+ Years)	Ongoing
Accept dedication of floodplain lands by private land owners along Line Creek and its tributaries for the purpose of public linear park system, trail connections, regional storm water facilities, and Line Creek Parkway.	●		●		●			●
Prepare design plans and construct the regional Line Creek Trail segment from NW 68th Street to NW 79th Street and associated connections to existing neighborhoods.	●				●			
Construct the Line Creek tributary trail spur from NW 79th St. to Barry Rd. on the west side of Green Hills Rd.	●					●		
Construct the regional Line Creek Trail segment from NW 79th St. to Barry Rd with construction of the associated segment of Line Creek Parkway.	●						●	
Construct trail linkages from the Line Creek Trail to new neighborhoods and retail areas through the development process.	●		●					●
Construct park and recreation facilities in the linear parklands in the vicinity of Line Creek Parkway and NW 72nd Street concurrently with the construction of roadways (i.e. Line Creek Parkway) that provide public access to the park area.	●			●			●	

IMPLEMENTATION

The work plan for implementation is summarized in the following matrix elements which provide a generalized actions steps, responsibilities, and time frame to achieve the vision of the Line Creek Valley Development Plan. The implementation matrix includes:

- Action Steps – First steps in implementing Development Plan recommendations.
- Implementation Responsibilities – Key groups and partnerships needed to work on the project. These may include:
  - City: Includes various City Departments, Boards, and Commissions;
  - Agencies: May include Federal, State, and County departments and agencies;
  - Private Sector: May include developers and land owners;
  - Neighborhoods: May include homes associations, neighborhood groups, and homeowners;
- Time Frame – A general phasing of actions over which the action is to occur, expressed in the following terms:
  - Short-term, 1 to 3 years;
  - Medium-Term, 3-5 years;
  - Long-Term, over 5 years; and
  - Ongoing

ACTION STEPS	IMPLEMENTATION RESPONSIBILITY				TIME FRAME			
Environmental Management	City	Agencies	Private Sector	Neighborhoods	Short Term (1-3 Years)	Mid Term (3-5 Years)	Long Term (5+ Years)	Ongoing
Conduct a cultural resources survey and develop archeological mitigation plan if required.	●	●	●		●			
Obtain 401/404 Permits from the US Army Corps of Engineers for public infrastructure. Prepare mitigation plans based on the location of identified federally designated wetlands.	●	●				●		
Monitor construction for compliance to storm water pollution prevention plans.	●	●	●	●				●
Implement a public awareness plan to reduce non-point source pollution.	●	●		●		●		
Encourage tree surveys and mitigation plans in accordance with the Development Framework and Guidelines for new development applications in areas designated for Woodland Areas.	●		●					●
Limit development encroachment into stream buffer areas by establishing no-build lines at the time of platting.	●		●					●

IMPLEMENTATION

ACTION STEPS	IMPLEMENTATION RESPONSIBILITY				TIME FRAME			
Storm Water Management	City	Agencies	Private Sector	Neighborhoods	Short Term (1-3 Years)	Mid Term (3-5 Years)	Long Term (5+ Years)	Ongoing
Adopt and provide education for the revised KC Metro APWA Sections 5200 and 5600, the city's new Development Ordinance, the KC-One Storm Water Management Plan, and the Wet Weather Solutions Program.	●		●					●
Design plans for regional storm water facilities.	●	●	●		●			
Construct regional detention facilities prior to future development in the upstream watershed.	●	●	●			●		
Design plans for localized multiple frequency detention facilities through the development approval process.			●					●
Prepare development drainage studies to demonstrate the effectiveness of localized BMPs through the development approval process.			●					●
Use academic research to monitor and rate the effectiveness of BMPs.	●	●	●	●				●

ACTION STEPS	IMPLEMENTATION RESPONSIBILITY				TIME FRAME			
Land Use, Zoning, Site Planning and Urban Design	City	Agencies	Private Sector	Neighborhoods	Short Term (1-3 Years)	Mid Term (3-5 Years)	Long Term (5+ Years)	Ongoing
Require "planned zoning" (i.e. Master Plan Development) to implement the recommendations, framework and guidelines of the Line Creek Valley Development Plan.	●		●					●
Use the Parkway Development Zone concepts in the development planning and approval process for areas along Line Creek Parkway.	●		●					●
Allow greater flexibility for lot and setback standards for planned developments in exchange for preservation of a greater amount of open space and woodland areas.	●		●					●
Require buildings to front onto the parkway when located at grade with the roadway.	●		●					●
Prepare urban design plans for public art, signage, decorative street lighting, and landscaping improvements to be placed in the public right-of-way at gateway locations as part of preliminary engineering for Line Creek Parkway.	●		●		●			
Require private developments in gateway areas to provide focal points in accordance with the Development Framework and Design Guidelines and with public improvement urban design plans.	●	●	●					●
Encourage landscape plans for commercial development to be prepared by registered landscape architects, with the City arborist to review and approve the street tree and parkway planting plans.	●		●					●

ACTION STEPS	IMPLEMENTATION RESPONSIBILITY				TIME FRAME			
Parkway and Transportation Network	City	Agencies	Private Sector	Neighborhoods	Short Term (1-3 Years)	Mid Term (3-5 Years)	Long Term (5+ Years)	Ongoing
Identify primary funding for the development of Line Creek Parkway and other major roadway improvements.	●	●			●			
Identify supplemental funding sources for additional local roadway and neighborhood street improvements.	●	●					●	
Prepare preliminary engineering for Line Creek Parkway.	●		●		●			
Identify the most suitable alignment for the Special Purpose Rapid Transit Corridor.	●	●	●		●			
Amend the Major Street Plan to reclassify both NW 72nd Street and NW 79th Street east of Waukomis / Green Hills Rd from an arterial street to a collector roadway.	●				●			

ACTION STEPS	IMPLEMENTATION RESPONSIBILITY				TIME FRAME			
Parks, Open Space, Trails	City	Agencies	Private Sector	Neighborhoods	Short Term (1-3 Years)	Mid Term (3-5 Years)	Long Term (5+ Years)	Ongoing
Accept dedication of floodplain lands by private land owners along Line Creek and its tributaries for the purpose of public linear park system, trail connections, regional storm water facilities, and Line Creek Parkway.	●		●		●			●
Prepare design plans and construct the regional Line Creek Trail segment from NW 68th Street to NW 79th Street and associated connections to existing neighborhoods.	●				●			
Construct the Line Creek tributary trail spur from NW 79th St. to Barry Rd. on the west side of Green Hills Rd.	●					●		
Construct the regional Line Creek Trail segment from NW 79th St. to Barry Rd with construction of the associated segment of Line Creek Parkway.	●						●	
Construct trail linkages from the Line Creek Trail to new neighborhoods and retail areas through the development process.	●		●					●
Construct park and recreation facilities in the linear parklands in the vicinity of Line Creek Parkway and NW 72nd Street concurrently with the construction of roadways (i.e. Line Creek Parkway) that provide public access to the park area.	●			●			●	

APPENDIX A: wet weather solutions program

The Wet Weather Solutions Program is a City of Kansas City, Missouri initiative to address problems that often occur during wet weather. These wet weather problems may include:

- Citizens are in danger of high water causing injury or damage to property;
- Stormwater run-off carries pollutants to area streams, lakes and rivers; and
- Sanitary sewers sometimes overflow, discharging untreated sewage into our streams, lakes and rivers.

To identify and address these issues, on July 10, 2003 the City Council formally established the Wet Weather Solutions Program and Wet Weather Community Panel through the adoption of Resolution 030764. As part of the Panel's on-going roles and responsibilities, the following Program Goals, Objectives, and Guiding Principles were developed to address the city's wet weather problems, and are provided as a primary reference to assist in the design and development of sustainable land use plans in Kansas City. In addition, the plans will be encouraged to incorporate information on stream buffering, recommended best management practices, and other identified wet weather management solutions.

Goals and Objectives

GOAL			
Minimize loss of life and injury and reduce property damage due to flooding			
Objective	**Objective**	**Objective**	**Objective**
Warn public of dangers of high water	Provide passable roads during flooding	Reduce flood damage to structures	Protect public infrastructure from flood damage

GOAL		
Improve Water Quality		
Objective	**Objective**	**Objective**
Protect Streams & Natural Resources	Reduce pollution in streams, lakes and rivers	Meet or exceed all applicable regulations

GOAL			
Maximize economic, social and environmental benefits			
Objective	**Objective**	**Objective**	**Objective**
Create and Sustain Recreational Opportunities	Support Economic Development and Sustainable Growth	Optimize Infrastructure Investment	Enhance Natural Habitats

LINE CREEK

"It's not just about the water. It's about a stronger, more prosperous, and sustainable community."

– Deborah O'Bannon, Wet Weather Community Panel Member

APPENDIX A: wet weather solutions program

Guiding Principles:

The City of Kansas City, Missouri faces immediate challenges in managing water quality, sewer overflows, economic development demands, changing regulatory requirements, time and financial constraints, and in meeting diverse citizen expectations. The Guiding Principles are the Wet Weather Community Panel's recommendations regarding the development and implementation of the Wet Weather Solutions Program. The Guiding Principles are based on community values and will guide decisions regarding how best to manage the city's resources in a sustainable way.

DESIRED OUTCOMES

Through the Wet Weather Solutions Program, Kansas City, Missouri will:

- Protect people from loss of life and injury and property from damage due to flooding.
- Reduce sewer overflows.
- Improve water quality.
- Generate multiple benefits such as natural resource preservation, recreational opportunities, economic investment and enhanced quality of life, as it pursues a standard of excellence in water management.

GUIDING PRINCIPLES

Through strong creative leadership and a stewardship ethics, the Wet Weather Solutions Program will take action to manage the City's water resources in a sustainable way. The following ten (10) principles will guide the program participants in achieving desired outcomes.

LEADERSHIP

- **Communication:** Use plain language so that information and discussions are immediately understood by all participants in the process
- **Participatory:** Many people have a stake in program decisions and their involvement will lead to more effective solutions. Because solutions will be watershed based, stakeholders outside of Kansas City will need to be involved. Citizens will have a meaningful say in actions that affect their lives and spend their tax dollars/user fees.
- **Collaborative:** Stakeholders are partners in each aspect of the decision-making including the development of alternatives and identification of preferred solutions.
- **Accountable:** Stakeholders and the project team are mutually accountable for successful program development and implementation. The City Council is the ultimate decision-maker and is accountable to the citizens it represents.
- **Transparent:** Strive for openness in data collection, analysis, option development, and decision-making so that the public and other stakeholders have confidence that outcomes are rational in light of all identified interests and inputs.

STEWARDSHIP

- Watershed-based: Considers all sources of problems and solutions so that strategies account for the interrelationship of water, land use, air quality, and human communities within a watershed, leading to project outcomes with multiple benefits.
- Maximize environmental, community and economic benefits: Prefer options that create multiple benefits for the community, environment, and the regional economy so that the legacy is a stronger, more appealing, and more prosperous community.
- Financial: Manage the community's resources with a long-term view, pursuing fairness in the distribution of the economic benefits and burdens.

TAKE ACTION

- Innovative: Innovate while developing the program to foster learning and adjustments. Let experience inform future plans.
- Show progress: Actively seek out existing projects that can demonstrate quick progress.

DISCUSSION QUESTIONS

The following questions can be used to systematically assess how the Guiding Principles were considered in the development of design options.

1. How were the perspectives of stakeholders taken into account in developing the recommendation?
2. How can value be added to this recommendation (e.g. open space, recreation, aesthetics, interagency cooperation, intradepartmental coordination, and/or education)?
3. How is this strategy/recommendation tailored to the identified problem in this specific location, neighborhood, and/or watershed?
4. How will the recommendation move the community towards achieving desired outcomes?
5. How can this strategy/recommendation be used to build community partnerships and support, as well as capacity to solve other problems.

APPENDIX A: wet weather solutions program

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APPENDIX B: excerpts from KCAPWA section 5600

Storm Drainage Systems & Facilities

SECTION 5605 NATURAL STREAMS

5605.1 SCOPE:

This section sets forth requirements for the protection of natural streams as a conveyance for stormwater. Unless otherwise provided for by City, State, or Federal ordinance, regulation, or standards, existing natural streams shall be preserved and protected in accordance with this section. Where natural streams are not preserved, the drainage will be handled through systems designed in accordance with Sections 5606 or 5607.

5605.2 NATURAL STREAM BENEFITS AND CHARACTERISTICS:

Natural streams provide numerous water quality, ecological, and quality of life benefits. Protection and preservation of natural streams is a national environmental objective, as set forth in the Clean Water Act. Streams and their associated wetlands provide critical habitat for plants and wildlife, water quality treatment, and improved infiltration of rainfall which lessens flood impacts, recharges groundwater, and preserves baseflow. Streams provide recreational and open space in communities, improve aesthetics, provide natural landscapes, and enhance adjacent property values. Stable streams in nature maintain a shape in plan, profile, and section that most efficiently transports the water and sediment supplied to them. The geometry and processes of natural streams involve unique terminology and concepts not common to engineered channels or pipe systems. Common features of stream geometry and characteristics are presented in Figure 5605–I. Certain definitions are contained in Section 5601. More complete information regarding the character and function of natural streams is given in Interagency (2001).

5605.3 STREAM PRESERVATION AND BUFFERS ZONES:

A. Recommended Approach: It is recommended that Cities adopt comprehensive stream preservation and buffer zone requirements as part of their master plan and enforce those policies during the planning phase of land development. Requirements may be selected to protect environmental and quality of life benefits and be tailored to local geography and natural resources. The size of buffers may be adjusted to reflect local experience with stream migration and stability, protection of adjacent wetlands or critical habitat, or water quality treatment. Guidance on stream protection is given in Wegner (1999), National Academy of Sciences (1999), and Heraty (1995). Natural streams should be preserved as systems and not segmented on a project-by-project basis, as the frequent intermixing of natural and man-made systems tends to degrade the function of both.

APPENDIX B: excerpts from KCAPWA section 5600

B. Default Approach: Where such comprehensive strategies have not been adopted, the following requirements shall be satisfied for all development/redevelopment proposed adjacent to or ultimately discharging to an existing natural channel:

1. Streams having a tributary area in excess of 40 acres shall be preserved. Preservation of smaller streams is encouraged. Preservation may be waived by the City/County Engineer where it is impractical, provided that the project has also received appropriate state and federal permits.
2. Buffer zones shall be established around all preserved streams. The limit of buffer zones shall be formally designated on a plat, deed, easement, or restrictive covenant, as directed by the City. Buffer widths as measured from the ordinary high water mark (OHM) outward in each direction shall exceed the following:

Contributing drainage basin size (acres)	Buffer width, from OHM outwards, measured separately in each direction
Less than 40 acres	40 feet
40 acres to 160 acres	60 feet
160 acres to 5000 acres	100 feet
Greater than 5000 acres	120 feet

3. The City/County Engineer may require wider buffers for less stable stream or special conditions to address water quality and ecological needs. These widths provide only moderate allowance for widening or migration in local streams of average stability. Geotechnical studies may be required if there is a risk of slope failure due to underlying soil or rock materials, and the buffer width shall be expanded to contain the zone of failure. Smaller buffers in isolated locations may be allowed where provision of the full width is impractical and bank stability concerns have been addressed.
4. No construction or disturbance of any type, including clearing, grubbing, stripping, fill, excavation, linear grading, paving, or building is allowed in the buffer zone except by permission of the City/County Engineer. Dense stands of native vegetation shall be maintained, particularly in the 25 feet closest to the top of bank.
5. Unless otherwise accepted by the City/County, any maintenance of riparian buffers shall be the responsibility of the property owner.
6. For work on existing facilities already located closer to the stream than allowed above, the new construction shall not encroach closer to the stream. Bank stability concerns shall be addressed. Formal designation of a buffer zone is not required.

5605.4 IN STREAM CONSTRUCTION - GENERAL REQUIREMENTS:
Construction in streams or their buffer zones shall conform to the general requirements of this subsection and to the appropriate specific requirements of the subsections following:

A. Stream Assessment: A stream assessment shall be conducted in accordance with Section 5605.5 for all construction within the buffer zone except for discharge outfalls, unless otherwise directed by the City/County Engineer.

B. Energy Management: The pre-project and post-project hydraulic and energy grade lines for the 100%, 10%, and 1% storm flows shall be plotted. The region of a stream where in-stream construction causes a change in these grade lines is con-

sidered the zone of influence. The extent of the zone of influence downstream shall be generally limited by energy dissipation and grade control. The upstream limit of the zone may extend a distance beyond the construction as a drawdown or backwater curve. Within the zone of influence, the energy of the flow on the channel will be evaluated for the potential of excessive scour, deposition, initiation of headcuts, or other instability. Use of vegetation to increase bank resistance and minimize increases or abrupt changes in velocities is recommended. Bank or bed stabilization may be required in areas of unavoidable velocity or depth increase.

C. Sediment Transport Continuity: The minimum post-project applied shear to the bed of the channel in the zone of influence at the 100%, 10%, and 4% ultimate conditions storm flow shall not be less than 90% of the minimum pre-project applied shear in the zone, so as to maintain the ability of the channel to transport sediment. If such shear stresses cannot be maintained, the engineer will evaluate the potential for future sediment removal or maintenance.

D. Transitions: In-stream structures shall be designed to gradually blend into the natural channel and provide a smooth transition of both geometry and roughness.

E. Repair of Disturbed Banks: The side slopes of banks where construction occurs shall be restored with vegetation in accordance with Section 5605-13 as quickly as possible.

F. Professional Judgment: Natural streams are complex, variable, and strongly governed by local geology and climate. These standards are based on general guidelines of good practice on typical local streams and may not be optimal or sufficient in all cases. Specific requirements may be increased or waived by the City/County Engineer if conditions warrant and decisions should be guided by prudent engineering judgment.

5605.5 STREAM ASSESSMENT:

When conducted, a stream assessment will extend a minimum of one wavelength up and downstream of the area to be impacted by construction. It shall include the components listed below, except modified by the City/County Engineer to better fit project needs. An example submittal is shown in Figure 5605-2.

A. Plan Form Analyses and Inventory: The plan-view of the natural stream using aerial photographs or planning-level aerial survey shall be plotted to an appropriate scale. Field surveys of the entire reach study area is not required. The following items shall be shown:

1. Ordinary high water mark.
2. Top of bank.
3. Ground contours (if available).
4. "Bank-full" and floodplain for the 1% ultimate-conditions storm (see paragraph B).
5. Thalweg, locations of riffles and pools, and spacing between riffles (see paragraph C).

APPENDIX B: excerpts from KCAPWA section 5600

6. Exposed bedrock, areas of differing bed and bank soil or rock materials, and the D50 and shear stress ratio at each riffle (see paragraph D)
7. Active scour and depositional areas, point bars, and islands.
8. Vegetation within the buffer zone, called out as mowed grass, mowed with trees, unmowed grass and plants, wooded, and bare. Trees greater than 6" diameter within 25 feet of the top of bank shall be located individually or by group. The species of dominant trees should be noted.
9. Meander length, wavelength, meander amplitude, bank-full width, and radius of curvature for each bend.
10. Total meander and valley length and sinuosity for the reach.
11. Photographs of main channel, streamside vegetation, and each riffle, appropriately referenced to plan-view location.

B. Bank-full Width, Depth and Discharge: If directed by the City/County Engineer, the geomorphic "bank-full" width, depth, and discharge shall be estimated using field indicators as detailed in Chapter 7 of USDA (1994). If field indicators are not used, "bank-full" flow shall be estimated as the rural-conditions 50% storm flow, and the bank-full width and depth estimated based on the dimensions of that flow through the existing channel. This assumption is intended to provide a rough upper estimate of the bank-full flow.

C. Longitudinal Profile and Sections: The elevations of the profile along the thalweg shall be field surveyed to the nearest 0.1 ft. and the following features noted: riffles, pools, exposed bed rock, and advancing headcuts (areas of bed elevation change that appear to be actively migrating upstream). The top of left and right bank and any field indicators of bank-full flow such as limits of woody vegetation or top of point bars shall be plotted at correct elevation along the profile. The bank-full flow and 1% ultimate storm flow profiles shall be plotted. One field cross section shall be surveyed through each pool and riffle, and the depth and width of bank-full flow and floodplain for the 1% ultimate conditions stormshall be shown on each section.

D. Bed and Bank Materials Analyses: The type of rock exposed in the bed and banks shall be identified. Bank soils shall be reported by Uniform Soil Classification using the visual-manual procedures (ASTM D 2488-00). The median (D50) particle size shall be determined using the Wolman Pebble Count Method (USDA, 1994, Chapter 11). A shear stress ratio shall be calculated for each riffle based on the applied shear at bank-full flow divided by the critical shear of the D50 particle in the riffle, using methods and tables described below.

E. Critical Shear Stress Analysis: The Shear stress ratio must be less than one at the extreme downstream point of any development in accordance with the guidelines below:

1. The average applied shear stress (τ_o) may be calculated from the hydraulic data as follows:

   $$\tau_o = \gamma RS$$

   where γ is the specific weight of water (62.4 pcf), R is the hydraulic radius at bankfull flow, and S is the water surface slope along the main channel bankfull flow, averaged over several bends in the area of the intervention. Effective flow may be calculated using methods described in detail in USACE 2001 or may be assumed to be equivalent to the 50% storm.

2. The critical shear stress, τ_c, is that at which particles in the bed or bank are entrained and scour ensues. Shield's method is used for calculating the calculating the critical shear stress of spherical, non-cohesive particles, as follows:

   $$\tau_c = \Theta(\gamma_s-\gamma) D_{50}$$

   where γ_s is the specific weight of sediment, γ is specific weight of water (62.4 lb/ft 3), D_{50} is the median particle size in the surface layer of bed or banks, and is the Shield's parameter (0.06 for gravel to cobble, 0.044 for sand)

   There are limited methods for calculating τ_c for fine-grained material. Field or laboratory testing generally determines the critical shear stress for these materials. The most widely available source is Chow (1988). Table 7-3, p. 165 is particularly relevant. More recently, the USDA Agricultural Research Service National Sedimentation Laboratory has developed computer software for calculating toe scour (ARS Bank-Toe Erosion Model, Prototype, August 2001). As part of that software, there are look-up tables. The combination of these two sources is presented in Table 1. Critical shear stress may also be determined from Urban Water Resources Research Council (1992), Figure 9.6, p. 335.

   In lieu of calculated values, the τ_c from Table 5605-1 may be used. Table 1 presents critical shear for sediment-laden water and where noted, clear water. The user must exercise judgment as to future conditions. Clear water values may be used below a heavily piped area, concrete channels designed to contain the future flows or immediately below a managed detention pond.

3. The ratio of average boundary stress to critical stress is the shear stress ratio:

   $$\text{shear stress ratio} = \tau_o / \tau_c$$

   If bed and bank materials are distinct, then the shear stress ratio should be calculated for each. If the shear stress ratio of either stream bed or bank is greater than one, the channel is prone to near-term adjustment and any interventions should be designed to prevent accelerated erosion. If the bed consists of rock, then the shear stress ratio is not applicable, unless the rock is prone to fracturing, slaking, or break-up, in which case the median size of particle should be used for calculation of the ratio.

APPENDIX B: excerpts from KCAPWA section 5600

F. Plan-Form Ratios: The following ratios shall be calculated, and those that lie outside the typical range shall be noted. Streams are highly variable and ratios outsides these ranges do not necessarily indicate problems:

Ratio	Typical Range
Meander length / Wavelength (sinuosity)	1.1 to 1.5
Meander length / Bank-full width	10 to 14
Radius of curvature / Bank-full width	2 to 5
Riffle Spacing / Bank-full width	5 to 7

G. Channel Condition Scoring Matrix: Using information summarized above, the channel condition scoring matrix given in Table 5605-2 shall be completed. A rating of 12 indicates a stream of moderate stability that will likely require only standard levels of protection during construction. A rating between 12 and 18 indicates that special measures may be necessary address those issues rated as poor in the assessment. Streams with a rating greater than 18 may exhibit significant system-wide instability and should be studied in more detail by experts in river engineering and fluvial geomorphology. (This scoring system is newly developed and its results shall be considered provisional.)

5605.6 DISCHARGE OUTFALLS:

Discharge points for inflows from enclosed systems or constructed channels shall be designed as one of the following. Energy management and sediment continuity checks are not required; however, energy dissipation shall be provided to reduce postdevelopment shear stress to pre-development shear stress at the outfall:

A. Primary outfalls are those where the entire upstream channel is replaced by an enclosed system or constructed channel which discharges flow in line with the direction of the downstream segment. Energy dissipation should be provided at the outlet to reduce velocities per Section 5606.4. Grade control downstream of the outlet and energy dissipater should be provided to prevent undermining of the outfall by future headcuts per Section 5605.10. The alignment and location of the outfall and associated energy dissipater and grade control should make a smooth transition into the downstream channel. Primary outfalls shall be used whenever the contributing drainage area of the outfalls is greater than 80% of the downstream channel.

B. Tributary outfalls are primary outfalls located on a tributary to a larger downstream segment. Energy dissipation and transition to natural stream flow should take place in the tributary at least one channel width upstream of the confluence per Section 5606.4. Grade control in the tributary upstream of the confluence shall be provided if the tributary flow line is higher than the adjoining channel or if future incision of the adjoining channel is anticipated. Tributary outfalls may be used in all situations of tributary flow.

C. Lateral outfalls are small outfalls that discharge from the banks of a natural stream. Outfalls shall be located to enter on a riffle or from the outside of a bend, but should generally not enter from the inside of a bend. Outfall pipes shall be oriented perpendicular to the flow of the stream with the invert at or slightly below top of the next downstream riffle. Outfalls shall be flush with or setback from the bank. The bank shall be shaped to provide a smooth transition and protected with reinforced vegetation (preferred) or rip-rap. If the outfall is in a bend, it shall be set back from the existing bank a sufficient distance to account for future meander migration, and the transition shall be graded and reinforced with vegetation. Riprap or hard armor protection should not be used in a bend. Perpendicular outfalls may only be used when the contributing drainage area of the outfall is less than 40% of that in the downstream channel.

D. Edge-of-buffer outfalls are discharge points in the outer half of the riparian buffer that return the discharge to diffused overland flow. Outfalls shall be designed to spread flow and allow overland flow and infiltration to occur. Overland flow shall be directed to run in the outer portion of the buffer parallel to the channel direction to increase length of flow and prevent short-circuiting directly into the stream. Low weirs and berms may be graded to direct flow and encourage short-term ponding. The buffer zone utilized for infiltration shall be maintained in dense, erosion-resistant grasses or grasses reinforced with turf-reinforcing mats designed to withstand the shear stresses of a I0% storm. Edge-of-buffer outfalls that are part of a system of upland drainage using multiple small, distributed overland swales and ditches instead of pipes may provide significant infiltration and water quality treatment. Edge-of-buffer outfalls shall only be used if each individual outfall can be designed to operate without scour or the formation of gullies.

5605.12 BANK STABILIZATION PROJECTS:

A. Bank stabilization projects should generally be limited to cases where existing buildings or infrastructure face significant property damage or safety issues. Projects to stabilize banks to facilitate reductions in buffer widths for new construction should be avoided.

B. Prior to stabilization, the causes of the instability should be considered, including the stream's current phase of channel evolution (Interagency, 2001, Chapter 7) and direction of meander migration. Stabilization may be unnecessary if a channel has ceased incision and widening and is in the process of deposition and restoration. If stability issues appear widespread or complex, a systematic evaluation of the stream system by professionals with expertise in river engineering and fluvial geomorphology may be justified.

C. Instability caused by geotechnical failure (slumping of banks due to weak soils in the adjacent slopes) shall be distinguished from fluvial failure (erosion of banks

APPENDIX B: excerpts from KCAPWA section 5600

caused by stream flows). For geotechnical issues, a geotechnical engineer shall evaluate the slope stability. Geotechnical designs shall provide for a 1.5 factor of safety (ratio of theoretical resisting forces to driving forces) against slope failure where it would endanger buildings, roadways, or other infrastructure, unless a lower factor of safety is approved by the City/County Engineer.

D. Bank stability projects should have a design life greater than the useful life of the facility being protected, or a life cycle cost analyses shall be performed that considers replacement and repair over the entire protection period. Responsible parties for future maintenance should be identified.

E. Stabilization should begin and end at stable locations along the bank. Bank stabilization should be limited to areas of potential erosion and are rarely required on the inside of bends. For long projects, stabilization may alternate from side to side and is rarely necessary across an entire cross section. The existing cross section should be mimicked to the extent practical and need not be planar or uniform over the entire length. Grade control shall be provided at the riffle both upstream and downstream of the stabilization to isolate it from the surrounding stream and protect the foundation from undercutting. Control at intermediate points for longer projects may also be required. Energy management and sediment transport continuity shall be checked, and energy dissipation provided if necessary.

F. "Hard-Armor" projects are those projects that use rip-rap, placed stone, gabions, retaining walls, or other rigid structures to provide geotechnical and fluvial stability. Such projects shall be designed in accordance with EM 1110-2-1205 (USACE, 1989), EM1110-2-1601 (USACE, 1994), or HEC-11 (FHWA 1989). Materials shall be sized to prevent dislodgement in the 1% storm. Gradation should comply with USACE or FHWA recommendations. Stones should be placed to maintain roughness and variations. All material shall be well placed to ensure interlock and stability. Materials shall be keyed into the bed and banks with adequate allowance for scour along the toe and the structure should have adequate foundation. Vertical walls should be avoided when possible as they tend to concentrate scour at their toe and are typically smoother than the natural channel.

G. Soil bioengineering involves the use of living vegetation in combination with soil reinforcing agents such as geogrids to provide bank stabilization by increasing soil shear resistance, dewatering saturated soils, and by reducing local shear stresses through increased hydraulic roughness.

1. Bio-engineering projects shall be designed in accordance with the principals of NRCS (1996) and Gray and Sotir (1996). Designs will be tailored to the urban environment by consideration of the requirement for immediate functionality upon construction, the extreme variability and high shear stress of urban flows and the availability of mechanized equipment and skilled operators.

2. Selection of plants and specifications for planting methods and soil amendments shall be prepared by a professional competent in the biological and stabilization properties of plants.
3. Plants selected shall be appropriate to local conditions and shall be native varieties to the greatest extent practical. Evaluation of local conditions includes assessment of site microclimate, bank slope, soil composition, strength and fertility, type and condition of existing vegetation, proximity to existing infrastructure, soil moisture conditions and likelihood of wildlife predation. Engineering factors influencing plant selection include frequency, height and duration of inundation, near-bank shear stress, size and volume of bed load as well as depth and frequency of scour.
4. Plants may be either locally harvested or purchased from commercial nurseries. When harvesting, no more than 10% of a given stand may be removed and no plant on the state rare or endangered species list may be harvested or damaged in harvesting operations. Plant material grown near the metropolitan area is adapted to local climatic conditions and is preferred over more remote sources. Some species such as red maple are particularly sensitive to locale and may only be used if locally available. Seed, plant plugs, rhizomes, whips, live stakes, bare root and container stock may be used. Turf grasses, noxious or invasive species shall not be used. A variety of plant species shall be used to provide greater reliability to a design. For critical functions such as protection from toe scour a minimum of three species should generally be employed.
5. Soil bioengineering methods are properly applied in the context of a relatively stable stream system, and relevant general requirements for all stream bank stabilization projects given in this section apply to bio-engineered projects. Soil bioengineering alone is not appropriate when the zone of weakness lies below the root zone of the plantings, or when rapid draw down can occur, such as in a spillway or dam embankment.

H. Composite methods are those which employ both hard armor and soil bioengineering. Typically, armor for toe protection in critical locations is provided, with soil-bioengineering for the remainder. Design principals for both hard armor and soil-bioengineering shall be observed as appropriate.

I. In-stream Stability Structures: In-stream structures are used to focus flow, control grade, dissipate energy and selectively lower near-bank stress. Stream barbs, weirs, guide vanes, vegetative sills, longitudinal peak stone, and grade controls are among the more commonly used in-stream structures. When constructed of natural material such as rock, such structures also create aquatic habitat. They may be used alone or in combination with hard armor, bioengineering or composite methods. In-stream structure design is a river engineering practice and is beyond the scope of this standard. Preliminary guidance and references for the design of some common structures is given in Castro (1999) and Interagency (2001), Chapter 8 and Appendix A.

APPENDIX C: storm water facility calculations

PROPOSED HYDROLOGY:

Existing Development	Acres
Existing Development (includes ROW)	**1,087**
Church	11
Commercial	51
Institutional	7
Res MF – Medium	46
Res MF – Medium High	184
Res Sing – Low	19
Res Sing – Med Low	562
Res Sing – Very Low	207
Non-Developable	
100-Year Floodplain	183
Parks and Open Space	102
Water Bodies	5
Development Opportunities	
Maximum Opportunity with Few Constraints	911
Maximum Opportunity with Moderate Constraints	319
Maximum Challenges to Development	239
Total Study Area	**2,842**

SUMMARY OF DRAINAGE POND ANALYSIS:

Description	Area	Tc	CN	100yr Storage
Upper Basins	99 ac	60 min	86	7 af
Lower Basins	471 ac	60 min	86	36 af

Tc (Time of Concentration)

CN (SCS Curve Number – Infiltration Rate)

100 yr storage (detention storage required in acre feet)

Subcatchment 1S: Catchment

Runoff = 1,475.32 cfs @ 12.60 hrs, Volume= 230.361 af, Depth> 5.87"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Yr. Rainfall=7.60"

Area (ac)	CN	Description
470.970	86	Direct Entry - Post-Development Condition
470.970		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
60.0					**Direct Entry, Direct Entry**

Pond 2P: Pond

Inflow Area = 470.970 ac, Inflow Depth > 5.87" for 100 Yr. event
Inflow = 1,475.32 cfs @ 12.60 hrs, Volume= 230.361 af
Outflow = 1,292.31 cfs @ 12.83 hrs, Volume= 226.714 af, Atten= 12%, Lag= 13.5 min
Primary = 1,292.31 cfs @ 12.83 hrs, Volume= 226.714 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 852.97' @ 12.83 hrs Surf.Area= 12.429 ac Storage= 35.993 af
Flood Elev= 859.00' Surf.Area= 13.682 ac Storage= 114.725 af

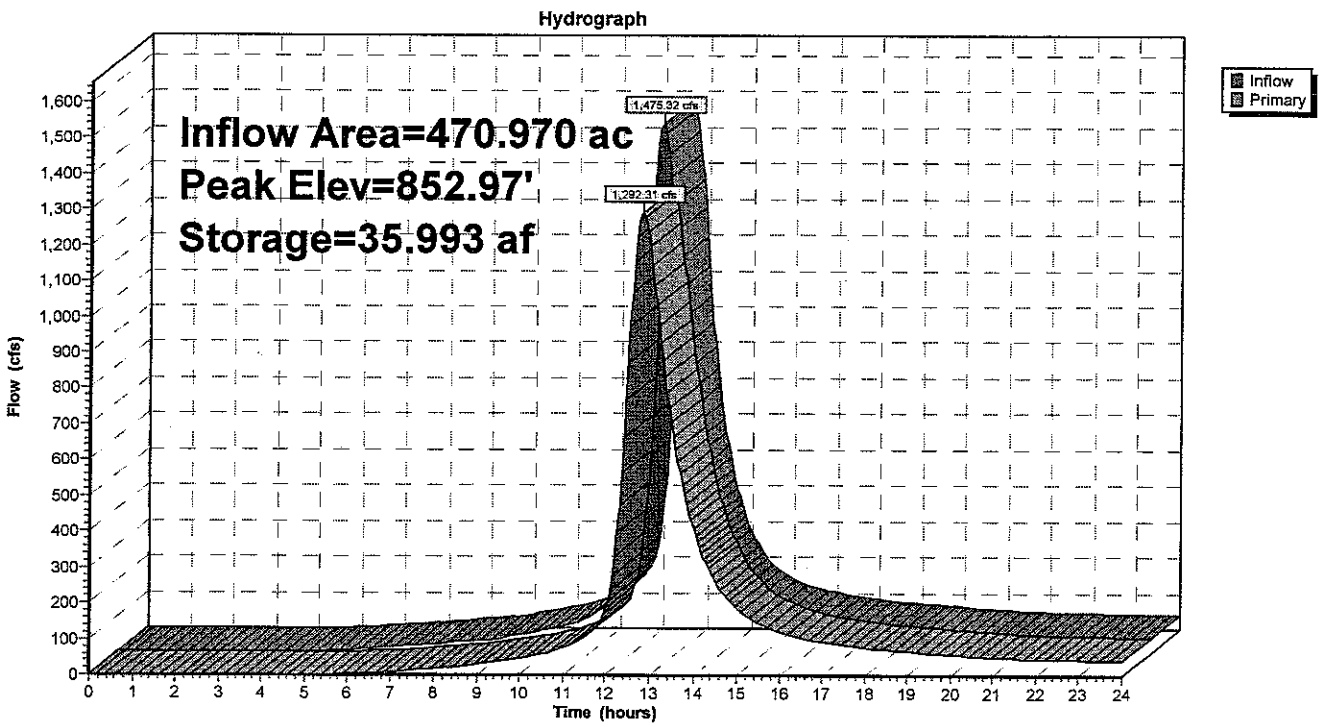
Plug-Flow detention time= 34.3 min calculated for 226.242 af (98% of inflow)
Center-of-Mass det. time= 25.0 min (853.2 - 828.2)

Volume	Invert	Avail.Storage	Storage Description
#1	850.00'	128.513 af	**718.00'W x 718.00'L x 10.00'H Prismatoid Z=3.0**

Device	Routing	Invert	Outlet Devices
#1	Primary	850.00'	**12.00' W x 3.00' H x 100.0' long Culvert X 5.00** RCP, groove end projecting, Ke= 0.200 Outlet Invert= 848.00' S= 0.0200 '/' Cc= 0.900 n= 0.013
#2	Primary	852.50'	**12.00' W x 1.00' H x 100.0' long Culvert X 4.00** RCP, groove end projecting, Ke= 0.200 Outlet Invert= 850.50' S= 0.0200 '/' Cc= 0.900 n= 0.013
#3	Primary	855.75'	**10.00' W x 2.50' H x 100.0' long Culvert X 0.00** RCP, groove end projecting, Ke= 0.200 Outlet Invert= 853.75' S= 0.0200 '/' Cc= 0.900 n= 0.013

Primary OutFlow Max=1,289.72 cfs @ 12.83 hrs HW=852.96' (Free Discharge)
- **1=Culvert** (Inlet Controls 1,228.77 cfs @ 6.91 fps)
- **2=Culvert** (Inlet Controls 60.95 cfs @ 2.73 fps)
- **3=Culvert** (Controls 0.00 cfs)

Pond 2P: Pond


Hydrograph
Inflow Area=470.970 ac
Peak Elev=852.97'
Storage=35.993 af
1,475.32 cfs
1,292.31 cfs
Inflow
Primary
Flow (cfs)
Time (hours)

Subcatchment 1S: Catchment

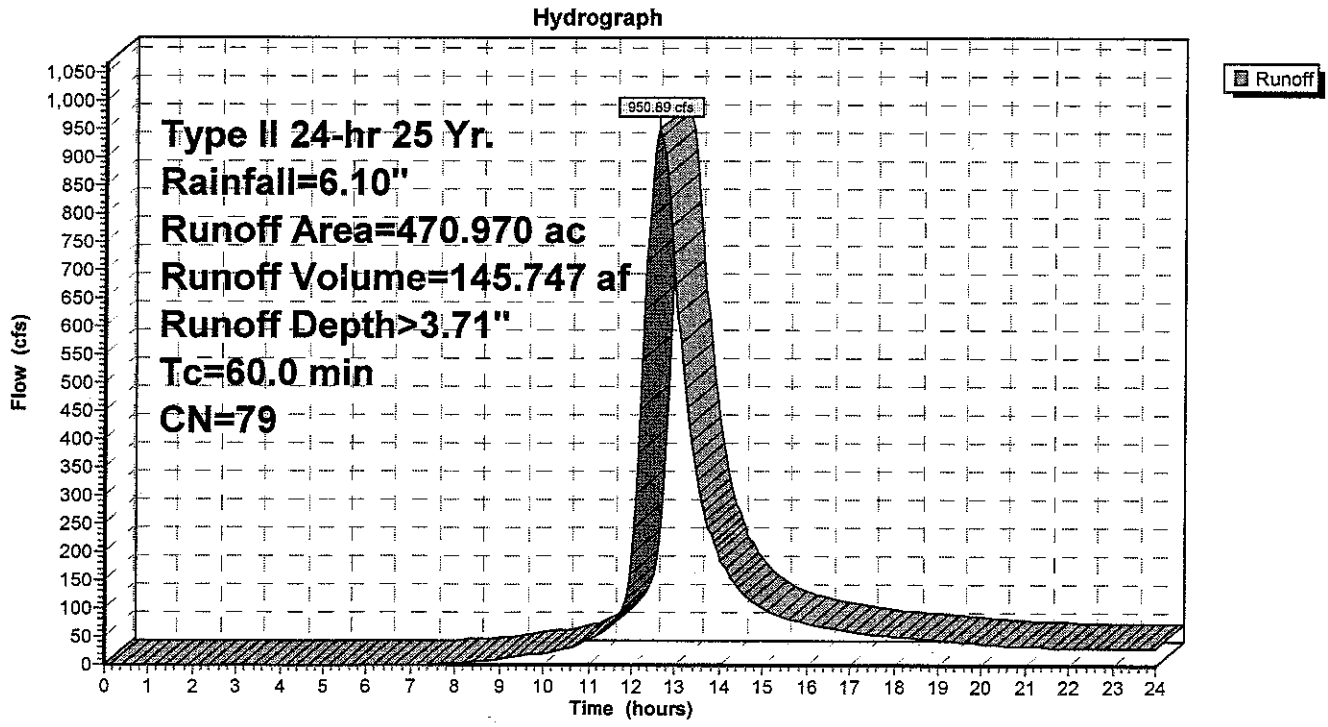
Runoff = 950.89 cfs @ 12.61 hrs, Volume= 145.747 af, Depth> 3.71"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 Yr. Rainfall=6.10"

Area (ac)	CN	Description
470.970	79	Direct Entry - Pre-Development Condition
470.970		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
60.0					**Direct Entry, Direct Entry**

Subcatchment 1S: Catchment



Subcatchment 1S: Catchment

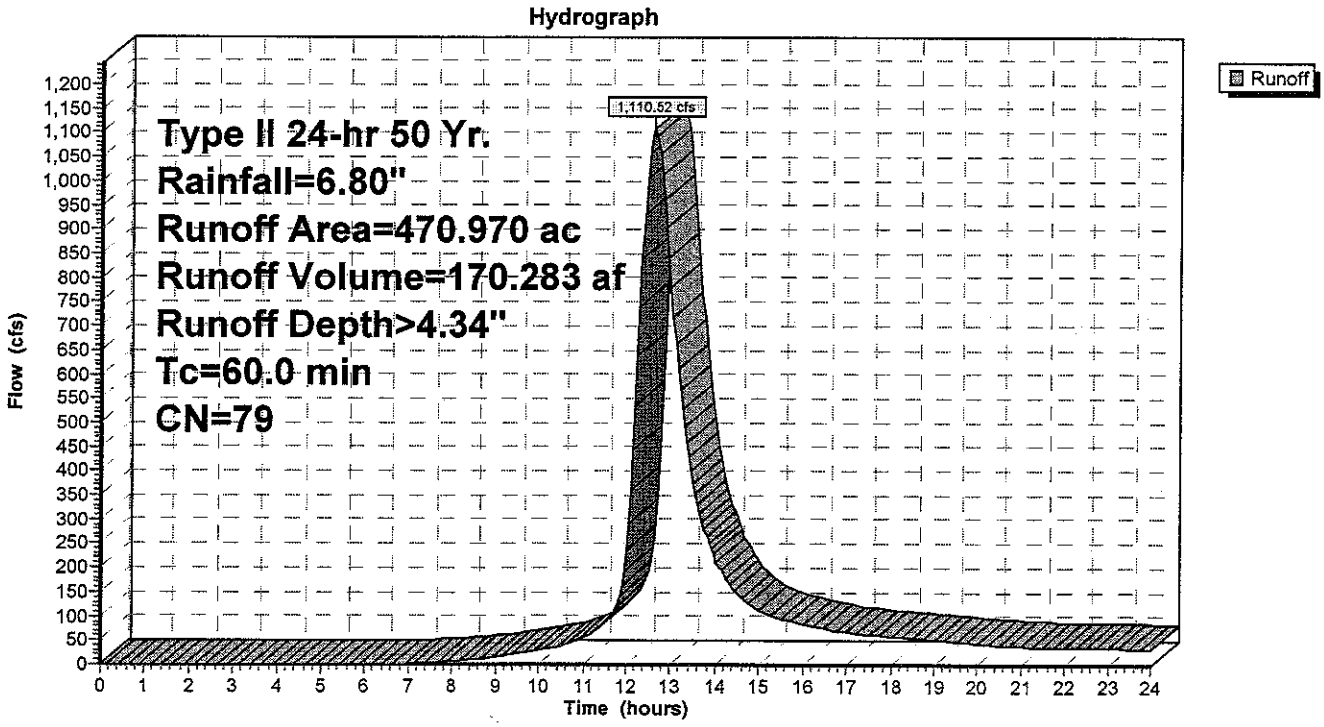
Runoff = 1,110.52 cfs @ 12.61 hrs, Volume= 170.283 af, Depth> 4.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 50 Yr. Rainfall=6.80"

Area (ac)	CN	Description
470.970	79	Direct Entry - Pre-Development Condition
470.970		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
60.0					**Direct Entry, Direct Entry**

Subcatchment 1S: Catchment



Subcatchment 1S: Catchment

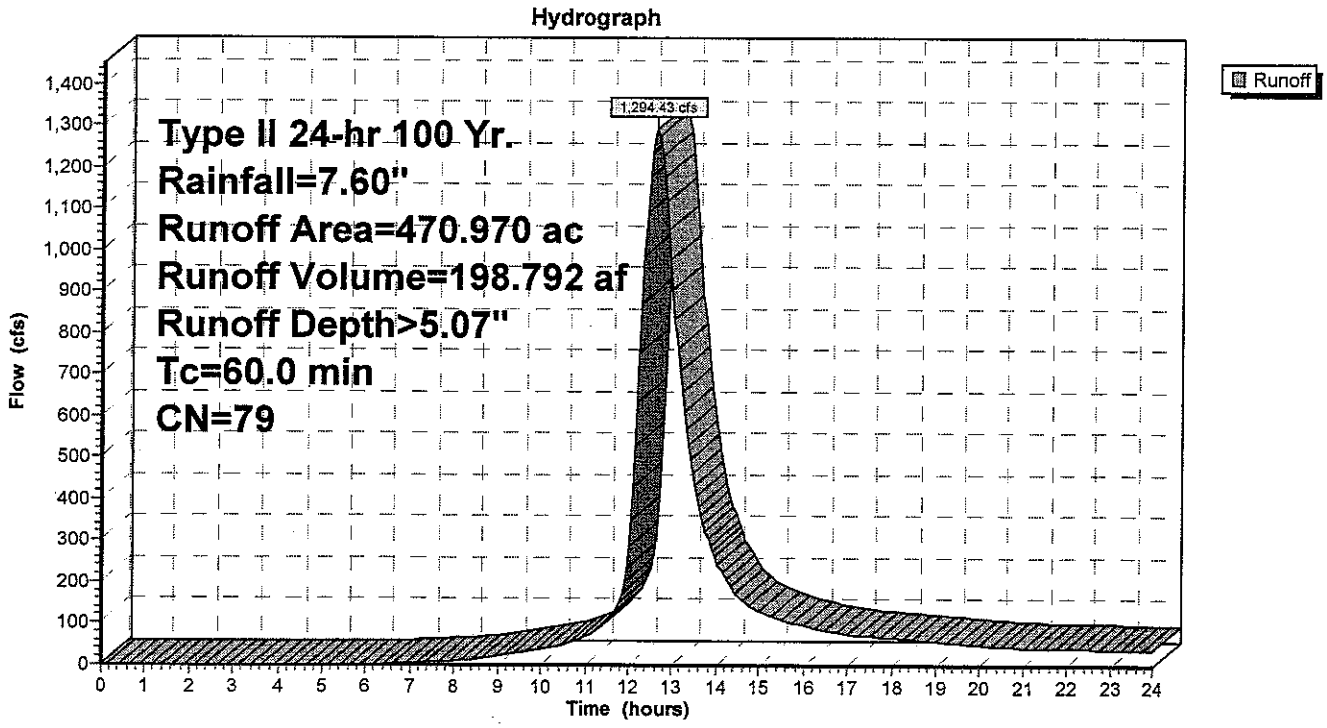
Runoff = 1,294.43 cfs @ 12.61 hrs, Volume= 198.792 af, Depth> 5.07"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Yr. Rainfall=7.60"

Area (ac)	CN	Description
470.970	79	Direct Entry - Pre-Development Condition
470.970		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
60.0					**Direct Entry, Direct Entry**

Subcatchment 1S: Catchment



Subcatchment 1S: Catchment

Runoff = 311.52 cfs @ 12.60 hrs, Volume= 48.642 af, Depth> 5.87"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Yr. Rainfall=7.60"

Area (ac)	CN	Description
99.448	86	Direct Entry - Post-Development Condition
99.448		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
60.0					**Direct Entry, Direct Entry**

Pond 2P: Pond

Inflow Area = 99.448 ac, Inflow Depth > 5.87" for 100 Yr. event
Inflow = 311.52 cfs @ 12.60 hrs, Volume= 48.642 af
Outflow = 271.23 cfs @ 12.83 hrs, Volume= 47.990 af, Atten= 13%, Lag= 13.8 min
Primary = 271.23 cfs @ 12.83 hrs, Volume= 47.990 af

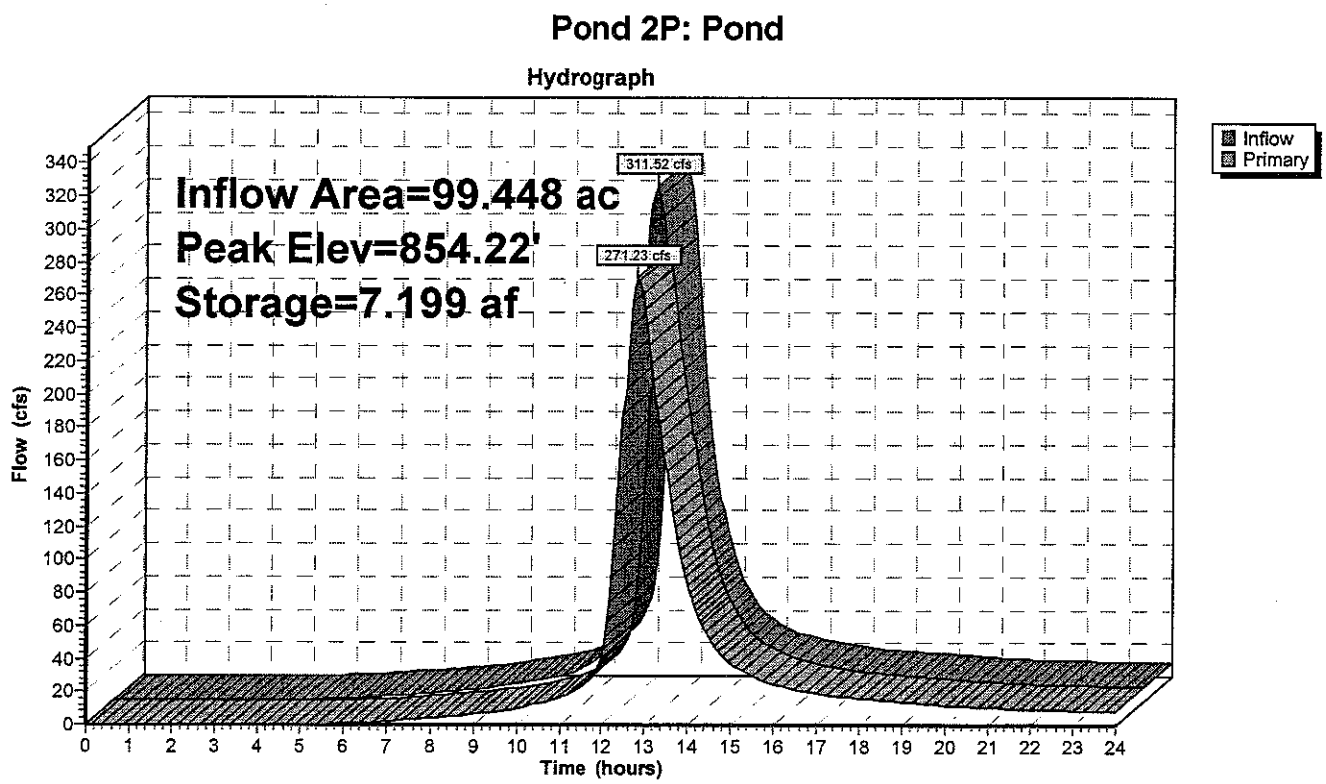
Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 854.22' @ 12.83 hrs Surf.Area= 1.868 ac Storage= 7.199 af
Flood Elev= 859.00' Surf.Area= 2.263 ac Storage= 17.069 af

Plug-Flow detention time= 30.2 min calculated for 47.890 af (98% of inflow)
Center-of-Mass det. time= 22.3 min (850.5 - 828.2)

Volume	Invert	Avail.Storage	Storage Description
#1	850.00'	19.376 af	**260.00'W x 260.00'L x 10.00'H Prismatoid Z=3.0**

Device	Routing	Invert	Outlet Devices
#1	Primary	850.00'	**8.00' W x 3.00' H x 100.0' long Culvert** RCP, groove end projecting, Ke= 0.200 Outlet Invert= 848.00' S= 0.0200 '/' Cc= 0.900 n= 0.013
#2	Primary	853.50'	**15.00' W x 1.00' H x 100.0' long Culvert** RCP, groove end projecting, Ke= 0.200 Outlet Invert= 851.50' S= 0.0200 '/' Cc= 0.900 n= 0.013
#3	Primary	855.75'	**10.00' W x 2.50' H x 100.0' long Culvert X 0.00** RCP, groove end projecting, Ke= 0.200 Outlet Invert= 853.75' S= 0.0200 '/' Cc= 0.900 n= 0.013

Primary OutFlow Max=270.76 cfs @ 12.83 hrs HW=854.21' (Free Discharge)
- **1=Culvert** (Inlet Controls 234.63 cfs @ 9.78 fps)
- **2=Culvert** (Inlet Controls 36.13 cfs @ 3.38 fps)
- **3=Culvert** (Controls 0.00 cfs)


Pond 2P: Pond
Hydrograph
Inflow Area=99.448 ac
Peak Elev=854.22'
Storage=7.199 af
311.52 cfs
271.23 cfs
Inflow
Primary
Flow (cfs)
Time (hours)

Subcatchment 1S: Catchment

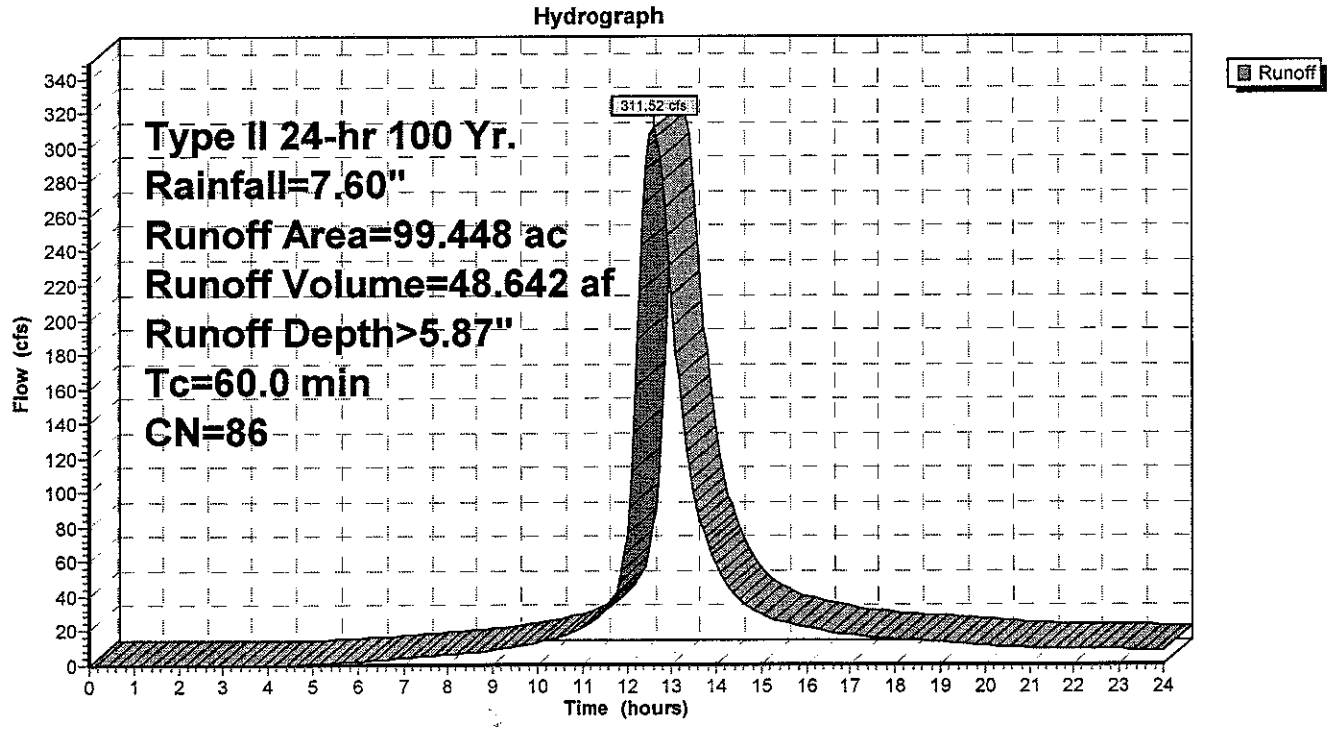
Runoff = 311.52 cfs @ 12.60 hrs, Volume= 48.642 af, Depth> 5.87"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Yr. Rainfall=7.60"

Area (ac)	CN	Description
99.448	86	Direct Entry - Post-Development Condition
99.448		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
60.0					**Direct Entry, Direct Entry**

Subcatchment 1S: Catchment



Subcatchment 1S: Catchment

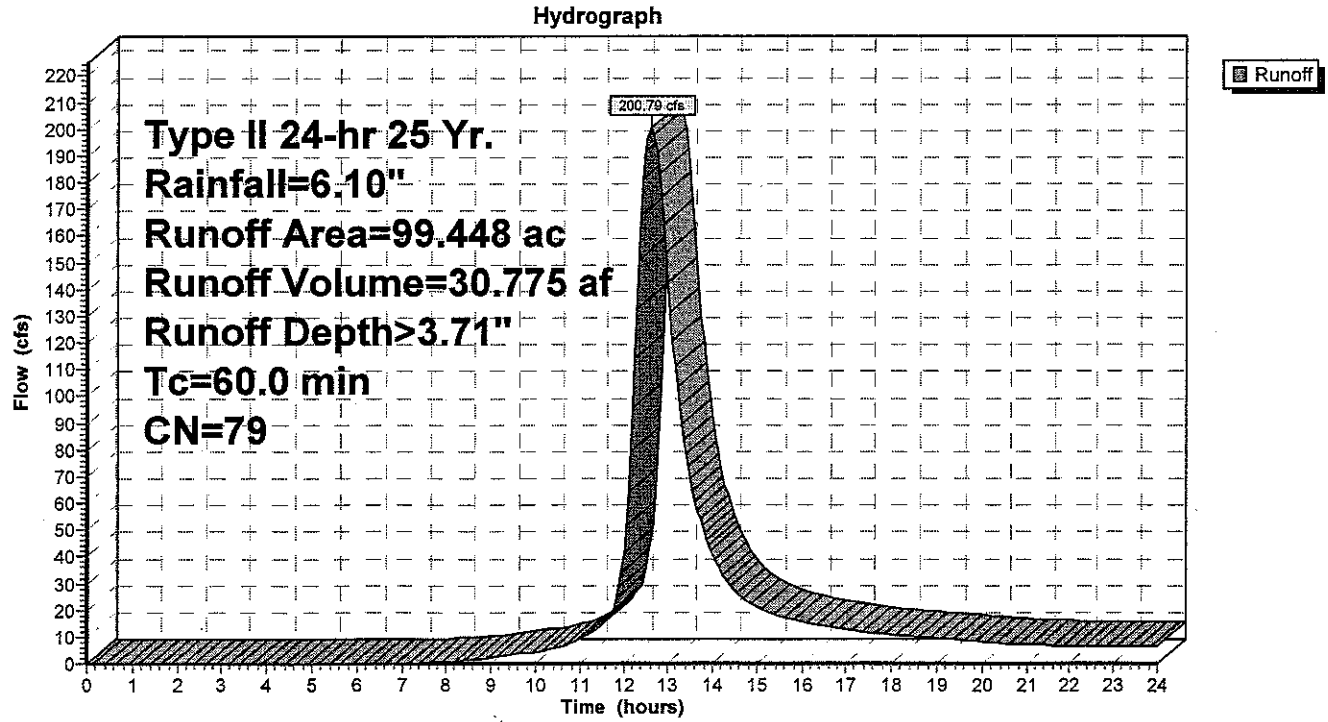
Runoff = 200.79 cfs @ 12.61 hrs, Volume= 30.775 af, Depth> 3.71"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 Yr. Rainfall=6.10"

Area (ac)	CN	Description
99.448	79	Direct Entry - Pre-Development Condition
99.448		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
60.0					**Direct Entry, Direct Entry**

Subcatchment 1S: Catchment



Subcatchment 1S: Catchment

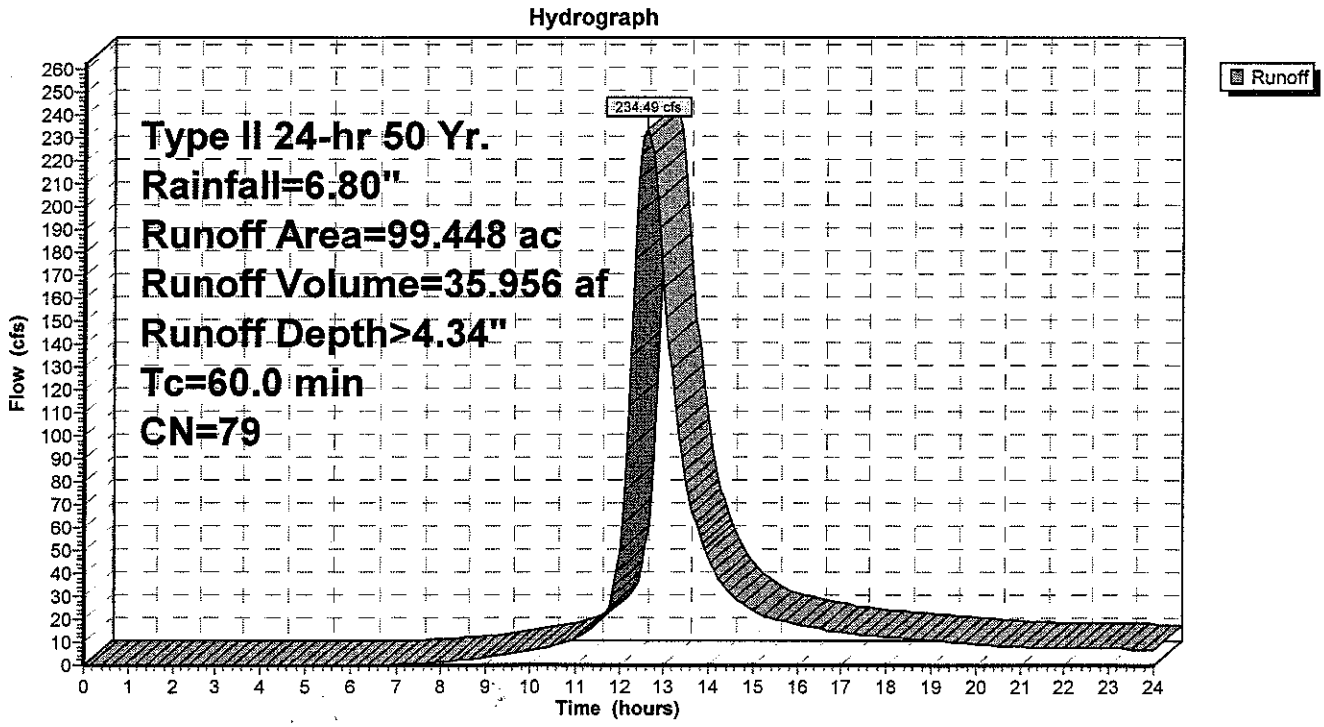
Runoff = 234.49 cfs @ 12.61 hrs, Volume= 35.956 af, Depth> 4.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 50 Yr. Rainfall=6.80"

Area (ac)	CN	Description
99.448	79	Direct Entry - Pre-Development Condition
99.448		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
60.0					**Direct Entry, Direct Entry**

Subcatchment 1S: Catchment



Subcatchment 1S: Catchment

Runoff = 273.33 cfs @ 12.61 hrs, Volume= 41.976 af, Depth> 5.07"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 Yr. Rainfall=7.60"

Area (ac)	CN	Description
99.448	79	Direct Entry - Pre-Development Condition
99.448		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
60.0					**Direct Entry, Direct Entry**

Subcatchment 1S: Catchment