

APPENDIX A - STORM DRAINAGE QUESTIONNAIRE

**Burns
&
McDonnell**

Memorandum

Date: October 24, 1994

To: Mike Wildgen
City Manager
Lawrence, Kansas

From: Dena Mezger
Project Manager
Stormwater Management Plan

RE: Public Meeting/ Open House
October 12, 1994 @ City Hall

Approximately 75 people attended the public meeting/open house concerning the Stormwater Management Master Plan over the three-hour period on October 12. The following is a summary of the discussions/events.

1. Fifteen drainage surveys were completed and turned in at the session. Several individuals indicated that they would be mailing the survey and several took extra copies to distribute to neighbors, members of homeowners' associations, etc. As of October 21, 25 surveys have been received.
2. Several residents from particular neighborhoods or areas attended the meeting as a group including members of the Centennial Neighborhood Association, south of the high school, and a group of neighbors from the vicinity of 15th and Lawrence. In addition, several residents from particular areas attended individually including several from areas adjacent to the Centennial neighborhood, and from the vicinity of Michigan and 2nd Street.
3. Reported drainage problems did not appear to be concentrated in any one particular area but were generally scattered throughout the city, even in some newer developments. Many have existed for a number of years and several were very localized, private property issues. City staff and/or Burns & McDonnell were already familiar with, or at least aware of, most of the areas. Two of those reported, which had not been previously identified, were referred to City staff to review in more detail to determine if immediate action was necessary.
4. Common themes from discussions with residents were:
 - a. Frustration with the City for not fixing problems that have existed for years.
 - b. Concern that new developments are being built without being required to provide sufficient new drainage facilities to prevent problems for

existing downstream development.

- c. Concern about developers and builders that have constructed homes in areas prone to drainage problems. A number of individuals cited examples of houses built on top of filled-in drainage channels which were later flooded by drainage that had no other place to go.
 - d. Support for establishing specific policies that future development be required to provide adequate drainage facilities and be prevented from building in drainageways so that new problems are not created.
 - e. Support for the use of open channel drainage systems although prevention of erosion was an important factor. Several residents expressed support for establishing policies requiring undeveloped green space to be left along channels to prevent construction of homes or other buildings too close to the channel where the system capacity could be affected and the buildings could be subject to flooding.
5. In general, discussions were fairly positive in nature and most people attending the meeting seemed encouraged that the City is taking the first steps toward solving existing drainage problems and preventing new ones by having a master plan prepared.

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LAWRENCE, KANSAS STORM DRAINAGE MASTER PLAN

STORMWATER DRAINAGE SURVEY

The City of Lawrence is beginning to prepare a new comprehensive Master Plan to improve storm drainage service in the City. This survey outlines topics and issues on which individuals opinions are important for the Master Plan to best meet the needs of the residents of Lawrence.

SUMMARY OF RESPONSES

A total of 125 separate questionnaires were returned. The numbers of responses to various questions do not add up to these total, however, since not all respondents answered all questions and some had multiple answers to one question.

INFORMATION ABOUT YOUR DRAINAGE PROBLEM

Please check the information that best describes your property

Open Ditch Eroding	4	Yard Doesn't Drain	40	Haven't Noticed Any Problems	16
In Back Yard	34	Street Ditch Overflows	28	Neighbors Downspouts/Yard	13
In Side Yard	21	Street Curb Overflows	69	Water Floods Structure	31
In Front Yard	10	Other Problems ?	24*		

How Often Do You Have A Problem With Drainage? (Please Check)

Every Hard Rain 77 Once A Year Or Less 19 Several Times A Year 22 Other Less Often 10

Other comments about your drainage problems.

Of the 24 "other" problems, seven specifically mentioned lack of system maintenance and 10 mentioned problems apparently related to sanitary sewer backups rather than storm drainage.

YOUR OPINIONS ON CRITERIA AND POLICY CONSIDERATIONS

Important goals of the Master Plan are 1) to develop procedures and criteria that will provide the same degree of freedom from drainage problems for everyone and 2) raise money that's needed to provide and maintain that service in a fair way. Please indicate your opinion with the statements below by marking the appropriate response.

	YES	NO
Street curbs and pipe storm sewers increase property value?	98	10
Developments that cause increased runoff should pay for necessary drainage improvements?	112	6
Its fair that people who benefit more from drainage improvements should pay more?	44	58
Its reasonable to expect property along drainage channels to be required to leave space for drainage that's always been there?	111	4
Its reasonable to expect property along drainage channels to leave space for drainage expected from reasonable upstream future development	90	18
Minor drainage nuisances, like neighbor's gutters, should be privately resolved	105	8
Open channels, if of adequate size, are an acceptable way to carry drainage		
a) through back yards	53	46
b) along roadsides	85	17
c) through commercial and industrial developments	75	22

YOUR OPINIONS ABOUT SETTING PRIORITIES FOR IMPROVEMENTS:

Drainage improvements to address every problem in Lawrence can't be made immediately. Please indicate your opinion about which City projects should be ranked with the highest priority for completion, with 1 being most important to you and 4 being least important to you.

	1ST	2ND	3RD	4TH
Water Entering Structures	65	21	11	7
Erosion Along Channels In Yards	5	10	35	46
Overflow & Flooding In Streets & Yards	45	59	21	3
The Most People Helped Per \$ Spent	10	25	23	37

STORMWATER DRAINAGE SURVEY

The City of Lawrence is beginning to prepare a new comprehensive Master Plan to improve storm drainage service in the City. This survey outlines topics and issues on which individuals opinions are important for the Master Plan to best meet the needs of the residents of Lawrence.

SUMMARY OF RESPONSES

A total of 21 additional questionnaires were returned after the survey was publicized the second time. The number of responses to various questions do not add up to this total, however since not all respondents answered all questions and some had multiple answers to 1 question.

INFORMATION ABOUT YOUR DRAINAGE PROBLEM

Please check the information that best describes your property

Open Ditch Eroding	3	Yard Doesn't Drain	1	Haven't Noticed Any Problems	0
In Back Yard	10	Street Ditch Overflows	2	Neighbors Downspouts/Yard	1
In Side Yard	0	Street Curb Overflows	9	Water Floods Structure	3
In Front Yard	1	Other Problems ?	3		

How Often Do You Have A Problem With Drainage? (Please Check)

Every Hard Rain 14 Once A Year Or Less 1 Several Times A Year 1 Other Less Often 2

Other comments about your drainage problems.

Of the "other" problems, one mentioned sanitary sewer backups.

YOUR OPINIONS ON CRITERIA AND POLICY CONSIDERATIONS

Important goals of the Master Plan are 1) to develop procedures and criteria that will provide the same degree of freedom from drainage problems for everyone and 2) raise money that's needed to provide and maintain that service in a fair way. Please indicate your opinion with the statements below by marking the appropriate response.

	YES	NO
Street curbs and pipe storm sewers increase property value?	12	3
Developments that cause increased runoff should pay for necessary drainage improvements?	14	2
Its fair that people who benefit more from drainage improvements should pay more?	5	11
Its reasonable to expect property along drainage channels to be required to leave space for drainage that's always been there?	14	0
Its reasonable to expect property along drainage channels to leave space for drainage expected from reasonable upstream future development	13	0
Minor drainage nuisances, like neighbor's gutters, should be privately resolved	13	2
Open channels, if of adequate size, are an acceptable way to carry drainage		
a) through back yards	5	11
b) along roadsides	12	3
c) through commercial and industrial developments	9	6

YOUR OPINIONS ABOUT SETTING PRIORITIES FOR IMPROVEMENTS:

Drainage improvements to address every problem in Lawrence can't be made immediately. Please indicate your opinion about which City projects should be ranked with the highest priority for completion, with 1 being most important to you and 4 being least important to you.

	1ST	2ND	3RD	4TH
Water Entering Structures	13	2	1	1
Erosion Along Channels In Yards	2	4	6	5
Overflow & Flooding In Streets & Yards	3	9	3	2
The Most People Helped Per \$ Spent	0	2	6	8

APPENDIX C - EROSION CONTROL PRINCIPLES &
PLOT PLAN REQUIREMENTS

EROSION AND SEDIMENTATION CONTROL PLAN PRINCIPLES

Effective erosion and sedimentation control requires that soil surfaces be protected from the erosive forces of water and wind, both temporarily and permanently, and that the eroded soil be retained on the site and used or disposed of appropriately. These controls are necessary to prevent decreased capacity and function of existing drainage systems, degradation of stream and lake ecology, reduction in reservoir storage volume, and damage to adjacent property due to siltation.

The Kansas Department of Transportation (KDOT) currently has standard plans and details for erosion control techniques applicable to highway construction projects and the Kansas Department of Health and Environment (KDHE) is completing the final draft of an erosion and sedimentation control plan for construction activity. This plan should be available in late April or early May, 1996. Copies of the KDOT standard plans are attached as examples. It is suggested that the City coordinate its erosion control plan with the state's or use the KDHE and/or KDOT plan(s) directly. In the meantime, the following are general erosion and sedimentation control principles for reference and use in evaluating a plan for the City.

Principles

1. Developers, builders and designers should carefully review the existing conditions of the construction site selected. When possible, a site should be selected that is more suitable to the project rather than forcing the terrain to conform to the new development as any modification of a site's drainage features or topography requires protection from erosion and sedimentation.
2. When possible, construction activities should be scheduled so as to minimize the exposed area of bare soil and the duration of exposure, taking into account the season and the weather forecast. Disturbed areas should be stabilized as quickly as possible with temporary and/or permanent seeding, other vegetation, or pavement where applicable. The removal of vegetative cover and altering the soil structure by clearing,

grading and compacting the surface increases runoff velocities and volumes thereby increasing an area's susceptibility to erosion . The contractor should be required to apply stabilizing measures as soon as possible after the land has been disturbed but no longer than 14 calendar days.

3. Due to the inability of any practice to completely eliminate all erosion, it may become necessary to trap sediment on site either permanently or temporarily. A sediment trap or basin should be located where deposition will occur and where access is easily obtainable for maintenance and cleanout. Whenever possible, sediment traps and basins should be planned and constructed before other land-disturbing activities begin. Locations should be selected during site evaluation.

In general, temporary sediment traps are used for drainage areas of five acres or less. These traps are formed by constructing an embankment of earth or granular material, or an excavation below existing grade, in the runoff path with the "dam" acting as an outlet weir. Larger sediment basins for drainage areas up to 100 acres generally involve construction of an earthen dike with a pipe or other improved outlet structure.

4. Diversion dikes and/or waterways are used to intercept runoff and divert it away from cut-and-fill slopes or other disturbed areas. These measures should be installed before clearing and grading. Utilize straw or hay bales and silt fences for temporary erosion control. Generally, straw bales are applicable only to drainage areas less than 1/2 acre such as typical residential building lots. Silt fence can be used in areas where it is possible to install 100 L.F. of fence for each 1/4 acre of drainage area.
5. Channels should be protected from erosion by using protective linings such as riprap, where applicable, and appropriate channel design, taking into consideration maintenance of the channel in the design. Practical methods of reducing velocities or controlling drainage paths should be implemented. Such methods include conveying stormwater runoff away from steep slopes to stabilized outlets; diverting runoff to temporary slope

drains or paved chutes or flumes; preserving natural vegetation when and where possible; and mulching and vegetating exposed areas immediately after construction.

6. Inspection and maintenance is necessary to maintain the effectiveness of erosion and sedimentation control measures. All erosion and sedimentation control facilities and practices should be regularly inspected to determine if they are working properly, and corrective measures should be taken immediately when deemed necessary. Inspections should occur at no less than 14 day intervals, as well as immediately following any storm event.
7. Developers and/or contractors should submit an erosion control plan, conforming to the City's adopted plan, for review and approval prior to beginning any construction activity. For construction sites greater than 5 acres in area, comply with NPDES Permit requirements as incorporated in the KDHE plan.

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City of Lawrence Storm Water Management Task Force
Plot Plan Requirements and Building Elevation Standards

1

Plot Plan Requirements

All applicants for building permits not requiring site plan approval as per Chapter 20-1428 of the Code of the City of Lawrence shall submit a plot plan, in duplicate, detailing the following information at the time of application.

The Plot Plan:

1. Shall be drawn accurately and to a scale of not less than 1" = 30' (one inch equals thirty feet).
2. Shall be arranged so that the top of the plan represents North or if otherwise oriented is clearly and distinctly marked.
3. Show boundaries and dimensions graphically, contain the written legal description of the property and its street address, show a written and graphic scale, and show a written description of its zoning district according to the final plat of record.
4. Show the location of all existing recorded easements (including drainage easements) according to the final plat of record.
5. Show the location of all building setback lines according to Table I, Chapter 20-608 of the Code of the City of Lawrence.
6. Show by written dimensions the relationship of the lot to any streets and rights of way which abut the boundaries of the lot.
7. Show the perimeter of the proposed construction with all cantilevers, patios, covered porches, decks, and overhangs and its relationship by dimensions to the lot boundary lines.
8. Show any suggested floor elevations, if any, according to the preliminary plat of the subdivision if the subject property has a drainage easement.
9. Show the flow line of street drainage.

Upon approval by the Department of Building Inspection one copy of the plot plan shall be stamped "Approved" and returned to the applicant at the time the permit is issued.

Elevations of the following points should be marked on the plot plan for all structures not requiring site plan approval as per Chapter 20-1428 of the Code of the City of Lawrence at the time of application for a building permit.

1. Lowest point where exterior framing contacts a concrete floor or foundation wall on

the street side of the building.

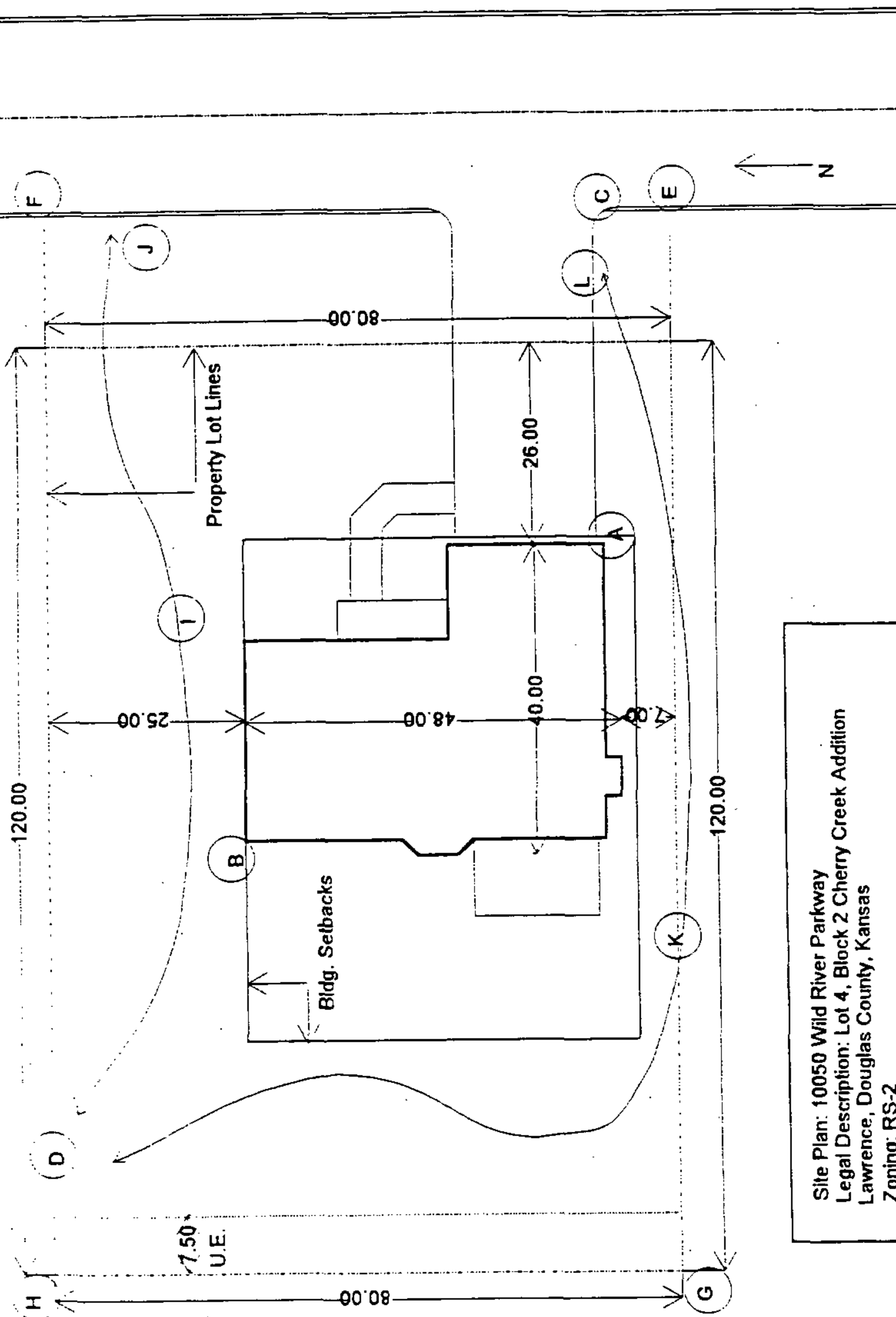
2. Lowest point where exterior framing contacts a concrete floor or foundation wall on rear or sides of the building.
3. Highest point of curb at curb cut for drive.
4. Points where drainage exits lot at lot line (There may be one or more of these exits. In the case of more than one drainage exit from the lot, all exits will be marked).
5. Points where lot lines, if extended, would intersect curb (Irregular or corner lots may have more than two such points, in which case all points will be marked).
6. Points where rear lot line intersects with side lot and adjacent or adjoining lot lines (In the event there are more than two such points of intersection, all points will be marked).
7. Highest points of drainage flow lines (If more than two such flow lines exist, the highest point of all flow lines will be marked).
8. Floor or foundation elevations of adjacent or adjoining structures, if any, at the nearest point to the subject structure.

General Standards

1. Backfill surrounding the foundation will be a minimum of 6" below the lowest exterior framing contacting a concrete floor or foundation wall.
2. All drainage swales will descend at a minimum negative grade of 2% from the foundation until reaching the point of drainage exit from the lot.
3. Perimeter backfill and yard grading will at all times slope away from the foundation a minimum of 6 inches or 2% grade (whichever is greater) to the point of drainage exit from the lot, or to a drainage swale in which the highest point is a minimum of 12 inches below the nearest point where exterior framing contacts a concrete floor or foundation wall of the structure and will maintain a slope with a minimum negative grade of 2% until it reaches the point of drainage exit from the lot. At no time will the grade of fill slopes be steeper than two horizontal to one vertical.
4. Front yards will drain to the street whenever possible. Front yards not draining to the street will drain to a swale located on a line parallel to the building foundation not less than 12 feet from the building foundation.

5. Side yard drainage swales will be located on the side yard lot lines with the highest point of the swale a minimum of 12 inches or 2% grade (whichever is greater) below the nearest point where exterior framing contacts a concrete floor or foundation wall of the structure or any adjacent or adjoining structure and shall continue to slope at a minimum grade of 2% until reaching the point of drainage exit from the lot.
6. Rear yard drainage swales will be located on a line parallel to the building foundation not less than 12 feet from the foundation.
7. Berms constructed to prevent drainage from adjacent or adjoining yards must be constructed entirely on the subject property. At no time shall such berms be constructed which would cause water to be retained by the adjacent or adjoining yards. Outlet swales will be located on the downhill side yard property lines.
8. Driveways will slope a minimum of 18 inches or 2% grade (whichever is greater) from the garage floor to the highest point of the curb at the driveway curb cut unless written approval is obtained from the building inspection department.
9. The elevation of the throat of all driveways will equal or exceed the highest point of the street curb at the driveway curb cut for a minimum of 5 feet from the rear of the curb before descending. Any driveway will ascend a minimum of 6" from its lowest point to the garage floor.
10. Applications for permits for properties possessing drainage easements must present required floor elevations from a licensed engineer indicating anticipated flow levels of storm water drainage based on computations of a 25 year storm.
11. All structures with exterior frame walls or openings located entirely or partially below exterior yard grade must have a protective curb or wall around the frame wall or opening equal to or higher than 3 inches above the highest point at which yard grade contacts the foundation wall at the nearest point to the opening.
12. The bottom of all outlets for storm water drainage from a structure must be located a minimum of 6 inches below the nearest point where exterior framing contacts a concrete floor or foundation wall. Such outlets will empty onto an impervious surface unless the outlet is a minimum of 3 feet from the foundation.

For Illustration Purposes Only



Site Plan: 10050 Wild River Parkway
Legal Description: Lot 4, Block 2 Cherry Creek Addition
Lawrence, Douglas County, Kansas
Zoning: RS-2
Scale: one inch equals 20 feet (1"=20')
Contractor: Ebb Tide Construction

10050 Wild River Parkway
Lawrence, Kansas 66044
Ebb Tide Construction
10050 Wild River Parkway
Lawrence, Kansas 66044

Legend for Plot Plan Illustration

- A= Lowest point where exterior framing contacts a concrete floor or foundation wall on the street side of the building.
- B= Lowest point where exterior framing contacts a concrete floor or foundation wall on rear or sides of the building.
- C= Highest point of curb at curb cut for drive.
- D,J,L= Points where drainage exits lot at lot line (There may be one or more of these exits. In the case of more than one drainage exit from the lot, all exits will be marked).
- E, F= Points where lot lines, if extended, would intersect curb (Irregular or corner lots may have more than two such points, in which case all points will be marked).
- G,H= Points where rear lot line intersects with side lot and adjacent or adjoining lot lines (In the event there are more than two such points of intersection, all points will be marked).
- I,K= Highest points of drainage flow lines (If more than two such flow lines exist, the highest point of all flow lines will be marked).

APPENDIX D - SUMMARY OF EXISTING STORMWATER UTILITIES

SUMMARY OF EXISTING STORMWATER UTILITIES

One of the many ways to administer and fund storm drainage system operation, maintenance, expansion and improvements is through the formation of a stormwater utility. Although utilized in other parts of the country rather extensively, this approach is relatively new to the Midwest. The basic concept is the same as for municipal water, wastewater or other utility organizations and is gaining acceptance in this area as public awareness of storm drainage issues increases.

Within this region several cities have established stormwater utilities. These include Olathe, Manhattan, Topeka and Wichita, Kansas, and Columbia and Kansas City, Missouri. Kansas City, Kansas is also investigating and evaluating implementation of a stormwater utility. The following are summaries of some of these utilities for reference and comparison.

CITY OF OLATHE, KANSAS

Olathe's utility has been in operation for approximately five years. It was enacted by an ordinance which must be renewed annually in conjunction with the city's budget. Originally, the utility was implemented for and authorized to fund only storm drainage capital improvements. It's purpose has recently been expanded to include funding of utility staff positions and system maintenance. Currently the utility generates approximately \$750,000 annually.

The rate structure is divided into two main categories, residential and non-residential, with the equivalent residential unit (ERU) based on 10,000 square feet of land area. All residential customers pay the same fee of \$2.00 per month. Non-residential customers are further divided into classes based on increments of 20,000 square feet of land area. The fees range from \$2.00 per month for 20,000 square feet or less, up to \$100.00 per month (the maximum fee for any class) for over 500,000 square feet. Fees are billed through the City's water utility.

CITY OF TOPEKA, KANSAS

Topeka's stormwater utility began operation in 1993, and is under the jurisdiction of the Department of Public Works. Property is divided into two

basic classifications, residential and nonresidential. Charges are based on Equivalent Residential Units which is defined as 2,018 square feet of impervious area. This impervious area includes all buildings, driveways, parking areas, etc. The basic rate for one ERU is \$2.85 per month although all residential customers do not pay the same fee. The residential classification is further divided into three rate groups as follows.

<u>Total Impervious Area</u>	<u>No. of ERU's</u>	<u>Monthly Billing</u>
<1,500	0.65	\$1.85
>1,500, <3,500	1.00	\$2.85
>3,500	1.56	\$4.45

All nonresidential properties are billed on the basis of the number of ERU's for the specific parcel calculated as the total impervious area (determined from aerial photo analysis) divided by 2,018. The total charge for a parcel is then determined by multiplying the number of ERU's by \$2.85. Governmental entities, including the State of Kansas, pay stormwater utility fees. The only areas excepted are impervious surfaces in public rights-of-way (streets, highways, etc.) and impervious areas at the airfield.

Billings are included with the City's water billing. Actual charges are computed daily, with the result that payments vary slightly by month. Topeka's stormwater utility generates approximately \$3.66 million per year.

CITY OF WICHITA, KANSAS

Wichita's stormwater utility operates similarly to Topeka's. It is also under the jurisdiction of the Department of Public Works with two basic classifications, residential and nonresidential, although the residential classification is not further broken down as in Topeka. An ERU in Wichita is defined as 2,139 square feet with the monthly charge set at \$1.66/month/ERU.

Residential customers are charged for one ERU, irrespective of lot or house size. Multi-family units also are charged one ERU per unit. Nonresidential properties are billed on the basis of the number of ERU's for the parcel times the basic ERU rate. Billings are handled as a separate line item on the City's water and sewer

billing system. Governmental and tax-exempt properties are included in the rate base. Streets and highways are excluded. The airport, including the runway, is included in the rate base. Wichita's stormwater utility generates approximately \$5.0 million per year.

CITY OF MANHATTAN, KANSAS

Manhattan's stormwater utility is presently funded through the imposition of a fee billed with the water and sewer billing. Residential properties, including multi-family units, are assessed at a monthly rate of \$0.25 per living unit irrespective of lot or building size. Properties devoted to any use other than residential are assessed on the basis of total developed area (e.g., tract size), not impervious area. A total of six rate groups are defined with monthly fees varying from \$1.30 for tracts less than or equal to 20,000 square feet, to \$150.00 for tracts greater than 1,000,000 square feet. The campus of Kansas State University is specifically included in the rate base by direct reference in the ordinance.

Manhattan's stormwater utility presently generates approximately \$112,000 per year. This amount, and the associated billing rates, was established as a start-up, or phase in, measure. The City's recently completed storm drainage master plan reviews the City's rates and rate base, and recommends adjustments or modifications necessary or desirable to properly fund the stormwater utility and recommended capital improvements.

CITY OF COLUMBIA, MISSOURI

Establishment of Columbia's stormwater utility, initial fee structure, and stormwater development charge on new construction were authorized by a special election in 1993. The initial proposal was based on the need to fund a \$5,000,000 storm drainage capital improvements program outlined in an earlier master plan.

The rate structure is based on four residential tiers with commercial property rates based on actual impervious area. The University of Missouri's properties are included in the utility customer base although they are billed a negotiated fee rather than charges based on actual impervious area.

Initially, the residential fee was \$0.65 per month for all units and \$4.00 per month for all nonresidential properties. The utility fees were revised in 1994 as indicated in the following table while development charges remained as originally approved. Annual revenues from the combination of utility fees and development charges are approximately \$830,000.

COLUMBIA, MISSOURI STORMWATER CHARGES

Utility Charges

Multifamily dwellings with more than 4 units	\$0.65/month
Single-family homes less than 750 sq. ft.	\$0.65/month
Multifamily dwellings with 4 or fewer units	\$0.85/month
Single-family homes 750 to 1,250 sq.ft.	\$0.85/month
Single-family homes 1,250 to 2,000 sq.ft.	\$1.15/month
Single-family homes more than 2,000 sq. ft.	\$1.35/month
Non-residential uses of developed land	\$4.00 or \$0.04/100 SF imperv. area per mo., whichever is greater

Development Charges on New Building Permits

Single-family homes and duplexes	\$0.09/SF
Multifamily buildings, offices, schools, churches	\$0.16/SF
Commercial and industrial	\$0.195/SF
Use categories not listed above	\$0.195/SF

The utility charges are based on "main floor area" as opposed to total impervious area per property and development charges on "total floor area." Total floor area is defined as the area within the perimeter of the outside walls of a building including basement area, main and upper floor areas, carports, garages, decks and porches. This development charge is similar in concept to an impact fee although the rates are somewhat arbitrary and not based on the actual impact of increased impervious area on the existing drainage system. The charge is waived, however, for any property served by a private detention facility constructed in accordance with City criteria and privately maintained.

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