

# 2007 PRELIMINARY ENGINEERING STUDY

QUIVIRA ROAD – 167<sup>TH</sup> STREET TO 179<sup>TH</sup> STREET  
175<sup>TH</sup> STREET – 179<sup>TH</sup> STREET TO QUIVIRA ROAD

Prepared For



The City of  
**Overland  
Park**  
KANSAS

February 2008

Prepared By

**BHC RHODES**  
CIVIL ENGINEERS • SURVEYORS

# *INDEX*

<i>EXECUTIVE SUMMARY</i> .....	1
<i>INTRODUCTION</i> .....	2
<i>BASIC INFORMATION AND PROCEDURES</i> .....	3
<i>EXISTING CONDITIONS</i> .....	4-5
<i>EXISTING UTILITIES</i> .....	6-7
<i>MEDIAN BREAKS AND TURN LANE STORAGE REQUIREMENTS</i> .....	8
<i>PRELIMINARY DESIGN</i>	
Design Criteria .....	9
Typical Sections.....	10
Proposed Right-of-Way .....	10
Proposed Horizontal Alignments.....	10
Proposed Vertical Alignments .....	11
Historical Considerations.....	11
Proposed Drainage.....	11
Bioretention Areas .....	12
Bioretention Costs.....	13
Retaining Walls .....	13
Existing Lakes and Ponds .....	13
Permitting .....	14
Construction .....	14
Estimated Earthwork Volumes .....	14
<i>OPINIONS OF PROBABLE COSTS</i>	
Total Project Cost Summary .....	15
Right-of-Way Costs.....	16-19
Utility Relocation Costs .....	20-21
Construction Costs.....	22-23
<i>APPENDIX</i> .....	Preliminary Plan and Profile Drawings

## ***EXECUTIVE SUMMARY***

This preliminary engineering study presents the results to establish preliminary horizontal and vertical alignments for Quivira Road from 167<sup>th</sup> Street to 179<sup>th</sup> Street and for 175<sup>th</sup> Street from 179<sup>th</sup> Street to Quivira Road. The purpose of this study was to perform a preliminary design to minimize impacts to existing development and to serve as a planning tool for future development. The findings of this study were established in coordination with the City of Overland Park, Kansas.

More specifically, the major objectives of this study were as follows:

- **Establish Design Criteria** – Establish design guidelines, typical roadway sections, and right-of-way widths for Quivira Road and 175<sup>th</sup> Street.
- **Develop Preliminary Horizontal/Vertical Alignments** – Develop preliminary horizontal and vertical alignments for Quivira Road and 175<sup>th</sup> Street.
- **Determine Major Drainage Improvements** – Size facilities for major drainage crossings.
- **Determine Total Project Costs** – Provide opinion of probable total project cost including construction, utility relocation, right-of-way and easement acquisition, administration, legal and engineering costs based upon 2007 construction costs.

The comprehensive solution to meet the objectives set forth is summarized in the subsequent pages of this report:

Quivira Road is classified as a thoroughfare which consists of a four-lane divided roadway with two through lanes in each direction separated by a raised median wide enough to accommodate left turn lanes where appropriate.

175<sup>th</sup> Street is classified as a super collector which consists of a four-lane undivided roadway with two through lanes in each direction.

Both roadway sections include curb and gutter, enclosed drainage systems, sidewalks, bike/hike trails as designated by the Greenway Linkages Master Plan and street lighting.

## ***INTRODUCTION***

The study presented herein was authorized in an agreement between the City of Overland Park and BHC RHODES on April 17, 2007. The agreement calls for the preparation of a preliminary engineering study and report together with preliminary scaled plans and drawings.

The study establishes recommended horizontal and vertical alignments for Quivira Road from 167<sup>th</sup> Street to 179<sup>th</sup> Street and for 175<sup>th</sup> Street from 179<sup>th</sup> Street to Quivira Road. Specifically, the study includes the following:

- Recommended typical sections.
- Required right-of-way widths.
- Proposed horizontal and vertical roadway alignments.
- Plan sheets showing existing right-of-way, ownership, utilities and topographic features, locations for retaining walls, construction limits and locations of major drainage structures.
- Drainage structure analyses including type, size, and location.
- Bioretention facility analyses including size and location.
- Roadway cross sections.
- Opinion of probable project costs.

Each of these items is discussed in the following sections. In addition, plan and profile drawings are part of the report appendix to illustrate the recommended roadway improvements.

This Preliminary Engineering Study has been prepared by BHC RHODES at the direction of the Overland Park Public Works Department and represents the best information available to the City Engineer.

## ***BASIC INFORMATION AND PROCEDURES***

In the development of the preliminary design study, the following information and procedures were utilized:

- Topographic information along the Quivira Road and 175<sup>th</sup> Street corridors was obtained from Johnson County AIMS maps and incorporated into Plan and Profile sheets. The City of Overland Park provided the AIMS maps.
- City ownership and plat maps were utilized to determine property owners and to plot existing right-of-way and property lines.
- Utility companies were contacted to determine the location of utility lines and easements in the corridor area. The utility information shown on the plan sheets was taken from the utility location maps supplied to BHC RHODES by each of the utility companies and does not represent field-verified locations.
- The existing surface was modeled from 2-foot AIMS contours. The created surface model has a tolerance of +/- 1 ft. at any given point.
- Field surveys were performed by BHC RHODES to establish pavement tie-in points and the flowlines of existing major drainage facilities and to assist in the validation of elevations shown on the AIMS mapping.
- The August 2006 Future Development Plan was obtained from the City of Overland Park.
- The following future development plans were obtained from Shafer, Kline & Warren, Inc. and were considered in the layout of Quivira Road and 175<sup>th</sup> Street:
  - “Blue Valley Southwest High School, Final Plat” prepared by Shafer, Kline & Warren, Inc., submitted October, 2007.
- The City of Overland Park provided turn bay locations and storage length requirements.
- Design criteria is in accordance with current ordinances for the City of Overland Park, the Kansas Department of Transportation, and the American Association of State Highway and Transportation Officials’ publication, *A Policy on Geometric Design of Highways and Streets*.
- Opinions of probable construction costs are based on 2007 dollar values. Recent bid tabs and other historical cost information were utilized to establish 2007 unit prices.
- “167<sup>th</sup> Street – Pflumm Road to Metcalf Avenue Preliminary Engineering Study” prepared by Affinis Corporation, submitted June 2006.
- “175<sup>th</sup>/179<sup>th</sup> Street – Lackman Road to Switzer Road” prepared by Cook, Flatt and Strobel Engineers, P.A., submitted April 1999.
- “Blue River Watershed Study” prepared by Camp Dresser & McKee Inc., amended December 2005.

## ***EXISTING CONDITIONS***

### **Roadways**

Quivira Road is a north/south thoroughfare corridor serving Overland Park and Johnson County residents. It is a two-lane roadway with no shoulders and open ditches. The roadway is paved from 179<sup>th</sup> Street to 175<sup>th</sup> Street and gravel from 175<sup>th</sup> Street to 167<sup>th</sup> Street. Quivira Road is currently located outside the corporate limits except for the west side of Quivira Road from 179<sup>th</sup> Street to 175<sup>th</sup> Street, which is within the Overland Park City Limits.

Quivira Road has one intersecting super collector – 175<sup>th</sup> Street, and one intersecting thoroughfare – 179<sup>th</sup> Street. There are also two intersecting residential side streets (Garnett and 176<sup>th</sup> Terrace) and several driveways including two future entrances to Blue Valley Southwest High School along the west side of the road.

175<sup>th</sup> Street is an east/west super collector corridor serving Overland Park and Johnson County residents. It is a two-lane paved roadway with no shoulders and open ditches. 175<sup>th</sup> Street is bordered almost entirely by Overland Park on the south side and Johnson County on the north side.

175<sup>th</sup> Street has two intersecting thoroughfares – Quivira Road and 179<sup>th</sup> Street. There are also several driveways including two future entrances to Blue Valley Southwest High School along the south side of the road.

### **Existing Right-of-Way**

The existing right-of-way ranges between 20 feet and 40 feet on either side of the section lines through undeveloped tracts of land and between 50 feet and 70 feet on either side of the section lines where subdivisions have been platted. The existing right-of-way is shown on the plan drawings in the Appendix.

### **Traffic Counts**

Traffic data from Johnson County and the City of Overland Park indicate 652 Average Daily Traffic (ADT) along Quivira Road and 482 ADT along 175<sup>th</sup> Street for the year 2004. A projected count of 24,000 ADT for Quivira Road is anticipated for the year 2030. Quivira Road and 175<sup>th</sup> Street are currently signed for 35 mph and 45 mph, respectively.

### **Land Use**

The properties adjacent to the roadways in this study include small subdivisions, as well as a mix of small and large tracts of land. The current planned zoning for the majority of the study corridor is low-density residential and transitional use. This includes most of the land adjacent to Quivira Road between 175<sup>th</sup> Street and 167<sup>th</sup> Street. There is a large area zoned mixed-use at the intersection of 175<sup>th</sup> Street and 179<sup>th</sup> Street. Further, the area between 179<sup>th</sup> Street and 175<sup>th</sup> Street on the west side of Quivira Road is zoned public and is the planned site of Blue Valley Southwest High School.

### **Existing Vertical Alignments**

According to AASHTO design criteria, adequate stopping sight distance and/or intersection site distance is not currently available at several locations along Quivira Road and 175<sup>th</sup> Street at the proposed design speeds. 175<sup>th</sup> Street is located near a high point in the Quivira Road profile, which will need to be lowered as a result of the new design speed. Currently the posted speed limits along Quivira Road and 175<sup>th</sup> Street are 35 mph and 45 mph, respectively. Because the proposed design speeds for Quivira Road and 175<sup>th</sup> Street are 50 mph and 40 mph, respectively, existing high spots in the profiles will need to be cut down and low spots will need to be filled in to meet the new criteria.

### **Existing Drainage**

There are currently open ditches adjacent to Quivira Road and 175<sup>th</sup> Street. Three existing drainage structures cross Quivira Road and 175<sup>th</sup> Street. A 42" corrugated metal pipe crosses Quivira Road approximately ¼ mile north of 175<sup>th</sup> Street. An 18' x 6' reinforced concrete box crosses Quivira Road 940' south of 167<sup>th</sup> Street. A 72" corrugated metal pipe crosses 175<sup>th</sup> Street approximately 0.4 miles west of Quivira Road. The majority of these structures cannot pass a 100-year event. None of the structures are long enough to accommodate the proposed typical section with adequate clear zone.

## ***EXISTING UTILITIES***

The major utilities in the study area are telephone, water, power, cable, and fiber optic. These utility lines are shown on the plan drawings in the Appendix and are described as follows:

### **Time Warner Cable**

#### **Quivira Road**

Time Warner Cable has overhead facilities attached to KCP&L's poles along east side of Quivira Road from Garnett to approximately 200' south of 175<sup>th</sup> Street. The facilities then continue underground to just north of 175<sup>th</sup> Street.

#### **175<sup>th</sup> Street**

Time Warner Cable has overhead facilities attached to KCP&L's poles along north side of 175<sup>th</sup> Street from just west of Quivira Road to the end of the project. There are underground facilities along the south side of 175<sup>th</sup> Street from just east of Quivira Road to the end of the project.

### **Kansas City Power & Light**

#### **Quivira Road**

KCP&L has overhead facilities along the east side of Quivira Road from Garnett to just north of 175<sup>th</sup> Street where it crosses over to the west. The overhead facilities continue on the west side of Quivira Road for the remaining length of the project.

#### **175<sup>th</sup> Street**

KCP&L has overhead facilities along the north side of 175<sup>th</sup> Street for the length of the project.

### **WaterOne**

#### **Quivira Road**

The Water District has a 24" line along the east side of Quivira Road from the beginning of the project to just north of 175<sup>th</sup> Street. There is a 36" transmission main along the east side of Quivira Road from just north of 175<sup>th</sup> Street to the end of the project. There is an 8" line along the east side of Quivira Road from Garnett to just south of 175<sup>th</sup> Street. The Water District has a 4" line on the west side of Quivira Road that begins approximately 300' north of Garnett and extends north for approximately 800'. With exception to the 24" line, the water lines are in private easement and relocations would be at the City's expense.

#### **175<sup>th</sup> Street**

The Water District has a 36" transmission main along the north side of 175<sup>th</sup> Street from the beginning of the project to just east of Quivira Road. There is a 12" line along the south side of 175<sup>th</sup> Street that begins at 179<sup>th</sup> Street and extends northeasterly for approximately 600'. The 12" line then reduces to an 8" line and continues east on the south side of 175<sup>th</sup> Street for the remaining length of the project. With exception to the 12" line, the water lines are in private easement and relocations would be at the City's expense.

## **AT&T**

### **Quivira Road**

AT&T has overhead facilities along the east side of Quivira Road from approximately 2200' north of 175<sup>th</sup> Street to the end of the project.

### **175<sup>th</sup> Street**

AT&T has a buried cable along the south side of 175<sup>th</sup> Street from Quivira Road to the end of the project.

## ***MEDIAN BREAKS AND TURN LANE STORAGE REQUIREMENTS***

Median break locations shown on the plan drawings are based on existing residential side streets and proposed entrances for future development. Additional locations meeting desirable spacing requirements are anticipated as development occurs but should be reviewed and approved with care to maintain the corridor's traffic integrity.

The City provided the following recommendations for proposed median break locations and full-width turn lane storage requirements (excluding tapers):

<u>Location</u>	<u>Northbound</u>	<u>Southbound</u>	<u>Eastbound</u>	<u>Westbound</u>
<b>On 175<sup>th</sup> Street</b>				
179 <sup>th</sup> Street	---	---	---	250' left 200' right
Center School Drive	---	---	---	200' left
East School Drive	---	---	---	200' left
Quivira Road	---	---	250' left	250' left
<b>On Quivira Road</b>				
175 <sup>th</sup> Street	250' left	250' left 200' right	---	---
North School Drive/ 176 <sup>th</sup> Terrace	200' left	150' left 200' right	---	---
South School Drive/ Garnett	250' left	150' left 200' right	---	---
179 <sup>th</sup> Street	---	300' dual left 200' right		

## ***PRELIMINARY DESIGN***

### **Design Criteria**

	<b><u>Quivira Road</u></b>	<b><u>175<sup>th</sup> Street</u></b>
<b>TYPICAL SECTION</b>		
Classification	Thoroughfare	Super Collector
Lane Width	12'-2" – inside lane 13'-0" – outside lane 12'-2" – left turn bay 10'-0" – right turn bay	12'-0" – inside lane 12'-0" – outside lane 12'-2" – left turn bay --
Median Width	24'	--
Shoulder		
Inside	Curb (Type D)	--
Outside	Curb (Type B)	Curb (Type B)
Normal Crown	2.08% (1/4"/ft)	2.08% (1/4"/ft)
<b>SIDE SLOPES</b>		
Maximum	4:1	4:1
<b>GEOMETRICS</b>		
Design Speed	50 mph	40 mph
Posted Speed	45 mph	35 mph
Min. Horizontal Radii	2000'	600'
Vertical Alignment		
Maximum Grade	6%	8%
Minimum Grade	1%	1%
Stopping Sight Distance*	400' – 475'	150'
K Value*	110-160 (Crest) 90-110 (Sag)	60-80 (Crest) 60-70 (Sag)
Superelevation Runoff	1:200	1:200
<b>DRAINAGE</b>		
Hydrology	Rational Method (<200 acres) SCS TR-55 (>200 acres)	
Ditch Design	100-year Design (2% minimum, 0.5' freeboard)	
Drainage Structures (Culverts)	100-year Design	

\*Criteria for vertical curves is based on the more conservative 1990 AASHTO Green Book.

## **Typical Sections**

The typical sections for the proposed roadways are shown in the Appendix. All standard thoroughfare and super collector sections consist of a 10" thick asphaltic concrete pavement over a 6" aggregate base course and an 8" fly ash treated subgrade.

The standard four-lane divided thoroughfare section recommended for Quivira Road (179<sup>th</sup> Street to 167<sup>th</sup> Street) is shown on Page 2 of the plans in the Appendix. The roadway width consists of a 13' outside lane and a 12'-2" inside lane. This section includes a 24' raised median which can be narrowed to 13' or 4' to accommodate single or dual left turn lanes, respectively. Five-foot sidewalks are located 1' inside the proposed right-of-way line. A 10' hike/bike trail will be utilized in locations designated by the Greenway Linkages Master Plan and will be located 1' inside the proposed right-of-way line. The trail locations are shown in the plans.

The four-lane super collector section recommended for 175<sup>th</sup> Street (179<sup>th</sup> Street to Quivira Road) is shown on Page 3 of the plans in the Appendix. The roadway width consists of a 12' outside lane and a 12' inside lane. The roadway widens as it approaches the intersection of Quivira Road to include a left turn lane and 4' raised median. Five-foot sidewalks are located 1' inside the proposed right-of-way line. A 10' hike/bike trail will be utilized in locations designated by the Greenway Linkages Master Plan and will be located 4' outside the proposed right-of-way line and 1' inside a proposed sidewalk easement along the planned site of Blue Valley Southwest High School. The trail locations are shown in the plans.

## **Proposed Right-of-Way**

Right-of-way requirements are indicated on the plan drawings as well as the typical sections on pages 2-3 of the Appendix. The thoroughfare roadway section will require a 120' right-of-way corridor with an additional 10' of right-of-way required to accommodate a right turn lane at thoroughfare/thoroughfare intersections. The super collector roadway section will require an 80' right-of-way corridor with an additional 20' of right-of-way required to accommodate a left turn lane at the intersection of Quivira Road.

Permanent drainage easements will be necessary for bioretention areas and at the ends of the crossroad drainage structures. A permanent sidewalk easement will be necessary to accommodate the hike/bike trail along 175<sup>th</sup> Street. Temporary construction easements will be necessary along most properties adjacent to construction. Permanent utility easements are present in most of the sub-divided properties. There are, however, locations where additional utility easements will be necessary to accommodate utility relocations. The exact locations of the proposed utility easements should be determined during the project design phase when more accurate utility information is available.

## **Proposed Horizontal Alignments**

A standard thoroughfare section, centered on section line, is recommended for Quivira Road as shown in the Appendix. A super collector section, centered on section line, is recommended for 175<sup>th</sup> Street as shown in the Appendix with the following exception. The horizontal alignment merges with the section line on a 600' radius curve from 179<sup>th</sup> Street.

**Proposed Vertical Alignments**

The minimum design criteria for thoroughfare and super collector type roadways is established in the City of Overland Park Municipal Code and the 1990 edition of “A Policy on Geometric Design of Highways and Streets” published by the American Association of State Highway and Transportation Officials. The two main design issues when developing the vertical alignments for these roadways are Stopping Sight Distance (S.S.D.) of a crest vertical curve and the “K” value of a sag vertical curve. The requirements for this project are shown in the Design Criteria section of this report. Appropriate intersection sight distance was achieved at all existing side streets and currently proposed entrances.

The vertical alignments of 175<sup>th</sup> Street and Quivira Road were developed with the assumption that 179<sup>th</sup> Street will be widened to current City thoroughfare standards in the future. Further, the horizontal curve at 175<sup>th</sup>/179<sup>th</sup> Street will be super elevated at 2% in the future rather than the existing 6% cross slope.

**Historical Considerations**

Based on a cursory review of the Kansas State Historical Society (KSHS) website, it appears that there are no known archaeological sites or historic structures within the project area and thus the improvements should have no effect on properties listed on the National Register of Historic Places. However, during final design it is recommended that further investigation be explored.

**Proposed Drainage**

New drainage structures beneath Quivira Road and 175<sup>th</sup> Street will be reinforced concrete boxes and a Conspan Bridge System. The major crossings were sized for a 100-year storm. A 1’ freeboard elevation was utilized in the culvert design. During final design it may be necessary to design a storm system that utilizes area inlets to collect the water at the toe of slopes where positive drainage cannot be achieved. Temporary interceptor ditches should be utilized in order to keep large areas of off-site drainage from entering the roadway. The temporary interceptor ditches will only be used where development has not yet occurred. Locations of the structures are shown on the plan and profile sheets in the Appendix.

There are three drainage structure crossings for this study area (two along Quivira Road and one along 175<sup>th</sup> Street). The data used in analyzing storm drainage flowing from the adjacent drainage areas is shown in the table below:

<b>Structure Location</b>	<b>Size</b>	<b>Area (acres)</b>	<b>CN Value</b>	<b>Time of Concentration (hr)</b>	<b>100 yr Type II 24 Hour Rainfall (in)</b>	<b>Q<sub>100</sub> (cfs)</b>
Sta. 113+14.67 Quivira Road	5’ x 5’ RCB	25	88	0.250	7.9	191
Sta. 135+28.31 Quivira Road	36’ x 9’ Conspan	569	88	0.707	7.9	2340
Sta. 30+73.60 175 <sup>th</sup> Street	7’ x 7’ RCB	67	88	0.261	7.9	503

Notes: Flows (Q) for all structures were determined using TR-55.  
Curve Numbers (CN) account for future development.

**Bioretention Areas**

As part of this study, bioretention areas were sized to treat the stormwater runoff from the roadway surface. The recommended bioretention areas are shown on the plans in the Appendix. Further investigation will be needed during the preliminary project design to determine the practicality of using the bioretention areas as shown on the preliminary plans. The data used in the preliminary sizing of the five bioretention areas for this study (three along Quivira Road and two along 175<sup>th</sup> Street) is shown in the table below:

<b>BMP No.</b>	<b>Location</b>	<b>Tributary Area, A<sub>T</sub> (acres)</b>	<b>Water Quality Volume, WQv (ac-ft)</b>	<b>Req'd Filter Bed Surface Area, A<sub>f</sub> (sq. ft.)</b>	<b>Recommended Dimensions, L<sub>f</sub> x W<sub>f</sub></b>
1	Sta. 112+00, Lt. Quivira Road	3.307	0.378	3893	90' x 45'
2	Sta. 133+65, Rt. Quivira Road	2.378	0.271	2799	80' x 40'
3	Sta. 137+35, Rt. Quivira Road	0.959	0.109	1129	50' x 25'
4	Sta. 29+50, Lt. 175 <sup>th</sup> Street	1.244	0.142	1464	60' x 30'
5	Sta. 32+55, Lt. 175 <sup>th</sup> Street	3.069	0.350	3612	90' x 45'

The required filter bed surface area, A<sub>f</sub> (ft<sup>2</sup>), was determined using the following equation:

$$A_f = (WQv * d_f) / [k * t_f * (h_{avg} + d_f)]$$

where

Tributary area to bioretention area, A<sub>T</sub> (ac)

(A<sub>T</sub> should be less than 4 acres)

Water quality volume, WQv (ac-ft)

(water quality rainfall event for the Kansas City Metropolitan Area is 1.37 inches)

Planting bed soil depth, d<sub>f</sub> (ft)

(d<sub>f</sub> should be between 2.5 feet and 4.0 feet) => **assumed 3.0 feet for study purposes**

Coefficient of permeability for planting soil bed, k (ft/day)

(k should be at least 1 ft/day) => **assumed 1.3 ft/day for study purposes**

Maximum ponding depth, h<sub>max</sub> (ft)

(h<sub>max</sub> should be between 3 inches and 6 inches) => **assumed 6 inches for study purposes**

Average height of water above bioretention bed, h<sub>avg</sub> (ft)

$$h_{avg} = h_{max} / 2$$

Time required for WQv to filter through the planting soil bed, t<sub>f</sub> (days)

(t<sub>f</sub> of 1 to 3 days is recommended) => **assumed 3 days for study purposes**

Approximate filter bed length, L<sub>f</sub> (ft), assuming a length to width ratio of 2:1

(L<sub>f</sub> should be at least 40 ft)

Approximate filter bed width, W<sub>f</sub> (ft), assuming a length to width ratio of 2:1

(W<sub>f</sub> should be at least 15 ft, and optimally half of L<sub>f</sub>)

### **Bioretention Costs**

Based on information provided by the City of Overland Park, construction and right-of-way costs have been calculated for each bioretention area and are summarized in the table below:

<b>BMP No.</b>	<b>Location</b>	<b>P.D.E. (sq. ft.)</b>	<b>T.C.E. (sq. ft.)</b>	<b>R/W Costs</b>	<b>Construction Costs*</b>
1	Sta. 112+00, Lt. Quivira Road	36,000	43,000	\$57,500	\$121,500
2	Sta. 133+65, Rt. Quivira Road	56,000	54,000	\$83,000	\$96,000
3	Sta. 137+35, Rt. Quivira Road	32,000	38,750	\$51,375	\$37,500
4	Sta. 29+50, Lt. 175 <sup>th</sup> Street	31,200	35,750	\$49,075	\$54,000
5	Sta. 32+55, Lt. 175 <sup>th</sup> Street	29,150	33,000	\$45,650	\$121,500

\*Construction costs estimated at \$30 per square foot of bioretention surface area.

### **Retaining Walls**

As part of this study, a number of locations were evaluated to determine the practicality of using retaining walls instead of extending the roadway side slopes and adversely impacting adjacent landowners. Although no retaining walls are shown on the plans, further investigation may be needed during the preliminary project design.

### **Existing Lakes and Ponds**

A man-made private pond is located on the east side of Quivira Road north of 179<sup>th</sup> Street. The wider proposed roadway section as well as the extension of the grading limits will impact this pond. In addition, the saturated ground near the pond could pose construction problems. It is recommended that the pond be drained during construction of the proposed roadway and that the west berm of the pond be moved to the east, outside of the proposed right-of-way. The surrounding drainage runoff will be collected with an area inlet and conveyed by the proposed roadway drainage system.

Additionally, a man-made private pond is located on the east side of Quivira Road approximately 1000' south of 167<sup>th</sup> Street. The proposed roadway will not affect this pond. However, depending on the final location and configuration of a proposed bioretention area, the pond will likely be impacted.

There are additional ponds adjacent to the existing roadways on the tracts of land owned by the Unified School District that could be affected by a wider roadway section. It is assumed that these ponds in question will be removed prior to the construction of 175<sup>th</sup> Street and Quivira Road during the future development of these tracts.

**Permitting**

Permits will be required before beginning construction activities on this project. Due to the continually changing nature of permitting requirements, it is recommended the engineer analyze permitting requirements during the project’s preliminary design phase. The following permits may be required and should be investigated:

- 404 Permit**
- Kansas DWR Permit**
- National Pollution Discharge Elimination System (NPDES) Permit**
- FEMA**
- Federal Aviation Administration Form 7460-1**
- City Land Disturbance Permit**
- Other**

**Construction**

At the request of the City, this report has been formatted to show six (6) separate sections of roadway. The quantities for each section have been calculated separately as well as the estimate of cost for each section. The quantities and costs can be found beginning on page 15 of this report. These opinions of probable costs, in addition to previous studies of this area, will assist the City in phasing of roadway construction.

Temporary surfacing will be necessary to maintain access to the school and residences throughout the study area. Recommendations for construction phasing and maintenance of traffic during construction will need to be evaluated during each preliminary project design. The cost of earthwork should also be considered during the sequencing of construction. As shown from the table below, various sections of roadway construction will have excess waste material while other sections will require borrow.

**Estimated Earthwork Volumes**

Unclassified Excavation	Compaction	Waste/Borrow
<b>179th/Quivira Intersection (North Leg)</b>		
929	5,020	4,091 cu. yd. Borrow
<b>Quivira (179th to 175th)</b>		
24,285	2,089	22,196 cu. yd. Waste
<b>175th/Quivira Intersection</b>		
37,368	11,775	25,593 cu. yd. Waste
<b>Quivira (175th to 167th)</b>		
22,052	45,083	23,031 cu. yd. Borrow
<b>167th/Quivira Intersection (South Leg)</b>		
1,028	4,429	3,401 cu. yd. Borrow
<b>175th (179th to Quivira)</b>		
17,897	21,151	3,254 cu. yd. Borrow

Note: All volumes shown are unadjusted volumes. No shrinkage factor has been applied.

**OPINIONS OF PROBABLE COSTS**

**Detailed Total Project Cost**

	179th/Quivira Intersection (North Leg)	Quivira (179th to 175th)	175th/Quivira Intersection	Quivira (175th to 167th)	167th/Quivira Intersection (South Leg)	175th (179th to Quivira)
1 Construction Cost*	\$811,350	\$2,258,709	\$2,545,193	\$5,441,895	\$562,770	\$3,392,507
2 Estimated Change Orders	\$40,568	\$112,936	\$127,260	\$272,095	\$28,139	\$169,626
3 Engineering Final Design Consultant EDC City Inspection (if Federal/CARS/SMAC/Other Cities Eligible)	\$81,135 \$8,114 \$24,341	\$225,871 \$22,588 \$67,762	\$254,520 \$25,452 \$76,356	\$544,190 \$54,419 \$163,257	\$56,277 \$5,628 \$16,884	\$339,251 \$33,926 \$101,776
4 Material Testing	\$8,114	\$22,588	\$25,452	\$54,419	\$5,628	\$33,926
5 Project Administration	\$8,114	\$22,588	\$25,452	\$54,419	\$5,628	\$33,926
6 Legal Publications, Blueprinting, Misc.	\$4,057	\$11,294	\$12,726	\$27,210	\$2,814	\$16,963
7 Ownership Certificates/Title Report	\$4,057	\$11,294	\$12,726	\$27,210	\$2,814	\$16,963
8 RW & Easement Acquisitions^	\$64,169	\$164,991	\$243,733	\$999,838	\$86,425	\$383,604
9 Utility Relocations†	\$0	\$71,400	\$156,600	\$374,400	\$84,000	\$151,200
<b>Total Project Cost</b>	<b>\$1,054,019</b>	<b>\$2,992,021</b>	<b>\$3,505,470</b>	<b>\$8,013,352</b>	<b>\$857,007</b>	<b>\$4,673,668</b>

\* Based on 2007 dollar values

^ See Right-of-Way Costs

† See Utility Relocation Costs

**Right-of-Way Costs**

Additional right-of-way and easements will be required for these projects as summarized on the following pages. All right-of-way costs are based on information provided by the City of Overland Park. Costs include right-of-way, permanent drainage and temporary construction easements.

The following unit costs were used to develop the proposed right-of-way costs for the different sections:

Platted

Right-of-way .....	\$4.00 per square foot
Permanent Drainage Easement.....	\$2.00 per square foot
Temporary Construction Easement .....	\$1.00 per square foot

Unplatted

Right-of-way .....	\$2.00 per square foot
Permanent Drainage Easement.....	\$1.00 per square foot
Temporary Construction Easement .....	\$0.50 per square foot

As part of the City’s right-of-way acquisition procedures, when right-of-way is acquired from a property adjacent to a proposed thoroughfare roadway, the building setback line extends a distance of 30’ beyond the proposed right-of-way. Due to the close proximity of two existing structures on Tract No. 13, the structures fall within the proposed building setback line. An additional cost of \$100,000 was added to the right-of-way costs for the potential mitigation of roadway impacts to each structure on Tract No. 13. This is to assist the City in determining the potential costs for right-of-way acquisition for each section.

**179th/Quivira Intersection (North Leg)**

<b>Tract No.</b>	<b>Easement Type</b>	<b>Approx. Area (sq. ft.)</b>	<b>Approximate Cost</b>
1	<i>Right-of-Way</i>	4,166	\$16,644
	<i>Temporary Construction</i>	31,149	\$31,149
	<i>Drainage</i>	0	\$0
2	<i>Right-of-Way</i>	837	\$3,348
	<i>Temporary Construction</i>	2,016	\$2,016
	<i>Drainage</i>	0	\$0
19	<i>Right-of-Way</i>	0	\$0
	<i>Temporary Construction</i>	11,012	\$11,012
	<i>Drainage</i>	0	\$0

<b>Subtotal Right-of-Way Costs</b>	<b>\$64,169</b>
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**Quivira (179th to 175th)**

<b>Tract No.</b>	<b>Easement Type</b>	<b>Approx. Area (sq. ft.)</b>	<b>Approximate Cost</b>
2	<i>Right-of-Way</i>	1,151	\$4,604
	<i>Temporary Construction</i>	2,877	\$2,877
	<i>Drainage</i>	0	\$0
3	<i>Right-of-Way</i>	3,550	\$14,200
	<i>Temporary Construction</i>	8,876	\$8,876
	<i>Drainage</i>	0	\$0
4	<i>Right-of-Way</i>	3,009	\$12,036
	<i>Temporary Construction</i>	6,014	\$6,014
	<i>Drainage</i>	0	\$0
5	<i>Right-of-Way</i>	3,495	\$13,980
	<i>Temporary Construction</i>	6,993	\$6,993
	<i>Drainage</i>	0	\$0
6	<i>Right-of-Way</i>	3,901	\$15,604
	<i>Temporary Construction</i>	17,545	\$17,545
	<i>Drainage</i>	0	\$0
7	<i>Right-of-Way</i>	496	\$1,984
	<i>Temporary Construction</i>	5,203	\$5,203
	<i>Drainage</i>	0	\$0
19	<i>Right-of-Way</i>	0	\$0
	<i>Temporary Construction</i>	55,075	\$55,075
	<i>Drainage</i>	0	\$0

<b>Subtotal Right-of-Way Costs</b>	<b>\$164,991</b>
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**175th/Quivira Intersection**

<b>Tract No.</b>	<b>Easement Type</b>	<b>Approx. Area (sq. ft.)</b>	<b>Approximate Cost</b>
7	<i>Right-of-Way</i>	4,273	\$17,092
	<i>Temporary Construction</i>	24,734	\$24,734
	<i>Drainage</i>	0	\$0
8	<i>Right-of-Way</i>	0	\$0
	<i>Temporary Construction</i>	3,431	\$3,431
	<i>Drainage</i>	0	\$0
10	<i>Right-of-Way</i>	4,771	\$9,542
	<i>Temporary Construction</i>	0	\$0
	<i>Drainage</i>	0	\$0
11	<i>Right-of-Way</i>	36,714	\$73,428
	<i>Temporary Construction</i>	25,146	\$12,573
	<i>Drainage</i>	0	\$0
13	<i>Right-of-Way</i>	30,685	\$61,370
	<i>Temporary Construction</i>	19,842	\$9,921
	<i>Drainage</i>	0	\$0
18	<i>Right-of-Way</i>	0	\$0
	<i>Temporary Construction</i>	3,702	\$3,702
	<i>Drainage</i>	0	\$0
19	<i>Right-of-Way</i>	0	\$0
	<i>Temporary Construction</i>	27,940	\$27,940
	<i>Drainage</i>	0	\$0

<b>Subtotal Right-of-Way Costs</b>			<b>\$243,733</b>
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**Quivira (175th to 167th)**

<b>Tract No.</b>	<b>Easement Type</b>	<b>Approx. Area (sq. ft.)</b>	<b>Approximate Cost</b>
11	<i>Right-of-Way</i>	88,817	\$177,634
	<i>Temporary Construction</i>	88,670	\$44,335
	<i>Drainage</i>	1,500	\$1,500
12	<i>Right-of-Way</i>	42,173	\$84,346
	<i>Temporary Construction</i>	72,481	\$36,241
	<i>Drainage</i>	88,000	\$88,000
13	<i>Right-of-Way</i>	131,384	\$462,768
	<i>Temporary Construction</i>	128,028	\$64,014
	<i>Drainage</i>	41,000	\$41,000

<b>Subtotal Right-of-Way Costs</b>			<b>\$999,838</b>
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**167th/Quivira Intersection (South Leg)**

<b>Tract No.</b>	<b>Easement Type</b>	<b>Approx. Area (sq. ft.)</b>	<b>Approximate Cost</b>
12	<i>Right-of-Way</i>	20,754	\$41,508
	<i>Temporary Construction</i>	17,725	\$8,863
	<i>Drainage</i>	0	\$0
13	<i>Right-of-Way</i>	16,627	\$33,254
	<i>Temporary Construction</i>	5,599	\$2,800
	<i>Drainage</i>	0	\$0

<b>Subtotal Right-of-Way Costs</b>	<b>\$86,425</b>
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**175th (179th to Quivira)**

<b>Tract No.</b>	<b>Easement Type</b>	<b>Approx. Area (sq. ft.)</b>	<b>Approximate Cost</b>
13	<i>Right-of-Way</i>	49,125	\$98,250
	<i>Temporary Construction</i>	77,629	\$38,815
	<i>Drainage</i>	60,350	\$60,350
14	<i>Right-of-Way</i>	0	\$0
	<i>Temporary Construction</i>	9,464	\$4,732
	<i>Drainage</i>	0	\$0
16	<i>Right-of-Way</i>	0	\$0
	<i>Temporary Construction</i>	14,552	\$7,276
	<i>Drainage</i>	0	\$0
17	<i>Right-of-Way</i>	14,419	\$28,838
	<i>Temporary Construction</i>	19,816	\$9,908
	<i>Drainage</i>	0	\$0
18	<i>Right-of-Way</i>	13,665	\$54,660
	<i>Temporary Construction</i>	69,885	\$69,885
	<i>Drainage</i>	5,445	\$10,890

<b>Subtotal Right-of-Way Costs</b>	<b>\$383,604</b>
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**Utility Relocation Costs**

Based on preliminary information, it appears several of the existing utilities will need to be relocated. No subsurface investigations of existing facilities were performed during this study. Therefore, during final design, additional information should be obtained to evaluate more accurately the possibility of avoiding some of the facilities that have been assumed to need relocation in this study. The following tables provide a summary of potential utility relocations and opinions of relocation costs for those utilities located in private easement.

**179th/Quivira Intersection (North Leg)**

Utility Company	Description	Approx. Length (Lin. Ft.)	Cost/Ft.	Approximate Cost
				\$0
			<b>Subtotal =</b>	<b>\$0</b>

**Quivira (179th to 175th)**

Utility Company	Description	Approx. Length (Lin. Ft.)	Cost/Ft.	Approximate Cost
WaterOne	4" PVC Waterline	820	\$30	\$24,600
WaterOne	8" PVC Waterline	780	\$60	\$46,800
			<b>Subtotal =</b>	<b>\$71,400</b>

**175th/Quivira Intersection**

Utility Company	Description	Approx. Length (Lin. Ft.)	Cost/Ft.	Approximate Cost
WaterOne	8" PVC Waterline	730	\$60	\$43,800
WaterOne	36" Transmission Main*	470	\$240	\$112,800
			<b>Subtotal =</b>	<b>\$156,600</b>

**Quivira (175th to 167th)**

Utility Company	Description	Approx. Length (Lin. Ft.)	Cost/Ft.	Approximate Cost
WaterOne	36" Transmission Main*	1560	\$240	\$374,400
			<b>Subtotal =</b>	<b>\$374,400</b>

**167th/Quivira Intersection (South Leg)**

Utility Company	Description	Approx. Length (Lin. Ft.)	Cost/Ft.	Approximate Cost
WaterOne	36" Transmission Main*	350	\$240	\$84,000
			<b>Subtotal =</b>	<b>\$84,000</b>

**175th (179th to Quivira)**

<b>Utility Company</b>	<b>Description</b>	<b>Approx. Length (Lin. Ft.)</b>	<b>Cost/Ft.</b>	<b>Approximate Cost</b>
WaterOne	8" PVC Waterline	1520	\$60	\$91,200
WaterOne	36" Transmission Main*	250	\$240	\$60,000
			<b>Subtotal =</b>	<b>\$151,200</b>

\*Assumed relocation would be necessary when additional fill in excess of two feet is to be placed above 36" transmission main.

## **Construction Costs**

Detailed preliminary opinions of probable cost are shown on the following pages. Separate quantities and construction costs have been figured for each of the following:

- 179<sup>th</sup> Street & Quivira Road Intersection (North Leg)
- Quivira Road (179<sup>th</sup> Street to 175<sup>th</sup> Street)
- 175<sup>th</sup> Street & Quivira Road Intersection
- Quivira Road (175<sup>th</sup> Street to 167<sup>th</sup> Street)
- 167<sup>th</sup> Street & Quivira Road Intersection (South Leg)
- 175<sup>th</sup> Street (179<sup>th</sup> Street to Quivira Road)

2007 Preliminary Engineering Study Quantities/Construction Cost

Item Description	Unit	17th/Quivira Intersection		Quivira (178th to 178th)		175th/Quivira Intersection		Quivira (178th to 167th)		167th/Quivira Intersection		178th (178th to Quivira)	
		Approx. Quantity	Total	Approx. Quantity	Total	Approx. Quantity	Total	Approx. Quantity	Total	Approx. Quantity	Total	Approx. Quantity	Total
Clearing and Grubbing	Lump Sum	1	\$20,000	1	\$80,000	1	\$50,000	1	\$150,000	1	\$20,000	1	\$80,000
Removal of Existing Structures	Lump Sum	1	\$10,808	1	\$30,088	1	\$53,904	1	\$72,489	1	\$7,497	1	\$45,190
Pond Removal	Lump Sum	1	\$100,000	0	\$0	0	\$0	0	\$0	0	\$0	0	\$0
Unclassified Excavation	Cu. Yd.	929	\$11,148	24,285	\$291,420	37,368	\$448,416	22,052	\$264,824	1,028	\$12,336	17,897	\$214,764
Compaction of Earthwork (All Types)	Cu. Yd.	5,020	\$15,060	2,089	\$6,267	11,775	\$35,325	45,083	\$135,249	4,429	\$13,287	21,151	\$63,453
Embankment (Contractor Furnished)	Cu. Yd.	4,091	\$81,820	0	\$0	0,000	\$0	23,031	\$460,620	3,401	\$68,020	3,254	\$65,080
Asphaltic Concrete Surface Course	Tons	501	\$32,565	1,791	\$116,415	1,617	\$105,105	2,430	\$157,950	420	\$27,300	2,262	\$146,390
Asphaltic Concrete Intermediate Course	Tons	2,128	\$127,680	7,198	\$431,860	6,828	\$409,680	10,543	\$632,580	1,773	\$106,380	9,121	\$547,260
Manipulation for Fly Ash Treated Subgrade (8")	Sq. Yd.	4,778	\$14,334	16,945	\$50,835	15,400	\$46,200	24,585	\$73,755	4,021	\$12,063	21,353	\$64,059
Fly Ash	Tons	286	\$14,300	1,013	\$50,650	920	\$46,000	1,468	\$73,400	241	\$12,050	1,276	\$63,800
Aggregate Base Course (OP Special) (6")	Sq. Yd.	4,778	\$36,224	14,446	\$115,588	15,400	\$123,200	24,585	\$196,680	4,021	\$32,168	20,388	\$163,104
Curb and Gutter, Combined (Type B)	Lin. Ft.	1,019	\$15,285	3,764	\$56,460	3,419	\$51,285	7,138	\$107,070	928	\$13,920	6,017	\$90,255
Curb (Type D) (Doweled)	Lin. Ft.	895	\$8,950	3,009	\$30,090	2,769	\$27,690	7,138	\$71,380	814	\$8,140	1,246	\$12,460
Concrete Median Nose	Each	1	\$1,500	4	\$6,000	4	\$6,000	4	\$6,000	0	\$0	3	\$4,500
Concrete Paver Stones	Sq. Ft.	1,172	\$9,376	0	\$0	2,172	\$17,376	0	\$0	0	\$0	1,780	\$14,240
Concrete Entrance Pavement (6")	Sq. Yd.	0	\$0	0	\$0	87	\$5,655	0	\$0	0	\$0	70	\$4,550
Sidewalk Construction (4")	Sq. Ft.	2,636	\$10,544	8,285	\$33,140	11,081	\$44,324	35,476	\$141,904	4,548	\$18,192	14,544	\$58,176
Sidewalk Ramps (6")	Each	2	\$5,000	8	\$20,000	4	\$10,000	0	\$0	2	\$5,000	6	\$15,000
Plant Mix Bitum. Mix - Commercial Gr. (I.C.) (6") Bikepath	Tons	126	\$6,820	427	\$29,890	187	\$13,080	0	\$0	0	\$0	721	\$50,470
6" Pipe Underdrain (All Types)	Lin. Ft.	1,069	\$12,828	3,562	\$42,744	3,619	\$43,428	7,138	\$85,656	928	\$11,136	5,792	\$69,504
36" x 9' CONSPAN Bridge System	Lin. Ft.	0	\$0	0	\$0	0	\$0	0	\$0	0	\$0	0	\$0
5' x 5' Reinforced Concrete Box Culvert	Lin. Ft.	0	\$0	0	\$0	0	\$0	0	\$0	0	\$0	0	\$0
7' x 7' Reinforced Concrete Box Culvert	Lin. Ft.	0	\$0	0	\$0	0	\$0	0	\$0	0	\$0	0	\$0
Stone Rip Rap	Sq. Yd.	0	\$0	0	\$0	0	\$0	0	\$0	0	\$0	122	\$91,500
Bioretention Ponds	Sq. Ft.	0	\$0	0	\$0	0	\$0	0	\$0	0	\$0	150	\$9,000
Electric Lighting System	Lump Sum	0	\$0	0	\$0	0	\$0	8500	\$255,000	0	\$0	5850	\$175,500
Traffic Signal Installation	Lump Sum	0	\$0	1	\$100,000	0	\$0	1	\$200,000	0	\$0	1	\$200,000
Sod (Fescue)	Sq. Yd.	2,309	\$11,545	8,160	\$40,800	6,698	\$33,490	22,200	\$111,000	2,545	\$12,725	10,109	\$50,545
Seed (Buffalo Grass)	Sq. Yd.	0.7	\$1,400	1.1	\$2,200	1.2	\$2,400	5.1	\$10,200	0.3	\$600	2.2	\$4,400
Land Corner Monument Box	Each	1	\$82,679	0	\$0	1	\$1,500	1	\$1,500	1	\$1,500	1	\$1,500
Storm Sewer System	Lump Sum	1	\$22,048	1	\$259,361	1	\$259,361	1	\$54,541	1	\$57,348	1	\$345,704
Traffic Control	Lump Sum	1	\$11,024	1	\$61,378	1	\$69,163	1	\$147,878	1	\$15,293	1	\$92,188
Permanent Pavement Marking & Signaling	Lump Sum	1	\$13,780	1	\$30,689	1	\$34,582	1	\$73,939	1	\$7,647	1	\$46,094
Stormwater BMP	Lump Sum	1	\$8,268	1	\$38,362	1	\$43,227	1	\$92,424	1	\$9,558	1	\$57,618
Temporary Water Pollution Control	Lump Sum	1	\$16,536	1	\$23,017	1	\$25,937	1	\$55,455	1	\$5,735	1	\$34,571
Contractor Construction Staking	Lump Sum	1	\$705,522	1	\$1,964,095	1	\$51,873	1	\$4,732,083	1	\$489,365	1	\$2,950,006
Subtotal	Lump Sum	0	\$0	1	\$294,614	1	\$331,982	1	\$709,812	1	\$73,405	1	\$442,501
Contingency (15%)	Lump Sum	0	\$0	1	\$71,400	1	\$156,600	1	\$374,400	1	\$84,000	1	\$151,200
Utility Relocations	Lump Sum	1	\$64,169	1	\$164,991	1	\$243,733	1	\$999,838	1	\$86,425	1	\$383,604
R/W & Easement Acquisition	Lump Sum	1	\$875,519	1	\$2,485,100	1	\$2,945,526	1	\$6,816,133	1	\$733,195	1	\$3,927,311
<b>TOTAL</b>													

## ***APPENDIX***