POE & ASSOCIATES OF KANSAS, INC.
CONSULTING ENGINEERS
5940 E. Central, Suite 200 ■ Wichita, KS 67208-4242
Phone 316/685-4114 ■ FAX 316/685-4444

June 18, 1997

Mike Lindebak
City Engineer
Engineering Department
City Bldg.-7th Floor, 455 N. Main
Wichita, Kansas 67202

Re: Pump Station Capacity at The Moorings

Dear Mr. Lindebak:

We are in the process of platting property located north of The Moorings Addition and the property surrounding Harbor Isle Addition. We have proposed the use the existing pumping station at 45th Street North and Meridian to provide sewer service to both of these areas. This letter is to provide information regarding the required pumping capacity of the existing station to provide service to these areas.

The following sewage flows were calculated using an average daily water usage of 100 gallons per person, 3.0 people per dwelling and 3.0 times the average for peak flows.

Description	No. Lots	Peak Flow
Existing Lots - The Moorings	292	183 gpm
Existing Lots - Harbor Isle	67	42 gpm
Moorings North (proposed)	379	263 gpm
Harbor Isle 2nd Addn. (proposed)	165	103 gpm

Salvation Army	40 gpm
Riverlawn Christian Church	71 gpm *
Northside Church of Christ	14gpm *
Total	716 gpm

* The flow for the church was estimated from water usage provided by the City Water Department (34,000 gal. per month and 6750 gal. per month respectively) Only one months record for water usage was available from the Northside Church of Christ.

When all lots are built out in the existing Moorings Additions and all of the lots in Harbor Isle Addition are completed the sewage flows are calculated to be 350 gpm (this includes each church and the Salvation Army property). An additional 366 gpm will be added when all of the proposed 544 lots are fully developed. Our preliminary study shows that gravity service can be provided to all lots in Harbor Isle 2nd Addition by extending a 10" main at 0.2% grade. It also shows that only about the south 2/3 of the area in the Moorings North Addition can be served by gravity. A lift station could be installed to serve that part of the Moorings North which can not be served by a gravity sewer. The lift station would pump the sewage into the gravity system which is now connected to the existing pump station.

We anticipate construction of 35 to 40 new homes each year which will add 25 gpm per year.

The attached report which was prepared by George Butler Associates, indicates a 740 gpm pumping rate for the existing pumping station.

It appears that the existing pumping station will continue to provide service for quite some time. However infiltration rates for the existing system are unknown and will be a determining factor in the future service of the pumping station.

The pump motors and impellers can be sized to increase the capacity of the pumping station. This would probably be a relatively inexpensive modification. Unless the force main is replaced it will probably be the limiting factor in the station capacity. If the force main flow is increased to a maximum of 5 fps the pump station can be sized to pump 1150 gpm.

We recommend monitoring the flows into the station as this area develops and to have a plan to increase the capacity of the station when it is warranted by future development.

Sincerely,

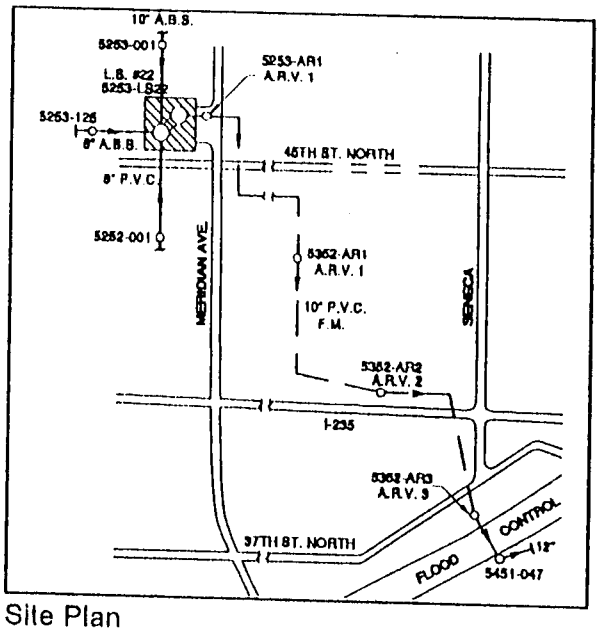
POE & ASSOCIATES of KANSAS, INC.

Kenny E. Hill, P.E.
Vice President

cc: Bill Bachman
Brad Bachman
Vicky Huang, P.E.
Mike Shoemaker, P.E.

A. **Background:**

Address:	4601 N. Meridian
Route:	North
Construction Date:	1978
Station Type:	BGP
Type of Pumps:	Vertical Centrifugal
Number of Pumps:	Two
Add. Pump Space:	None
Drainage Basin:	EC05
Force Main Dia.:	10"
Force Main Type:	PVC
Force Main Length:	10,412'
No. Air Rel. Valves:	4



Site Plan

B. **Station Inspection and Inventory:** An inspection and inventory of the lift station was made on June 10, 1994. The results of the inventory of the lift station components are located at the end of this section and in *Book No. 2 - Lift Station Field Manual - North Route.*

C. **Operator Comments:** The following comments were stated by the City staff and/or GBA personnel present during the station inspection:

1. Station does not contain a secondary power source.

D. **Station Testing:** A draw down test was performed on the station on June 10, 1994. The following table is a summary of the test results as shown on the Pump Station Testing Form at the end of this section:

	Pump No. 1	Pump No. 2	Pump No. 3
Pump Flow Rate (Gallons per Minute)			
Nameplate	700	700	N/A
Test Results	860	756	N/A
Pump Total Dynamic Head (Feet of Water)			
Nameplate	36	36	N/A
Test Results	24.7	32.7	N/A

E. Evaluation of Station Capacity:

1. *Evaluation of the Pump Curve(s)*: Copies of the manufacturer's pump curves for each pump in the lift station are included at the end of this section and in *Book No. 2 - Lift Station Field Manual - North Route*. The graph on Page IV-22-7 shows the manufacturer's pump curves for combinations of one or more pumps operating simultaneously. The graph also shows the test points resulting from the "draw down" tests. The fact that the test points are slightly below the manufacturer's pump curve for one pump operating indicates that the pumps have lost some capacity due to worn or bent impellers.

2. *Evaluation of the System Curve*: Using the results of the draw down testing and the layout of the piping and force main as shown on the station plans, a system curve was derived that approximates existing conditions. The estimated system curve can also be seen on the graph on Page IV-22-7.

   As shown on the Pump Station Testing Form at the end of this section, the pressure readings and the pump "on" times were steadily increasing during the draw down testing of both pumps. This indicates that the system was not in a steady state condition. After reviewing the as-builts it was noted that the force main leaving the station (El. 135.70) is higher than the discharge of the force main (El. 128.65). The as-builts also show an air release valve at the force main leaving the station which slowly allows air into the force main during the period when the pumps are "off".

   Therefore, during normal operating conditions, the force main remains in a partially empty state. However, during the pump testing, the force main was filling up due to the different operating conditions of shorter more frequent pump cycles. Each operation of the pumps during the testing brought the flow rate and total dynamic head (TDH) closer to the natural operating point of the system when the force main is full. Using the flow rate into the station, the times and pressure recorded for the last cycle of Pump No. 2, a flow rate of 726.6 gpm at 32.3 feet of TDH. This is close to the design point of 700 gpm at 36 feet of TDH.

   It was estimated that when the force main filled completely under high flow conditions the system curve would approximate that shown on the graph on Page IV-22-7.

3. *Evaluation of the Station Capacity*: From the intersection of the manufacturer's pump curve and existing system curves, the following table describes the approximate lift station capacity:

Pump Condition	Station Capacity (in gpm)		
	One Pump Operating	Two Pumps Operating	Three Pumps Operating
Optimal (w/ new impellers)	655	755	N/A
Current	640	740	N/A

F. **Evaluation of Growth Potential To Station:** The area tributary to the station and the tributary sewer listed in inch-diameter-mile, both currently and in the year 2010, are as follows:

Basin Characteristics	Currently	Year 2010
Developed Area (Acres):	140	142
Tributary Sewer (idm):	35.6	36.2

The following flow rates and basin coefficients for the area tributary to the station were obtained from the flow monitoring performed for the *Sewer Master Plan.*

Flow Monitoring Basin:	EC05
Wastewater Production, WWP (MGD/Ac.):	0.00035
Peaking Factor for Wastewater Production:	1.50
Basin Infiltration Rate (gpd/idm):	201
Inflow Coefficient, "K":	0.00648
10-year Peak Rainfall Intensity (in/hr):	1.9

Using the above areas, tributary sewers, flow rates and coefficients, the following table estimates the peak flow rate to the station for current development and for development in the year 2010:

Tributary Flow Components	Current	Future
Peak WWP (gpm)	51	52
Infiltration Rate (gpm)	5	5
Inflow Rate (gpm)	774	785
Peak WWP and I/I Rate (gpm)	830	842

The above table shows that the future peak flow rate is 1.1 times higher than the current capacity of the station as described in Paragraph E. Due to storage capacity in the interceptors upstream of the wet well and the increase in the pump capacity as the water surcharges in the wet well, the ratio of 1.1 is considered acceptable. However, it is recommended that monitoring of the station's capacity be incorporated into the Preventative Maintenance Program to forecast further losses in capacity.

G. Evaluation of Pump Operation and Maintenance History:

1. Operation History: The following table represents the operation of the pumpsbetween September 1993 and June 1994:

Pump Operation Conditions	Hours of Pump Operation Per Day	
	Pump No. 1	Pump No. 2
Min. Month (April 1994)	0.323	0.320
Max. Month (June 1994)	0.608	0.381
Average (Sept. 1993 - June 1994)	0.383	0.480

The above table indicates that Pump No. 2 operates 6 minutes more each day than Pump No. 1. The table also suggests that the station pumps approximately 11 hours more during the maximum month than during the minimum month - a peak month ratio of 1.5.

2. Maintenance History: The following table shows the lift station alarm conditions reported by the SCADA system for the last year and lists the costs required to respond to the alarm and remedy the problem:

Date	Alarm Types	Actual Problems	Emergency Callout Cost
28-Jul-93	Data Fail (SCADA)	System OK	$36.64
21-Sep-93	Data Fail (SCADA)	System OK	$36.64
16-Nov-93	Power Failure	KG&E Problem	$45.80
Annual Emergency Callout Cost			$119.08

The alarms regarding the data fail with the SCADA system are normal alarms which can't be predicted or prevented. The power failure alarm can be prevented by installing an emergency power generator.

Based on the estimated annual operation and maintenance costs provided by the Sewage Treatment Division and the annual emergency callout costs, the following table estimates the annual costs to operate and maintain the lift station:

Annual Operation and Maintenance Cost	$4,774.00
Annual Emergency Callout Cost	$119.08
Total Annual O & M Cost	$4,893.08
Present Worth Cost of O & M Costs (1995-2010)	$52,879.52

(Note: Present worth was obtained using an annual inflation rate of 4% and an annual interest rate of 8%)

H. Evaluation of Cost-Effective Removal of Station:

1. Determination of Present Worth Lift Station Costs:

Based on recommendations regarding improvements to this lift station, the following table estimates the present worth of future station improvement costs:

Improvement Items	Future Cost	Date	Present Worth Cost
1. Install Emergency Generator	$14,000.00	1995	$14,000.00
2. Reline Inside of Wet Well	$6,000.00	1995	$6,000.00
3. Replace Impellers and Motors	$14,599.83	2000	$9,936.40
4. Replace Impellers	$6,303.30	2010	$1,987.06
Present Worth Cost of Station Improvements			$31,923.47

(Note: Present worth was obtained using an annual inflation rate of 4% and an annual interest rate of 8%)

The following table represents the present worth cost (1995-2010) to keep the station in service and meeting the capacity estimated for future development:

Operation and Maintenance	$52,879.52
Station Improvements	$31,923.47
Total Cost	$84,802.98

(Note: Present worth was obtained using an annual inflation rate of 4% and an annual interest rate of 8%)

2. Determination of Planning Level Construction Costs for a Gravity Sewer to Replace Lift Station: Based on information from the collection system network, the closest point in the collection system which has the capacity to accept the additional flows from the pump station was not within 5280 feet of the lift station. Therefore, removal of the station from service was not pursued further.

I. **Recommendations**:

1. Install emergency power generator for the lift station.
2. Reline inside of wet well to remove infiltration.