# ENGINEERING REPORT

## OF

## PROPOSED WATER SUPPLY SYSTEM ADDITIONS

## FOR

## NORTHERN HEIGHTS ESTATES II SUBDIVISION
## PULASKI COUNTY, MISSOURI, AN
## ADDITION TO NORTHERN HEIGHTS ESTATES SUBDIVISION

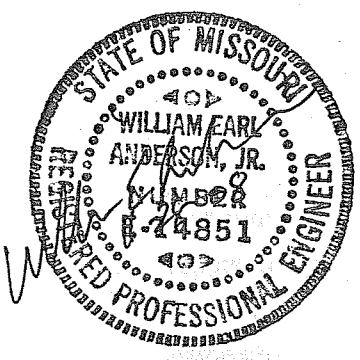
## FOR

## HIGHWAY H UTILITIES, INC.
## P.O. BOX 308
## WAYNESVILLE, MISSOURI 65583

## BY


ANDERSON
& ASSOCIATES
Consulting Engineers, LLC

1511 Watts Drive ❖ P.O. Box 806
Rolla, Missouri 65402-0806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# APPENDICES

# I. GENERAL INFORMATION

## A. Operating Authority

The proposed development is "*Northern Heights Estates II Subdivision*" located adjacent to Northern Heights Estates Subdivision just North of Waynesville, Missouri and East of Missouri Highway 17, in Pulaski County, Missouri. As per the site map attached as Appendix A, the subdivision addition is located in a portion of Section 12 of Township 36 North, Range 12 West of the 5th Principal Meridian and encompasses approximately 160 acres which will be developed into 133 single family home lots (117 to be developed as home lots) with roads and utility areas. The system's continuing operating authority will be: Highway "H" Utilities, a Public Service Commission Regulated Utilities, P.O. Box 308, Waynesville, Missouri 65583. Northern Heights Estates II will not have a home owners association.

Financial information on Highway "H" Utilities is included in Appendix E.

## B. Proposed Water and Sewer Systems Additions

The water supply system addition will consist of a deep well with a submersible electric pump, a hydropneumatric storage tank and small diameter PVC pipe distribution system. The sewage system will be a Septic Tank Effluent Pump (STEP) system delivering the partially treated sewage to a recirculating sand filter treatment plant to be located adjacent to the existing sewage treatment plant. The treated effluent will be discharged to an unnamed tributary of the Gasconade River.

The area served will be the proposed *Northern Heights Estates II Subdivision.*

## C. Description of Area Served

The subdivision is located in a portion of Section 12 of Township 36 North, Range 12 West of the 5th Principal Meridian and encompasses approximately 160 acres which will

be developed into 133 single family home lots with roads and utility areas as shown in Figure 1, Appendix A.

## II EXTENT OF THE WATER SYSTEM ADDITION

### A. Nature and Extent of the System Addition

The nature of the development will be single family homes on a high ridge top.

The extent of the water system addition will be the boundary of *Northern Heights Estates II Subdivision* as shown on the attached site map in Appendix A.

### B. Provisions for Extension

Provisions have been made to extend the system to the East and South by extending the 3-inch and 4-inch mains respectively.

### C. Future Service

The projected future requirements will be 133 single family lots.

### D. Water Usage Rate

The usage rates based upon Missouri Department of Natural Resources guidelines and water production records from Highway H Utilities, Inc. at other subdivisions are projected to be an average of 75 gallons per capita per day. With a projected occupancy rate of 3.7 persons per household that projects to 277.5 gallons per day per house. The entire addition,

if fully developed at 133 homes, would have an average demand of 36,908 gallons per day or 25.6 gallons per minute (gpm).

### E. Peak Flow Rates

Peak Flow rates will be considered to be 165 gallons per minute (gpm) based upon 1 gpm per connection plus 30 gpm for irrigation uses. Fire flows were not considered in sizing the system components.

## III ALTERNATIVE PLANS

Alternative sources of water supply considered included the City of Waynesville and Public Water Supply District No. 2 of Pulaski County. The nearest connecting part of the Waynesville system is over 1.5 miles away and is a relatively low pressure system at a much lower elevation than *Northern Heights Subdivision II*. Pulaski County Public Water Supply District No. 2 does not have service available in the area.

## IV SOIL AND GROUNDWATER CONDITIONS

The shallow soils at *Northern Heights Subdivision* are residual clays with sand and cherty rock. All buried PVC water mains will have to be bedded with select backfill material of sand or crushed baserock to protect the pipe against damage from cherty rock.

# V FLOW REQUIREMENTS

## A. HYDRAULIC ANALYSIS

The well, pump, hydropneumatic storage tanks, and the distribution system have been designed to adequately deliver the anticipated peak flow rates of 163 gpm at a minimum residual pressure of 35 psi at ground level.

The hydraulic calculations are presented in Appendix B.

## B. FIRE FLOWS

Fire flows were not included in the sizing of *Northern Heights Estates Subdivision* system.

# VI. SOURCE OF SUPPLY

## A. LEGAL DESCRIPTION

The proposed well and hydropneumatic tank site is located in the SE¼ of the SE¼ of the NW¼ of Section 12, Township 36 North, Range 12 West, Pulaski County, Missouri on an unplated portion of *Northern Heights Estates II Subdivision*.

## B. ADVANTAGES OF SITE

The advantages of the well and hydropneumatic tank site include its elevation (approximately 970 feet), being adjacent to a subdivision road, it's relative unobtrusive location behind two lots and it's safe distance from the sewage treatment plant site and any other potential pollution sources. It is also relatively close to three phase power which will be required for the 25 horsepower submersible pump.

## C. Elevation of the Well Site

The elevation of the well and hydropneumatic tank site is approximately 970 feet. The high and low house site service elevations of the subdivision are approximately 1,001 feet and approximately 920 feet, respectively.

## D. Character of the Formations

The probable character of the formations through which the water source is to be developed are listed in the Missouri Department of Natural Resources, Division of Geology and Land Survey report and are as follows:

**STRATIGRAPHY**

| | | | LITHOLOGY | | |
|---|---|---|---|---|---|
| TOP | BOT | FORMATION NAME | PRIMARY | SECONDARY | MINOR |
| 0 | 15 | Residuum & Top Soil | Chert | Clay | |
| 15 | 360 | Ordovician System | | | |
| 15 | 360 | Canadian (Ibexian) Series | | | |
| 15 | 50 | Roubidoux Formation | Dolomite | Chert | Sand |
| 50 | 360 | Gasconade Dolomite | Dolomite | Chert | Sand |
| 50 | 115 | Upper Gasconade Dolomite | Dolomite | Chert | Sand |
| 115 | 345 | Lower Gasconade Dolomite | Dolomite | Chert | |
| 345 | 360 | Gunter Sandstone Member | Dolomite | Sand | Chert |
| 345 | 360 | Gunter Sandstone Member | Dolomite | Sand | Chert |
| 360 | 1030 | Cambrian System | | | |
| 360 | 1030 | Upper Cambrian Series | | | |
| 360 | 665 | Eminence Dolomite | Dolomite | Chert | |
| 665 | 900 | Potosi Dolomite | Dolomite | | Chert |
| 900 | 1020 | Derby-Doerun Dolomite | Dolomite | Siltstone | Chert |

The proposed subdivision is located in the Ozark Highland Physiographic Province. A review of the published literature indicates the site is underlain by either the Roubidoux Formation or the Jefferson City Dolomite Formation of Ordovician Age. The Roubidoux Formation consists of dolomite, chery dolomite, sandy dolomite, dolomitic

sandstone and sandstone. The dolomite in the Roubidoux Formation is finely crystalline, light-gray to brown and thinly to thickly bedded. The sandstone is composed of fine to medium grained quartz sand which characteristically is subrounded and frosted. Gray and brown are predominant on weathered surfaces, but the color of fresh sandstone is commonly light yellow, tan or red at the surface and white in the subsurface. The thickness of the Roubidoux ranges from 100 to 250 feet.

The Gasconade Dolomite Formation consists of light gray, medium to coarsely crystalline, thin to thick bedded, cherty dolomite, divisible into two units. The upper unit is a massive bedded, relatively cherty-free dolomite, that forms bluffs and pinnacled glades. The upper unit consists of vuggy, medium to coarse crystalline and weathers to a coarsely pitted surface.. It also consists of sparse dark gray or brown chert nodules or stringers with some druse. The thickness of the unit ranges from 40 to 70 feet. The lower unit is similar to the upper unit but contains 30 to 50 percent chert. The lower unit is light gray, medium to coarsely crystalline dolomite, containing thin beds or nodules of white to gray porcelaneous chert. Cryptozoan structures are common in the upper portion of the lower unit by a persistent, locally silicified cryptozoan reef two (2) to eight (8) feet thick. Thin beds of silicified oolites are common, as are karst features such as solution cavities (caves), sinkholes and weather joints or seams. The entrance to Pike's Peak Cave is located approximately 2,500 feet West by Southwest of the well head.

## E. Existing Wells

Missouri Department of Natural Resources, Geological Survey & Resource Assessment Division records do not show any existing wells within a 1,000 foot radius of the proposed well head. The existing well for Northern Heights Estates Subdivision is approximately 3,700 feet to the South.

A summary of the well records in the extended area are shown in Appendix C.

## F. Sources of Possible Contamination

The records available do not show any possible sources of contamination within a 1,000 foot radius. Missouri Highway 17 is located approximately 5,000 feet to the South

at an elevation of approximately 800 feet. Roubidoux Creek is approximately 5,100 feet to the South and the Gasconade River is approximately 4,000 feet to the North and 9,000 feet to the West.

## G. Known Aquifers

The well is anticipated to fully penetrate the Ozark aquifer and bottom in the Derby-Doerun Dolomite and is anticipated to yield 200 to 300 gallons per minute (see Appendix D). There are no known aquifers that would reduce yield.

## H. Depth of Aquifers

The anticipated depth of the Ozark aquifer is 800 to 1,000 feet per Missouri Department of Natural Resources recommendations shown in Appendix D.

## I. Well Head Protection

Well head protection measures will include casing and grouting the well to a minimum depth of 400 feet and building a well house around the well head with an elevated concrete floor. All sewage collection treatment will be by a Septic Tank Effluent Pumped-Recirculating Sand Filter which will discharge to the Gasconade watershed at a point approximately 1,000 feet to the South of the new well.