MISSOURI
DEPARTMENT OF
NATURAL RESOURCES

Michael L. Parson
Governor

Dru Buntin
Director

February 14, 2023

Forbes Lake of the Ozarks Park
26506 Gardiner Road
Edwards, MO 65326

RE: Forbes Lake of the Ozarks Park Residential Housing Development

To Whom It May Concern:

From November 30, 2022 to December 6, 2022, four geologists with the Missouri Geological Survey conducted a geohydrologic evaluation of the 12,800 acre Forbes Lake of the Ozarks Park. The property is located east of Warsaw and south of Lake of the Ozarks. The purpose of the onsite evaluation was to observe the geologic and hydrologic characteristics at the proposed residential housing development and to determine potential impacts to the state's water resources in the event of wastewater treatment failure.

The property has been subdivided into three zones based on the observed geologic and hydrologic characteristics. The following table summarizes the minimum lot size required for each zone with the designated water supply. A map showing the three zones follows this report.

Geologic Zone	Water Supply	Minimum Lot Size
Zone 1	Community Public Water Supply	3.6
Zone 1	Multifamily Wells or Individual Domestic Wells with Full Length Grout	4.0
Zone 1	Individual Domestic Wells	4.8
Zone 2	Community Public Water Supply	4.4
Zone 2	Multifamily Wells or Individual Domestic Wells with Full Length Grout	4.8
Zone 2	Individual Domestic Wells	5.0
Zone 3	Community Public Water Supply	5.0
Zone 3	Multifamily Wells or Individual Domestic Wells with Full Length Grout	5.0
Zone 3	Individual Domestic Wells	5.0

Surficial materials on the property have variable organic matter content but are routinely very gravelly silty clay below a thin layer of topsoil. The surficial materials are less than

five feet in thickness across the site, with many locations having zero to less than one foot of soil. These residual materials developed in place from the weathering of dolomite bedrock. They display moderate to high permeability. Due to the thinness and permeability of the surficial materials, the potential for effluent perching on lower permeability bedrock and surfacing is high.

Bedrock is found at the surface across much of the site. The observed bedrock formations are predominantly Ordovician-aged dolomites: The Jefferson City-Cotter Dolomite, the Roubidoux Formation, and the Gasconade Dolomite. Remnant channel sandstones of Pennsylvanian-age are found on some ridgetops. These sandstones are areally limited do no factor into the sitewide hydrology.

The dolomites have low to moderate primary permeability but high secondary permeability where dissolution along fractures, joints, and bedding planes has created karst features. The prevalence of the observed karst development is the basis upon which the site has been divided into geologic zones.

No karst features were identified in Zone 1, and only incipient dissolution, primarily along waterways and the lakeshore, was observed. Zone 2 includes all areas within one mile of observed karst features such as caves and sinkholes. Zone 3 has pervasive karst development. These karst features are conduits through which water or wastewater can rapidly recharge into the drinking water aquifer.

In the event of wastewater treatment failure, the local groundwater as well as the surface waters of area streams and the Lake of the Ozarks may be adversely impacted.

If you have any questions, please feel free to contact me at 573-368-2162 or via email at molly.starkey@dnr.mo.gov. The map of the geologic zones in the development and the completed forms for each zone and water supply are enclosed.

Sincerely,

MISSOURI GEOLOGICAL SURVEY

Molly A. Starkey

Molly Starkey, RG
Environmental Assistance Unit

Enclosures

c: Chuck Harwood, Water Protection Program
Kansas City Regional Office

Missouri Department Of Natural Resources
Missouri Geological Survey
Geological Survey Program
Environmental Geology Section

Project ID Number
RHD23034
County
Benton County

Request Details

Project: Forbes Lake Ozark Zone 1 - Public Wells

Legal Description: 22 T40N R21W

Quadrangle: EDWARDS
Latitude: 38 13 41.54
Longitude: -93 14 11.19

Organization Official

Name: Forbes Environmental Control Committee
Address: 26506 Gardiner Rd
City: Edwards
State: MO Zip: 65326
Phone: 660-438-4093
Email: ecc@forbesmo.org

Preparer

Name: Charles Harwood
Address: 1101 Riverside Dr
City: Jefferson City
State: MO Zip: 65101
Phone: 573-751-9155
Email: charles.harwood@dnr.mo.gov

Project Details

Report Date: 02/17/2023
Date of Field Visit: 11/30/2022
Project Exempt: No

Previous Reports: RHD23019
RHD23020
RHD23021
RHD23031

Upper Bedrock

- [ ] 0.0 Surficial materials greater than 20 feet thick or bedrock generally displays low permeability
- [ ] 0.1 Bedrock has moderate to high near-surface relatively low permeability at depth
- [x] 0.4 Bedrock has persistent open fractures and/or moderate to high permeability
- [ ] 1.2 Bedrock displays well developed karst features

Surficial Materials Type

- [ ] 0.0 Clay: Glacial drift or residuum with low permeability
- [ ] 0.1 Silt/Sand, Loess, silty and sandy alluvium, moderate permeability
- [x] 0.4 Gravel: gravelly alluvium and residuum,
- [ ] 1.2 Macropore permeability: relict bedrock structure residuum

Water Supply

- [x] 0.0 Community Public Water Supply
- [ ] 0.1 Non-community public water supply
- [ ] 0.4 Multi-family wells
- [ ] 1.2 Individual Domestic Wells

Surficial Material Thickness

- [ ] 0.0 Greater than 20 feet
- [ ] 0.1 Greater than 10 feet but less than or equal to 20 feet
- [ ] 0.4 Greater than 5 feet but less than or equal to 10 feet
- [x] 1.2 Less than 5 feet

Approximate Groundwater Velocity

- [ ] 0.0 Low to moderate
- [x] 1.2 High

Watershed Hydrology

- [ ] 0.0 Limited recharge
- [x] 0.4 Local recharge
- [ ] 1.2 Regional recharge

This evaluation is not an approval under the current residential housing development rules and pertains only to groundwater contamination potential. This report is valid for one year only at the location specified.

Minimum Lot Size: **3.6 acres** Total of rating numbers for all categories equals minimum lot size in acres.

Missouri Department Of Natural Resources
Missouri Geological Survey
Geological Survey Program
Environmental Geology Section

Project ID Number
RHD23034
County
Benton County

Remarks:

From November 30, 2022 to December 6, 2022, four geologists with the Missouri Geological Survey conducted a geohydrologic evaluation of the 12,800 acre Forbes Lake of the Ozarks Park. The property is located east of Warsaw and south of Lake of the Ozarks. The purpose of the onsite evaluation was to observe the geologic and hydrologic characteristics at the proposed residential housing development and to determine potential impacts to the state's water resources in the event of wastewater treatment failure.

Surficial materials on the property have variable organic matter content but are routinely very gravelly silty clay below a thin layer of topsoil. The surficial materials are less than five feet in thickness across the site, with many locations having zero to less than one foot of soil. These residual materials developed in place from the weathering of dolomite bedrock. They display moderate to high permeability. Due to the thinness and permeability of the surficial materials, the potential for effluent perching on lower permeability bedrock and surfacing is high.

Bedrock is found at the surface across much of the site. The observed bedrock formations are predominantly Ordovician-aged dolomites: The Jefferson City-Cotter Dolomite, the Roubidoux Formation, and the Gasconade Dolomite. Remnant channel sandstones of Pennsylvanian-age are found on some ridgetops. These sandstones are areally limited do no factor into the sitewide hydrology.

The dolomites have low to moderate primary permeability but high secondary permeability where dissolution along fractures, joints, and bedding planes has created karst features. The prevalence of the observed karst development is the basis upon which the site has been divided into geologic zones. No karst features were identified in Zone 1, and only incipient dissolution, primarily along waterways and the lakeshore, was observed.

The minimum required lot size for lots served by a public water supply or community public water supply well is 3.6 acres. In the event of wastewater treatment failure, the local groundwater as well as the surface waters of area streams and the Lake of the Ozarks may be adversely impacted.

Missouri Department Of Natural Resources
Missouri Geological Survey
Geological Survey Program
Environmental Geology Section

Project ID Number
RHD23031
County
Benton County

Request Details

Project: Forbes Lake Ozark Zone 1 - Individual Wells

Legal Description: 22 T40N R21W

Quadrangle: EDWARDS
Latitude: 38 13 37.67
Longitude: -93 14 12.73

Organization Official

Name: Forbes Environmental Control Committee
Address: 26506 Gardiner Rd
City: Edwards
State: MO Zip: 65326
Phone: 660-438-4093
Email: ecc@forbesmo.org

Preparer

Name: Charles Harwood
Address: 1101 Riverside Dr
City: Jefferson City
State: MO Zip: 65101
Phone: 573-751-9155
Email: charles.harwood@dnr.mo.gov

Project Details

Report Date: 02/17/2023
Date of Field Visit: 11/30/2022
Project Exempt: No

Previous Reports: RHD23019
RHD23020
RHD23021

Upper Bedrock

- [ ] 0.0 Surficial materials greater than 20 feet thick or bedrock generally displays low permeability
- [ ] 0.1 Bedrock has moderate to high near-surface relatively low permeability at depth
- [x] 0.4 Bedrock has persistent open fractures and/or moderate to high permeability
- [ ] 1.2 Bedrock displays well developed karst features

Surficial Materials Type

- [ ] 0.0 Clay: Glacial drift or residuum with low permeability
- [ ] 0.1 Silt/Sand, Loess, silty and sandy alluvium, moderate permeability
- [x] 0.4 Gravel: gravelly alluvium and residuum,
- [ ] 1.2 Macropore permeability: relict bedrock structure residuum

Water Supply

- [ ] 0.0 Community Public Water Supply
- [ ] 0.1 Non-community public water supply
- [ ] 0.4 Multi-family wells
- [x] 1.2 Individual Domestic Wells

Surficial Material Thickness

- [ ] 0.0 Greater than 20 feet
- [ ] 0.1 Greater than 10 feet but less than or equal to 20 feet
- [ ] 0.4 Greater than 5 feet but less than or equal to 10 feet
- [x] 1.2 Less than 5 feet

Approximate Groundwater Velocity

- [ ] 0.0 Low to moderate
- [x] 1.2 High

Watershed Hydrology

- [ ] 0.0 Limited recharge
- [x] 0.4 Local recharge
- [ ] 1.2 Regional recharge

This evaluation is not an approval under the current residential housing development rules and pertains only to groundwater contamination potential. This report is valid for one year only at the location specified.

Minimum Lot Size: **4.8 acres** Total of rating numbers for all categories equals minimum lot size in acres.

Missouri Department Of Natural Resources
Missouri Geological Survey
Geological Survey Program
Environmental Geology Section

Project ID Number
RHD23031
County
Benton County

Remarks:

From November 30, 2022 to December 6, 2022, four geologists with the Missouri Geological Survey conducted a geohydrologic evaluation of the 12,800 acre Forbes Lake of the Ozarks Park. The property is located east of Warsaw and south of Lake of the Ozarks. The purpose of the onsite evaluation was to observe the geologic and hydrologic characteristics at the proposed residential housing development and to determine potential impacts to the state's water resources in the event of wastewater treatment failure.

Surficial materials on the property have variable organic matter content but are routinely very gravelly silty clay below a thin layer of topsoil. The surficial materials are less than five feet in thickness across the site, with many locations having zero to less than one foot of soil. These residual materials developed in place from the weathering of dolomite bedrock. They display moderate to high permeability. Due to the thinness and permeability of the surficial materials, the potential for effluent perching on lower permeability bedrock and surfacing is high.

Bedrock is found at the surface across much of the site. The observed bedrock formations are predominantly Ordovician-aged dolomites: The Jefferson City-Cotter Dolomite, the Roubidoux Formation, and the Gasconade Dolomite. Remnant channel sandstones of Pennsylvanian-age are found on some ridgetops. These sandstones are areally limited do no factor into the sitewide hydrology.

The dolomites have low to moderate primary permeability but high secondary permeability where dissolution along fractures, joints, and bedding planes has created karst features. The prevalence of the observed karst development is the basis upon which the site has been divided into geologic zones. No karst features were identified in Zone 1, and only incipient dissolution, primarily along waterways and the lakeshore, was observed.

The minimum required lot size for individual domestic wells in this zone is 4.8 acres. In the event of wastewater treatment failure, the local groundwater as well as the surface waters of area streams and the Lake of the Ozarks may be adversely impacted.

Missouri Department Of Natural Resources
Missouri Geological Survey
Geological Survey Program
Environmental Geology Section

Project ID Number
RHD23033
County
Benton County

Request Details

Project: Forbes Lake Ozark Zone 1 - Multifamily Wells

Legal Description: 22 T40N R21W

Quadrangle: EDWARDS
Latitude: 38 13 42.19
Longitude: -93 14 11.87

Organization Official

Name: Forbes Environmental Control Committee
Address: 26506 Gardiner Rd
City: Edwards
State: MO Zip: 65326
Phone: 660-438-4093
Email: ecc@forbesmo.org

Preparer

Name: Charles Harwood
Address: 1101 Riverside Dr
City: Jefferson City
State: MO Zip: 65101
Phone: 573-751-9155
Email: charles.harwood@dnr.mo.gov

Project Details

Report Date: 02/17/2023
Date of Field Visit: 11/30/2022
Project Exempt: No

Previous Reports: RHD23019
RHD23020
RHD23021
RHD23031

Upper Bedrock

- [ ] 0.0 Surficial materials greater than 20 feet thick or bedrock generally displays low permeability
- [ ] 0.1 Bedrock has moderate to high near-surface relatively low permeability at depth
- [x] 0.4 Bedrock has persistent open fractures and/or moderate to high permeability
- [ ] 1.2 Bedrock displays well developed karst features

Surficial Materials Type

- [ ] 0.0 Clay: Glacial drift or residuum with low permeability
- [ ] 0.1 Silt/Sand, Loess, silty and sandy alluvium, moderate permeability
- [x] 0.4 Gravel: gravelly alluvium and residuum,
- [ ] 1.2 Macropore permeability: relict bedrock structure residuum

Water Supply

- [ ] 0.0 Community Public Water Supply
- [ ] 0.1 Non-community public water supply
- [x] 0.4 Multi-family wells
- [ ] 1.2 Individual Domestic Wells

Surficial Material Thickness

- [ ] 0.0 Greater than 20 feet
- [ ] 0.1 Greater than 10 feet but less than or equal to 20 feet
- [ ] 0.4 Greater than 5 feet but less than or equal to 10 feet
- [x] 1.2 Less than 5 feet

Approximate Groundwater Velocity

- [ ] 0.0 Low to moderate
- [x] 1.2 High

Watershed Hydrology

- [ ] 0.0 Limited recharge
- [x] 0.4 Local recharge
- [ ] 1.2 Regional recharge

This evaluation is not an approval under the current residential housing development rules and pertains only to groundwater contamination potential. This report is valid for one year only at the location specified.

Minimum Lot Size: **4.0 acres** Total of rating numbers for all categories equals minimum lot size in acres.

Missouri Department Of Natural Resources
Missouri Geological Survey
Geological Survey Program
Environmental Geology Section

Project ID Number
RHD23033
County
Benton County

Remarks:

From November 30, 2022 to December 6, 2022, four geologists with the Missouri Geological Survey conducted a geohydrologic evaluation of the 12,800 acre Forbes Lake of the Ozarks Park. The property is located east of Warsaw and south of Lake of the Ozarks. The purpose of the onsite evaluation was to observe the geologic and hydrologic characteristics at the proposed residential housing development and to determine potential impacts to the state's water resources in the event of wastewater treatment failure.

Surficial materials on the property have variable organic matter content but are routinely very gravelly silty clay below a thin layer of topsoil. The surficial materials are less than five feet in thickness across the site, with many locations having zero to less than one foot of soil. These residual materials developed in place from the weathering of dolomite bedrock. They display moderate to high permeability. Due to the thinness and permeability of the surficial materials, the potential for effluent perching on lower permeability bedrock and surfacing is high.

Bedrock is found at the surface across much of the site. The observed bedrock formations are predominantly Ordovician-aged dolomites: The Jefferson City-Cotter Dolomite, the Roubidoux Formation, and the Gasconade Dolomite. Remnant channel sandstones of Pennsylvanian-age are found on some ridgetops. These sandstones are areally limited do no factor into the sitewide hydrology.

The dolomites have low to moderate primary permeability but high secondary permeability where dissolution along fractures, joints, and bedding planes has created karst features. The prevalence of the observed karst development is the basis upon which the site has been divided into geologic zones. No karst features were identified in Zone 1, and only incipient dissolution, primarily along waterways and the lakeshore, was observed.

The minimum lot size required for multifamily wells or individual domestic wells with full length grout is 4 acres. In the event of wastewater treatment failure, the local groundwater as well as the surface waters of area streams and the Lake of the Ozarks may be adversely impacted.

Missouri Department Of Natural Resources
Missouri Geological Survey
Geological Survey Program
Environmental Geology Section

Project ID Number
RHD23036
County
Benton County

Request Details

Project: Forbes Lake Ozark Zone 2 - Public Wells

Legal Description: 19 T40N R20W

Quadrangle: EDWARDS
Latitude: 38 13 31.57
Longitude: -93 11 22.2

Organization Official

Name: Forbes Environmental Control Committee
Address: 26506 Gardiner Rd
City: Edwards
State: MO Zip: 65326
Phone: 660-438-4093
Email: ecc@forbesmo.org

Preparer

Name: Charles Harwood
Address: 1101 Riverside Dr
City: Jefferson City
State: MO Zip: 65101
Phone: 573-751-9155
Email: charles.harwood@dnr.mo.gov

Project Details

Report Date: 02/17/2023
Date of Field Visit: 11/30/2022
Project Exempt: No

Previous Reports: Not Applicable

Upper Bedrock

- [ ] 0.0 Surficial materials greater than 20 feet thick or bedrock generally displays low permeability
- [ ] 0.1 Bedrock has moderate to high near-surface relatively low permeability at depth
- [ ] 0.4 Bedrock has persistent open fractures and/or moderate to high permeability
- [x] 1.2 Bedrock displays well developed karst features

Surficial Materials Type

- [ ] 0.0 Clay: Glacial drift or residuum with low permeability
- [ ] 0.1 Silt/Sand, Loess, silty and sandy alluvium, moderate permeability
- [x] 0.4 Gravel: gravelly alluvium and residuum,
- [ ] 1.2 Macropore permeability: relict bedrock structure residuum

Water Supply

- [x] 0.0 Community Public Water Supply
- [ ] 0.1 Non-community public water supply
- [ ] 0.4 Multi-family wells
- [ ] 1.2 Individual Domestic Wells

Surficial Material Thickness

- [ ] 0.0 Greater than 20 feet
- [ ] 0.1 Greater than 10 feet but less than or equal to 20 feet
- [ ] 0.4 Greater than 5 feet but less than or equal to 10 feet
- [x] 1.2 Less than 5 feet

Approximate Groundwater Velocity

- [ ] 0.0 Low to moderate
- [x] 1.2 High

Watershed Hydrology

- [ ] 0.0 Limited recharge
- [x] 0.4 Local recharge
- [ ] 1.2 Regional recharge

This evaluation is not an approval under the current residential housing development rules and pertains only to groundwater contamination potential. This report is valid for one year only at the location specified.

Minimum Lot Size: **4.4 acres** Total of rating numbers for all categories equals minimum lot size in acres.

Missouri Department Of Natural Resources
Missouri Geological Survey
Geological Survey Program
Environmental Geology Section

Project ID Number
RHD23036
County
Benton County

Remarks:

From November 30, 2022 to December 6, 2022, four geologists with the Missouri Geological Survey conducted a geohydrologic evaluation of the 12,800 acre Forbes Lake of the Ozarks Park. The property is located east of Warsaw and south of Lake of the Ozarks. The purpose of the onsite evaluation was to observe the geologic and hydrologic characteristics at the proposed residential housing development and to determine potential impacts to the state's water resources in the event of wastewater treatment failure.

Surficial materials on the property have variable organic matter content but are routinely very gravelly silty clay below a thin layer of topsoil. The surficial materials are less than five feet in thickness across the site, with many locations having zero to less than one foot of soil. These residual materials developed in place from the weathering of dolomite bedrock. They display moderate to high permeability. Due to the thinness and permeability of the surficial materials, the potential for effluent perching on lower permeability bedrock and surfacing is high.

Bedrock is found at the surface across much of the site. The observed bedrock formations are predominantly Ordovician-aged dolomites: The Jefferson City-Cotter Dolomite, the Roubidoux Formation, and the Gasconade Dolomite. Remnant channel sandstones of Pennsylvanian-age are found on some ridgetops. These sandstones are areally limited do no factor into the sitewide hydrology.

The dolomites have low to moderate primary permeability but high secondary permeability where dissolution along fractures, joints, and bedding planes has created karst features. The prevalence of the observed karst development is the basis upon which the site has been divided into geologic zones. Zone 2 includes all areas within one mile of observed karst features such as caves and sinkholes.

The minimum required lot size for a public water supply well in Zone 2 is 4.4 acres. In the event of wastewater treatment failure, the local groundwater as well as the surface waters of area streams and the Lake of the Ozarks may be adversely impacted.

Missouri Department Of Natural Resources
Missouri Geological Survey
Geological Survey Program
Environmental Geology Section

Project ID Number
RHD23032
County
Benton County

Request Details

Project: Forbes Lake Ozark Zone 2 - Individual Wells

Legal Description: 19 T40N R20W

Quadrangle: EDWARDS
Latitude: 38 13 40.53
Longitude: -93 11 28.56

Organization Official

Name: Forbes Environmental Control Committee
Address: 26506 Gardiner Rd
City: Edwards
State: MO Zip: 65326
Phone: 660-438-4093
Email: ecc@forbesmo.org

Preparer

Name: Charles Harwood
Address: 1101 Riverside Dr
City: Jefferson City
State: MO Zip: 65101
Phone: 573-751-9155
Email: charles.harwood@dnr.mo.gov

Project Details

Report Date: 02/17/2023
Date of Field Visit: 11/30/2022
Project Exempt: No

Previous Reports: Not Applicable

Upper Bedrock

- [ ] 0.0 Surficial materials greater than 20 feet thick or bedrock generally displays low permeability
- [ ] 0.1 Bedrock has moderate to high near-surface relatively low permeability at depth
- [ ] 0.4 Bedrock has persistent open fractures and/or moderate to high permeability
- [x] 1.2 Bedrock displays well developed karst features

Surficial Materials Type

- [ ] 0.0 Clay: Glacial drift or residuum with low permeability
- [ ] 0.1 Silt/Sand, Loess, silty and sandy alluvium, moderate permeability
- [x] 0.4 Gravel: gravelly alluvium and residuum,
- [ ] 1.2 Macropore permeability: relict bedrock structure residuum

Water Supply

- [ ] 0.0 Community Public Water Supply
- [ ] 0.1 Non-community public water supply
- [ ] 0.4 Multi-family wells
- [x] 1.2 Individual Domestic Wells

Surficial Material Thickness

- [ ] 0.0 Greater than 20 feet
- [ ] 0.1 Greater than 10 feet but less than or equal to 20 feet
- [ ] 0.4 Greater than 5 feet but less than or equal to 10 feet
- [x] 1.2 Less than 5 feet

Approximate Groundwater Velocity

- [ ] 0.0 Low to moderate
- [x] 1.2 High

Watershed Hydrology

- [ ] 0.0 Limited recharge
- [x] 0.4 Local recharge
- [ ] 1.2 Regional recharge

This evaluation is not an approval under the current residential housing development rules and pertains only to groundwater contamination potential. This report is valid for one year only at the location specified.

Minimum Lot Size: **5.0 acres** Total of rating numbers for all categories equals minimum lot size in acres.

Missouri Department Of Natural Resources
Missouri Geological Survey
Geological Survey Program
Environmental Geology Section

Project ID Number
RHD23032
County
Benton County

Remarks:

From November 30, 2022 to December 6, 2022, four geologists with the Missouri Geological Survey conducted a geohydrologic evaluation of the 12,800 acre Forbes Lake of the Ozarks Park. The property is located east of Warsaw and south of Lake of the Ozarks. The purpose of the onsite evaluation was to observe the geologic and hydrologic characteristics at the proposed residential housing development and to determine potential impacts to the state's water resources in the event of wastewater treatment failure.

Surficial materials on the property have variable organic matter content but are routinely very gravelly silty clay below a thin layer of topsoil. The surficial materials are less than five feet in thickness across the site, with many locations having zero to less than one foot of soil. These residual materials developed in place from the weathering of dolomite bedrock. They display moderate to high permeability. Due to the thinness and permeability of the surficial materials, the potential for effluent perching on lower permeability bedrock and surfacing is high.

Bedrock is found at the surface across much of the site. The observed bedrock formations are predominantly Ordovician-aged dolomites: The Jefferson City-Cotter Dolomite, the Roubidoux Formation, and the Gasconade Dolomite. Remnant channel sandstones of Pennsylvanian-age are found on some ridgetops. These sandstones are areally limited do no factor into the sitewide hydrology.

The dolomites have low to moderate primary permeability but high secondary permeability where dissolution along fractures, joints, and bedding planes has created karst features. The prevalence of the observed karst development is the basis upon which the site has been divided into geologic zones. Zone 2 includes all areas within one mile of observed karst features such as caves and sinkholes.

The minimum required lot size for individual domestic wells in Zone 2 is 5 acres. In the event of wastewater treatment failure, the local groundwater as well as the surface waters of area streams and the Lake of the Ozarks may be adversely impacted.

Missouri Department Of Natural Resources
Missouri Geological Survey
Geological Survey Program
Environmental Geology Section

Project ID Number
RHD23035
County
Benton County

Request Details

Project: Forbes Lake Ozark Zone 2 - Multifamily Wells

Legal Description: 19 T40N R20W

Quadrangle: EDWARDS
Latitude: 38 13 40.81
Longitude: -93 11 25.85

Organization Official

Name: Forbes Environmental Control Committee
Address: 26506 Gardiner Rd
City: Edwards
State: MO Zip: 65326
Phone: 660-438-4093
Email: ecc@forbesmo.org

Preparer

Name: Charles Harwood
Address: 1101 Riverside Dr
City: Jefferson City
State: MO Zip: 65101
Phone: 573-751-9155
Email: charles.harwood@dnr.mo.gov

Project Details

Report Date: 02/17/2023
Date of Field Visit: 11/30/2022
Project Exempt: No

Previous Reports: Not Applicable

Upper Bedrock

- [ ] 0.0 Surficial materials greater than 20 feet thick or bedrock generally displays low permeability
- [ ] 0.1 Bedrock has moderate to high near-surface relatively low permeability at depth
- [ ] 0.4 Bedrock has persistent open fractures and/or moderate to high permeability
- [x] 1.2 Bedrock displays well developed karst features

Surficial Materials Type

- [ ] 0.0 Clay: Glacial drift or residuum with low permeability
- [ ] 0.1 Silt/Sand, Loess, silty and sandy alluvium, moderate permeability
- [x] 0.4 Gravel: gravelly alluvium and residuum,
- [ ] 1.2 Macropore permeability: relict bedrock structure residuum

Water Supply

- [ ] 0.0 Community Public Water Supply
- [ ] 0.1 Non-community public water supply
- [x] 0.4 Multi-family wells
- [ ] 1.2 Individual Domestic Wells

Surficial Material Thickness

- [ ] 0.0 Greater than 20 feet
- [ ] 0.1 Greater than 10 feet but less than or equal to 20 feet
- [ ] 0.4 Greater than 5 feet but less than or equal to 10 feet
- [x] 1.2 Less than 5 feet

Approximate Groundwater Velocity

- [ ] 0.0 Low to moderate
- [x] 1.2 High

Watershed Hydrology

- [ ] 0.0 Limited recharge
- [x] 0.4 Local recharge
- [ ] 1.2 Regional recharge

This evaluation is not an approval under the current residential housing development rules and pertains only to groundwater contamination potential. This report is valid for one year only at the location specified.

Minimum Lot Size: **4.8 acres** Total of rating numbers for all categories equals minimum lot size in acres.

Missouri Department Of Natural Resources
Missouri Geological Survey
Geological Survey Program
Environmental Geology Section

Project ID Number
RHD23035
County
Benton County

Remarks:

From November 30, 2022 to December 6, 2022, four geologists with the Missouri Geological Survey conducted a geohydrologic evaluation of the 12,800 acre Forbes Lake of the Ozarks Park. The property is located east of Warsaw and south of Lake of the Ozarks. The purpose of the onsite evaluation was to observe the geologic and hydrologic characteristics at the proposed residential housing development and to determine potential impacts to the state's water resources in the event of wastewater treatment failure.

Surficial materials on the property have variable organic matter content but are routinely very gravelly silty clay below a thin layer of topsoil. The surficial materials are less than five feet in thickness across the site, with many locations having zero to less than one foot of soil. These residual materials developed in place from the weathering of dolomite bedrock. They display moderate to high permeability. Due to the thinness and permeability of the surficial materials, the potential for effluent perching on lower permeability bedrock and surfacing is high.

Bedrock is found at the surface across much of the site. The observed bedrock formations are predominantly Ordovician-aged dolomites: The Jefferson City-Cotter Dolomite, the Roubidoux Formation, and the Gasconade Dolomite. Remnant channel sandstones of Pennsylvanian-age are found on some ridgetops. These sandstones are areally limited do no factor into the sitewide hydrology.

The dolomites have low to moderate primary permeability but high secondary permeability where dissolution along fractures, joints, and bedding planes has created karst features. The prevalence of the observed karst development is the basis upon which the site has been divided into geologic zones. Zone 2 includes all areas within one mile of observed karst features such as caves and sinkholes.

The minimum required lot size for individual domestic wells in Zone 2 is 5 acres. In the event of wastewater treatment failure, the local groundwater as well as the surface waters of area streams and the Lake of the Ozarks may be adversely impacted.

The minimum required lot size for multifamily wells or individual domestic wells with full length grout in Zone 2 is 4.8 acres. In the event of wastewater treatment failure, the local groundwater as well as the surface waters of area streams and the Lake of the Ozarks may be adversely impacted.

Missouri Department Of Natural Resources
Missouri Geological Survey
Geological Survey Program
Environmental Geology Section

Project ID Number
RHD23037
County
Benton County

Request Details

Project: Forbes Lake Ozark Zone 3

Legal Description: 24 T40N R20W
Quadrangle: KNOBBY
Latitude: 38 13 35.1
Longitude: -93 4 58.5

Organization Official

Name: Forbes Environmental Control Committee
Address: 26506 Gardiner Rd
City: Edwards
State: MO Zip: 65326
Phone: 660-438-4093
Email: ecc@forbesmo.org

Preparer

Name: Charles Harwood
Address: 1101 Riverside Dr
City: Jefferson City
State: MO Zip: 65101
Phone: 573-751-9155
Email: charles.harwood@dnr.mo.gov

Project Details

Report Date: 02/17/2023
Date of Field Visit: 11/30/2022
Project Exempt: No

Previous Reports: RHD23025

Upper Bedrock

- [ ] 0.0 Surficial materials greater than 20 feet thick or bedrock generally displays low permeability
- [ ] 0.1 Bedrock has moderate to high near-surface relatively low permeability at depth
- [ ] 0.4 Bedrock has persistent open fractures and/or moderate to high permeability
- [x] 1.2 Bedrock displays well developed karst features

Surficial Materials Type

- [ ] 0.0 Clay: Glacial drift or residuum with low permeability
- [ ] 0.1 Silt/Sand, Loess, silty and sandy alluvium, moderate permeability
- [ ] 0.4 Gravel: gravelly alluvium and residuum,
- [x] 1.2 Macropore permeability: relict bedrock structure residuum

Water Supply

- [x] 0.0 Community Public Water Supply
- [ ] 0.1 Non-community public water supply
- [ ] 0.4 Multi-family wells
- [ ] 1.2 Individual Domestic Wells

Surficial Material Thickness

- [ ] 0.0 Greater than 20 feet
- [ ] 0.1 Greater than 10 feet but less than or equal to 20 feet
- [ ] 0.4 Greater than 5 feet but less than or equal to 10 feet
- [x] 1.2 Less than 5 feet

Approximate Groundwater Velocity

- [ ] 0.0 Low to moderate
- [x] 1.2 High

Watershed Hydrology

- [ ] 0.0 Limited recharge
- [ ] 0.4 Local recharge
- [x] 1.2 Regional recharge

This evaluation is not an approval under the current residential housing development rules and pertains only to groundwater contamination potential. This report is valid for one year only at the location specified.

Minimum Lot Size: **5.0 acres** Total of rating numbers for all categories equals minimum lot size in acres.

Missouri Department Of Natural Resources
Missouri Geological Survey
Geological Survey Program
Environmental Geology Section

Project ID Number
RHD23037
County
Benton County

Remarks:

From November 30, 2022 to December 6, 2022, four geologists with the Missouri Geological Survey conducted a geohydrologic evaluation of the 12,800 acre Forbes Lake of the Ozarks Park. The property is located east of Warsaw and south of Lake of the Ozarks. The purpose of the onsite evaluation was to observe the geologic and hydrologic characteristics at the proposed residential housing development and to determine potential impacts to the state's water resources in the event of wastewater treatment failure.

Surficial materials on the property have variable organic matter content but are routinely very gravelly silty clay below a thin layer of topsoil. The surficial materials are less than five feet in thickness across the site, with many locations having zero to less than one foot of soil. These residual materials developed in place from the weathering of dolomite bedrock. They display moderate to high permeability. Due to the thinness and permeability of the surficial materials, the potential for effluent perching on lower permeability bedrock and surfacing is high.

Bedrock is found at the surface across much of the site. The observed bedrock formations are predominantly Ordovician-aged dolomites: The Jefferson City-Cotter Dolomite, the Roubidoux Formation, and the Gasconade Dolomite. Remnant channel sandstones of Pennsylvanian-age are found on some ridgetops. These sandstones are areally limited do no factor into the sitewide hydrology.

The dolomites have low to moderate primary permeability but high secondary permeability where dissolution along fractures, joints, and bedding planes has created karst features. The prevalence of the observed karst development is the basis upon which the site has been divided into geologic zones. Zone 3 has pervasive karst development. These karst features are conduits through which water or wastewater can rapidly recharge into the drinking water aquifer.

The minimum required lot size for all water supply sources in Zone 3 is 5 acres. In the event of wastewater treatment failure, the local, shallow, and regional groundwater as well as the surface waters of area streams and the Lake of the Ozarks may be adversely impacted.