



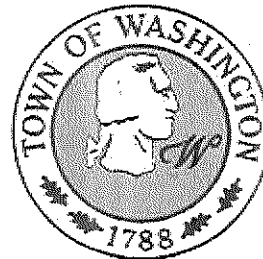
Engineering  
& Design

# DRAFT ENGINEER'S REPORT

November 10, 2022

**KILLEARN ROAD STUDY**

**TOWN OF WASHINGTON  
DUTCHESS COUNTY, NY**



Prepared for:

Town of Washington  
Highway Department  
Engineering Services  
10 Reservoir Drive  
Millbrook, NY 12545

Prepared by:

DRAFT

Daniel Farnan  
NY Professional Engineer  
License No. 092510

DRAFT

Patrick Mulkern  
NY Professional Engineer  
License No. 100594

**Colliers Engineering & Design**  
18 Computer Drive East Suite 203  
Albany New York 12205  
Main: 877 627 3772  
Colliersengineering.com

Project No. 21003140G

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## EXECUTIVE SUMMARY

This report presents Colliers Engineering & Design's (CED) study of Killearn Road's existing conditions and developed alternatives for the Town of Washington's (Town) review. When a preferred alternative is selected by the Town, CED will review and finalize this report, tailored to the chosen alternatives and funding options available to that alternative.

### Findings:

1. There is a lack of uniform, adequately sized roadside drainage throughout the entire 3.29-mile corridor. Where drainage is the most inadequate, road section failure or recent repairs were noted. Lack of proper road drainage is the number one issue facing the road.
2. Many adjacent properties drain to the roadway, which exacerbates the issues the road is facing.
3. Wear from of heavy traffic was noted on the roadway. Traffic counts from Chestnut Ridge Road (C.R. 23) and State Route 343 show high levels of truck volume. We anticipate some of these trucks may use Killearn Road in higher-than-expected occurrences for a low-volume, local road. Large volumes of heavy truck traffic accelerate road deterioration.
4. The road is not signed properly per Federal and State standards for its geometrical limitations and physical conditions.
5. The soil under the most southern end of Killearn Road, near Chestnut Ridge Road (C.R. 23) is extremely poor material for road foundations. Future failures in this area may be expected.
6. No official determinations could be made in this study on Right-of-Way (ROW). However, incidental evidence from our due diligence leads us to believe some roadside areas may not be owned by the Town, or ROW may limit some areas of future repairs.

### Recommendations:

1. Consider the repair/reconstruction alternatives within this report and program a construction project which will alleviate issues on Killearn Road. At a minimum, improve road drainage to the maximum extent possible for the Town's highway maintenance budget.
2. Perform a survey to accurately map the limits of the Killearn Road, existing drainage structures, elevations/contours, and ROW. Data would be needed for most reconstruction alternatives, ditch installation and utility relocations.
3. A traffic count study should be performed to determine actual number vehicle trips per day, heavy vehicle count, and average vehicle speed on the roadway. Sign the road appropriately for existing conditions.
4. Post Killearn Road with a weight limit to reduce the number of heavy trucks utilizing the road as a cut-through. Institute a permitting program for local construction and deliveries vehicles over the weight limit that need to access Killearn Road.

5. Work with local law enforcement to enforce both the weight limit and speed limits of the roadway.

**Next Steps:**

1. The Town Board and involved departments should review this report in full
2. The Town and CED should meet to discuss the results of this report in more detail.
3. The Town should select a preferred alternative to pursue.
4. CED will develop a conceptual design of the Preferred alternative, with more detail, refined cost estimates, and direction on how the Town could proceed with repairs.
5. CED will finalize this report and conclude our services for this task.
6. The Town would then need to secure funding for the Preferred Alternative and proceed into a design/construction project.

## INTRODUCTION

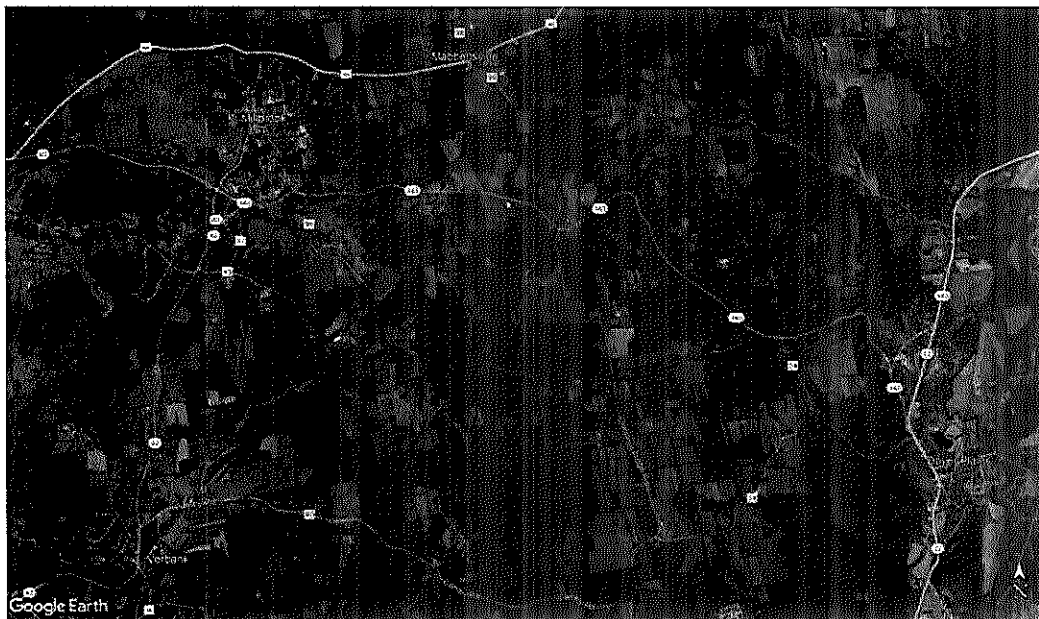
This report documents an engineering study conducted for Killearn Road. The purpose of the study was to review and analyze existing conditions of Killearn Road and adjacent terrain to determine the factors contributing to the road's deterioration. From this study, alternatives have been developed to provide the Town multiple design options to pursue for repairing the existing deterioration and maintenance issues with the road, as well as mitigating future deterioration.

Killearn Road is a 3.29-mile-long gravel road from Hoxie Road to Chestnut Ridge Road (C.R.23). The road is variable in width from 16ft to 25ft and exhibits a variable crown slope and is one-lane access in each direction, in most areas.

Portions of the roadway are subject to surface failure during the winter and springs months. The road has multiple areas experiencing drainage issues and deterioration of the gravel surface within the travel lanes. Rilling and erosion of the side slopes has also occurred throughout the road length on each side of the roadway. Poor drainage is the cause of most issues with the road.

### Study Location

Killearn Road is located in the Town of Washington, in Dutchess County, NY. The road intersects with Hoxie Road at the north end and with Chestnut Ridge Road (CR 23) at the south End. A portion of Killearn Road extends north beyond Hoxie Road for approximately 1,000ft and intersects with NY State Route 343.



*Figure 1 – Location Map*

## EVALUATION OF EXISTING CONDITIONS

Research and field evaluations were conducted by CED staff in August, September, and October 2022, within the limits of the study to document existing conditions. Findings are summarized below. A separate site visit was conducted by Colliers Subsurface Utility Engineering staff on October 13, 2022, to mark out existing underground utilities within a portion of the road length.

### Roadway Classification and Regulations

Killearn Road classified as a **Local Rural Road** per New York State Department of Transportation's (NYSDOT) Functional Classification Codes. As such, this classification is exempt from most all sources of Federal Aid used on road rehabilitation. The road is maintained by the Town of Washington Highway Department and is classified as a "dirt road" per the Town's website.

### Scenic Road Designation

In 1994, the Town introduced Scenic Road Local Law to add a new section to the Town's Zoning Law, noted as Scenic Roads, Section 344. The local law granted the ability to designate certain Town roads, or portions of, as Scenic Roads, which requires Town Planning Board review and approval for future alterations or improvements to Scenic Roads including, but not limited to:

- Widening of the Right-of-Way
- Widening of the traveled portions of the road
- Paving
- Changes of grade
- Straightening
- Removal of stone walls
- Removal of mature trees

The Town Planning Board reserves the right to approve or disapprove of proposed alterations or improvements to Scenic Roads, and to dictate that the proposed alterations and improvements are carried out so as to preserve the existing aesthetic, historic, and/or scenic characteristics of the road. Routine maintenance practices are exempt from review by the Planning Board per the Law's Section 6.c

Killearn Road has been designated as a Scenic Road by the Town. Therefore, the Town Planning Board will need to approve most of the proposed alternatives included in this report. The alternatives developed and presented in this report account for these restrictions by minimizing changes to proposed road width and grade changes. The preferred alternative selected will be reviewed to minimize clearing of existing trees or stone wall structures.

Should it be warranted or considered, the Scenic Road Local Law allows for the appeal and rescission of a Scenic Road Designation, per the Law's Section 4.C. Also, it should be noted that Killearn Road is not part of the New York Scenic Byways program. It is not clear if the road was evaluated by NYSDEC for a formal designation process as a Scenic Road. Therefore, the designation appears to be unique to the Town's regulations.

## Understanding Operation and Maintenance of a Gravel Road

Gravel roads make up approximately 34% of all roads, or roughly 1.39 million miles of roadways in the US, as of 2013<sup>1</sup>. As of 2022, it is estimated that 10% or roughly 19,000 miles of roads are unpaved in New York State, all of which are owned locally and not by the State<sup>2</sup>. The Federal Highway Administration recognizes that local roads with very low traffic volumes, such as Killbuck Road, often lack funding programs for pavement or significant repair. As a result, a higher level of regular maintenance is suggested to maximize gravel road performance and life cycle. The Town is not alone in experiencing issues with Gravel Roads throughout New York. However, with only 10% of our roads being gravel we must look to other areas of the US for excellent gravel road operation, such as areas of the Midwest where a majority of roads in a State are unpaved.

Adams County, Colorado is one of the leading areas of the US embarking on an aggressive gravel road maintenance and repair process. Their goal is to treat roads at the optimum time in their life cycle to maximize their full useful life, improving gravel longevity and saving operational costs. If maintenance and repair is deferred for extended periods of time, roads will rapidly deteriorate and ultimately escalate to failure. Adams County's experience shows that spending \$1 on gravel maintenance will save or delay spending \$6 to \$10 on future rehabilitation or reconstruction costs<sup>3</sup>.

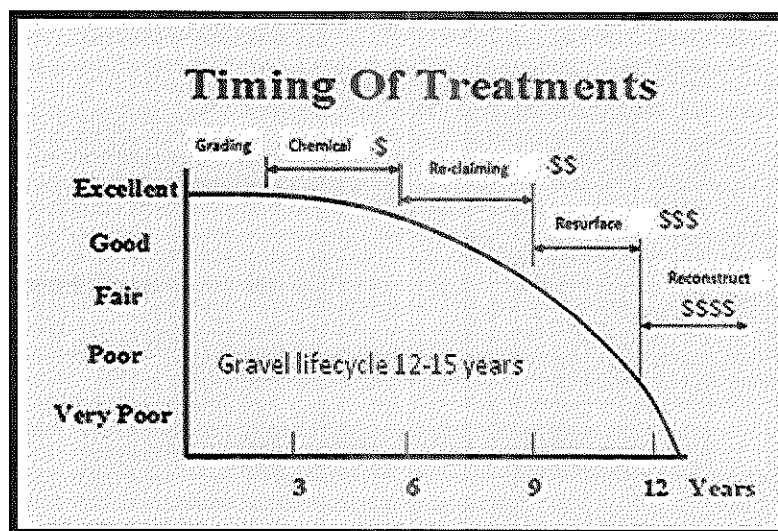


Figure 2 – Gravel Road Life Cycle and Costs<sup>2</sup>

What can be gained from examples like Adams County is their experience with planning road maintenance and repair programs. In their experience, a gravel road may have only a 15-year

<sup>1</sup> Table 1-4: Public Road and Street Mileage in the United States by Type of Surface (2016)

<sup>2</sup> "Locally Owned Roads by the Numbers" Jan. 2022, Office of New York State Comptroller

<sup>3</sup> Adams County, Colorado, Gravel Road Resurfacing Program.

maximum life before complete reconstruction is required as shown in **Figure 2** above. For reference, asphalt roads typically have a 20-year life with proper maintenance.

The life cycle of a gravel road greatly depends on the quality of materials used as well as its maintenance. The surface gravel or "wearing course" is typically recommended to be a manufactured material that includes fractured (crushed) road aggregate, sands, and a minor number of "fines" (silts and clays) equaling no more than 15% of the material's makeup. Typical material gradations recommended by FHWA are shown in **Figure 3** below.

Annual precipitation	> 20 inches	< 20 inches
Sieve	Percent Passing	Percent Passing
1" (25.0 mm)	100	
3/4" (19.0 mm)		100
No. 4 (4.75 mm)	45 - 70	50 - 78
No. 8 (2.36 mm)	27 - 55	37 - 67
No. 40 (425 mm)	10 - 28	13 - 35
No. 200 (75 mm)	3.0 - 12.0	8.0 - 15.0
Liquid Limit Max	25	30
Plasticity Index	3 - 10	8 - 15

*Figure 3 – FHWA Surface Aggregate Recommendations based on Annual Precipitation*

Local to New York, the *Cornell Local Roads Program* offers municipalities technical tips for gravel road material specifications. We have included that document in **Appendix A** for the Town's reference.

Aside from regular maintenance and use of proper materials, all gravel roads require proper drainage. The FHWA states *"Drainage of water from the road surface to a ditch is imperative for maintaining the design life of the road."*<sup>4</sup> FHWA gives illustrative examples of this shown in **Figure 4** below. Further, FHWA goes on to include the following in their *Gravel Roads Construction and Maintenance Guide* introduction to road drainage:

*"An often-repeated adage in the road construction and maintenance business is 'The three most important things to understand in building and maintaining roads are drainage, drainage, and drainage!' This certainly does get an important message across. But, too often, this critical issue is ignored when building and maintaining local roads. When drainage is poor, the best efforts to rehabilitate or maintain roads will bring disappointing results. When water can be drained off of road surfaces and out of roadbed soils, the road will invariably become easier to maintain. Good drainage is critical even in arid regions."*<sup>4</sup>

<sup>4</sup> "Gravel Roads Construction and Maintenance Guide", FHWA, 2015



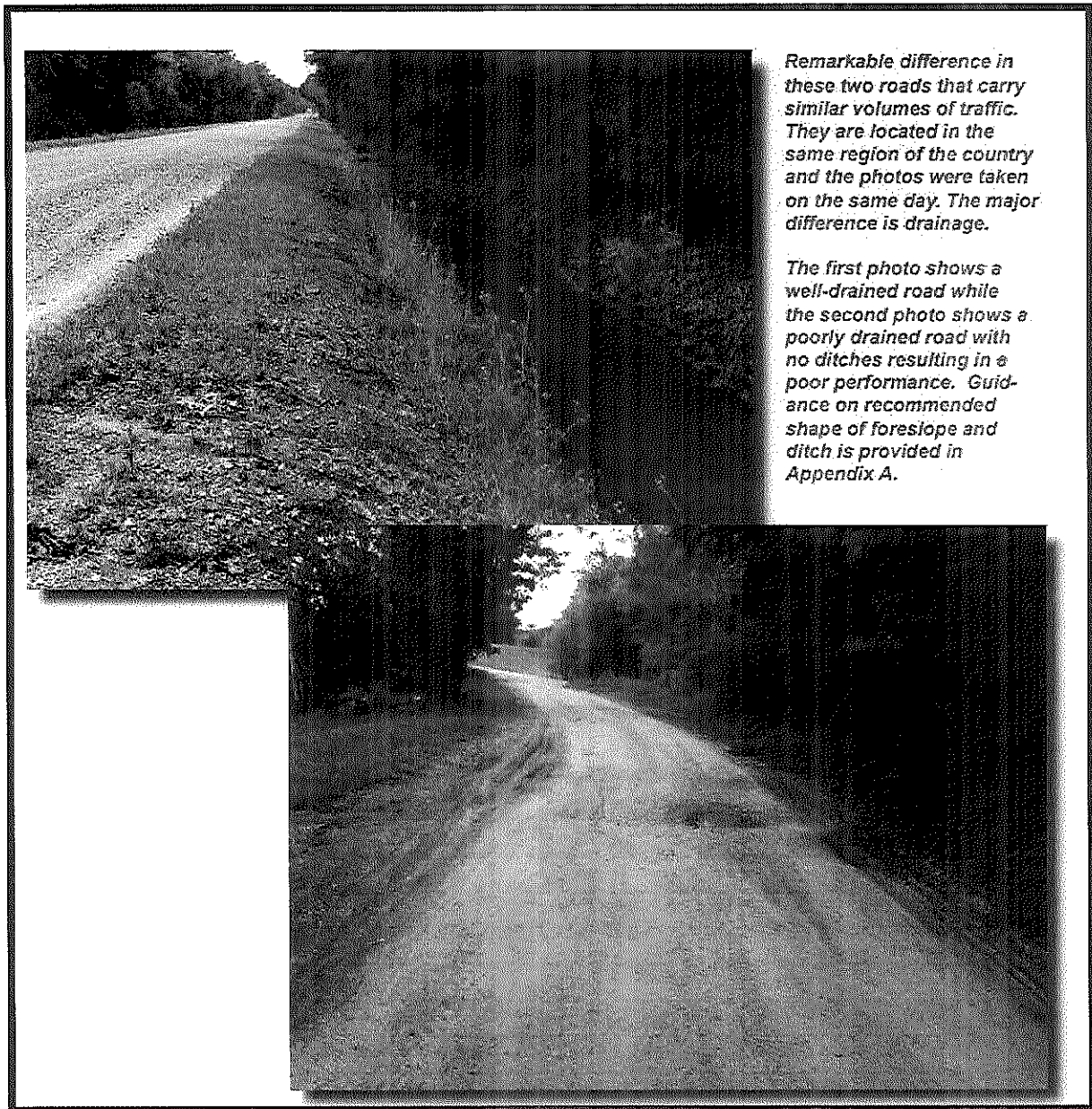


Figure 4 – Excerpt from FHWA “Gravel Roads Construction and Maintenance Guide” on Drainage <sup>4</sup>

Much of our review herein focuses on Killearn Road's poor drainage, and how deficient conveyance of water impairs the longevity of any repairs made to the roadway. Almost all generally accepted typical road sections, both paved and unpaved roads, accommodate drainage through use of sloped road crowns (4% min. or  $\frac{1}{2}$ " per foot for gravel), a shoulder drop (6% paved to 12% slope unpaved) and ditches. Two typical road sections from publications issued by neighboring New England states are presented in **Figures 5 and 6**. Both figures show gravel road sections following the same aggressively sloped road crowns (4% or more), shoulders, and accommodations for ditches. **Please note, New York State Department of Transportation does not own or operate any unpaved roads and does not issue typical sections or other guidance for gravel road construction. Therefore, other State's data is referenced herein.**

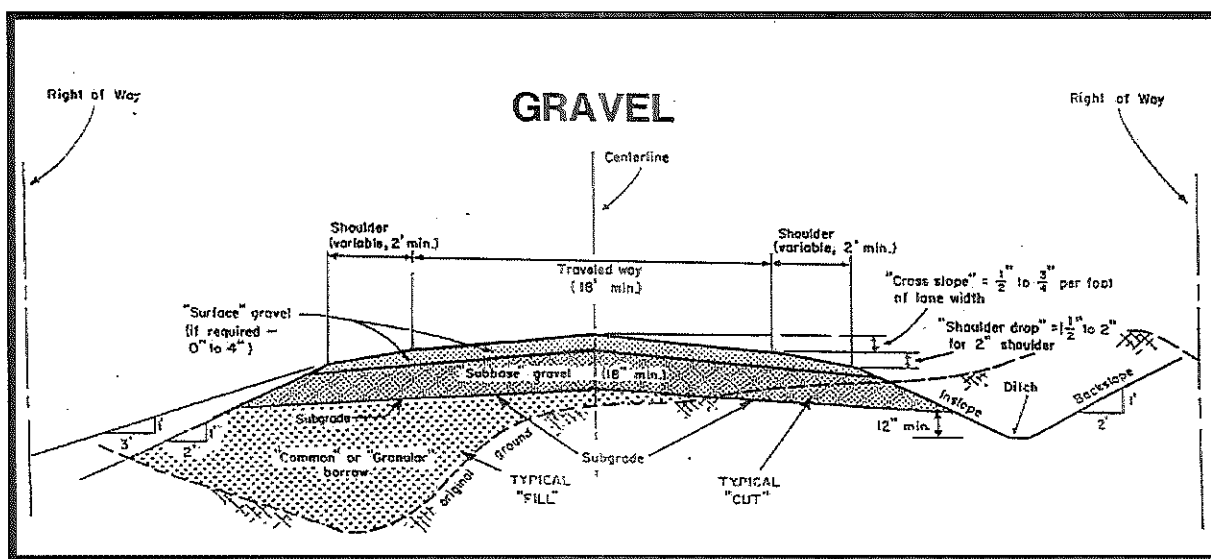


Figure 5 – Typical Section for Gravel Roads – State of Maine

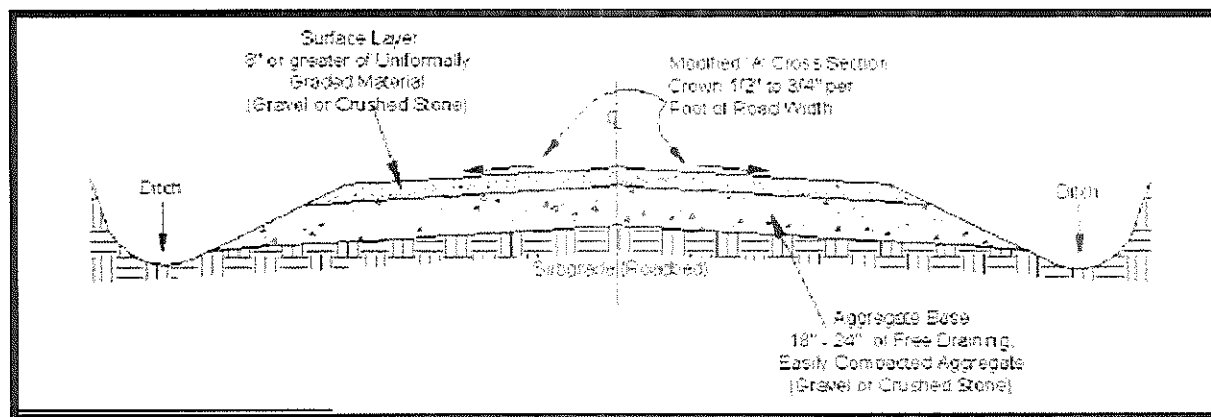


Figure 6 – Typical Section for Gravel Roads – State of Massachusetts

## Existing Roadway Conditions

Field assessments conducted during the summer and fall of 2022 found that Killearn Road has multiple geometric and roadway deficiencies for the full length of the road. The road is variable in width, ranging from as little as 16ft wide to nearly 25ft. There is a “Rough Road” sign posted at the beginning of Killearn Road, just south of the intersection with Hoxie Road. A group of “Rough Road”, “One Lane Road” and “20 mph” advisory signs are posted at the southern end of Killearn Road, just west of the intersection with Chestnut Ridge Road. There are multiple farm and agricultural properties along the road, which imply the need or frequency of agricultural vehicle access along the road. We note that AASHTO’s recommendation for roadway width of an agricultural access road is 24ft minimum, which is a Two-Lane Road. This conflicts with Killearn Road’s posting for a “One Lane Road”.

The road also exhibits a varying crown with a majority of the roadway exhibiting little to no crown, appearing flat. The lack of a sufficient crown slope has likely led to the numerous potholes and erosion rutting found throughout the length of the road, as a result of surface water ponding on the travel way.

Various horizontal and vertical curves existing along the road appear to be non-conforming to current AASHTO design standards. There is limited sight distance available for the majority of the curves and the numerous driveways along the road. Many of the driveways on either side of the road are moderately to severely sloped, approach Killearn Road at sharp angles, further reducing sight distance for motorists leaving the driveway, and motorists along Killearn Road unable to see a car coming down the driveway slope that is nearly parallel to the roadway.

The road also experiences transverse rutting (sometimes called “Washboarding”) from heavy truck tires. Notable sections are discussed in the *‘Site Assessment’* section below. During a site visit on October 25, 2022, multiple heavy construction vehicles were observed making frequent trips along the road, in each direction. The heavy construction vehicles, and frequent trips back and forth, appear to be overloading road section for Killearn Road, and is resulting in severe distress to the subgrade and surface course. This would exacerbate the deterioration of the gravel road and promote the drainage issues that the road is experiencing.

## Site Assessment

A site visit conducted by CED documented multiple instances and areas exhibiting signs of deterioration and need for improvement. Many of these locations of issues observed were similar to the concerns previously expressed by the Town. The assessment below illustrates typical examples and is not an inclusive list of every observed deficiency. Please refer to **Attachment 1 – Site Plans** for locations indicated by address and road station number.



*Figure 7 - Embankment Erosion near 623 Killearn Road*

- At 623 Killearn Road (Sta. 7+00) and just north of 252 Killearn Road (Sta. 94+00) there are signs of runoff eroding a hole through the built-up embankment sides.

Runoff appears to run parallel for a distance along the road edge due to a lack of drainage ditch adjacent to the road. This has led to erosion on the road edges and created the natural built-up embankment at each side of the roadway. Eventually the surface runoff has broken through the built-up sides and has eroded the embankment slope down to an existing culvert outlet. Both locations this occurs are low points along the road, and the embankment erosion occurs on the downstream side.

This issue occurs in multiple locations due to poor drainage relief.



*Figure 8 – Typical Gravel Surface Rutting*

- At 452 - 460 Killearn Road (Sta. 50+00±), there is a large section experiencing severe rutting (sometimes called "Washboarding") as a result of heavy vehicle traffic on the road. The construction vehicles appear to make multiple trips in each direction during the day, wearing down the existing gravel surface, for approximately 200-ft.

The area shown in above Figure 8 was the worse area of rutting CED observed. However, smaller areas of rutting existing throughout the 3.29-mile corridor.



*Figure 9 - Rutting and Potholing near 430 Killearn Road*

- At multiple occurrences, there are large sections of potholing and ruts within the travel lanes. The areas pool with water and are further deteriorated during rainstorms.

Areas with the worst deterioration occur at 596 Killearn Road (Sta. 13+00), at the driveway entrance to 430 Killearn Road (Sta. 56+00) extending approximately 250ft South beyond the driveway, and at the driveway entrances to 68 & 48 Killearn Road (Sta. 155+00).



*Figure 10 – Collapsed Culvert and Embankment Erosion 387 Killearn Road*

- Approximately 200ft south of the driveway entrance to 387 Killearn Road (Sta. 69+50), the existing 12" CMP culvert crossing beneath Killearn Road is crushed and the inlet is heavily silted and blocked with debris and vegetation. There are signs of runoff overtopping the roadway, due to the blocked pipe inlet, before running off the downstream side embankment. The downstream embankment slope is eroded, and the top of pipe is exposed up to the edge of the travel lane.

A number of culverts on the road are in similar condition. In fact, CED had to visit the site multiple times to find some culverts that were buried or missed in earlier site visits.





*Figure 11 – Roadway Settlement, 252 Killearn Road*

- At 252 -254 Killearn Road (Sta. 103+25), north of the driveway entrance, there is an existing culvert crossing beneath the roadway that is showing signs of settlement. The road edge is lined with stone headwalls on each side, at the inlet and outlet of the pipe. The road area directly above the culvert is visibly depressed below grade. The pipe does not exhibit any signs of failure or crushing, however the embankment slopes and shoulder show signs of erosion at the stone headwalls.





*Figure 12 – Roadway Ponding, 108 Killearn Road*

- At 108 Killearn Road (Sta. 143+00), the existing culvert is silted and blocked, leading to ponding along the roadway edge. The edge of the travel lane is mudded, and ponding has backed up into the property's front lawn. There are signs of ponding encroaching into the travel lane.

Lack of proper road drainage as shown in above **Figure 12** is typical throughout many areas of the road.

## Pavement Surface Evaluation and Rating Study – (PASER)

An official *Pavement Surface Evaluation and Rating Study* (PASER) was not conducted for Killearn Road. However, based on our site observations detailed above, CED would likely rate Killearn Road as a Level 2, which is detailed in **Figure 13** below. Roads with this rating usually require more significant repairs or reconstruction.

Surface rating	Visible distress	General condition/treatment measures
5 Excellent	No distress. Dust controlled. Excellent surface condition and ride.	New construction or total reconstruction. Excellent drainage. Little or no maintenance needed.
4 Good	Dust under dry conditions. Moderate loose aggregate. Slight washboarding.	Recently regraded. Good crown and drainage throughout. Adequate gravel for traffic. Routine grading and dust control may be needed.
3 Fair	Good crown (3"-6"). Adequate ditches on more than 50% of roadway. Gravel layer mostly adequate. Some culvert cleaning needed. Moderate washboarding (1"-2" deep) over 10%-25% of area. Moderate dust. None or slight rutting (< 1" deep). An occasional small pothole (< 2" deep). Some loose aggregate (2" deep).	Shows traffic effects. Regrading (reworking) necessary to maintain. Needs some ditch improvement and culvert maintenance. Some areas may need additional gravel.
2 Poor	Little or no roadway crown (< 3"). Adequate ditches on less than 50% of roadway. Portions of the ditches may be filled and/or show erosion. Culverts partially full of debris. Moderate to severe washboarding (> 3" deep) over 25% of area. Moderate rutting (1"-3") over 10%-25% of area. Moderate potholes (2"-4") over 10%-25% of area. Severe loose aggregate (> 4" thick).	Travel at slow speeds (less than 25 mph) is required. Needs additional new aggregate. Major ditch construction and culvert maintenance also required.
1 Failed	No roadway crown or road is bowl shaped with extensive ponding. Little if any ditching. Filled or damaged culverts. Severe rutting (> 3" deep) over 25% of area. Severe potholes (> 4" deep) over 25% of area. Many areas (> 25%) with little or no aggregate.	Travel is difficult and road may be closed at times. Needs complete rebuilding and/or new culverts.

**Figure 13 – PASER Rating Systems for Gravel Roads**

## Traffic Considerations

There is no recorded traffic data for Killearn Road available in the NYSDOT Traffic Data Viewer database, or in the Dutchess County Traffic Data database. Data is available for the two roads that Killearn Road connects to however, State Route 343 and Chestnut Ridge Road (CR 23) measured in Average Annual Daily Traffic (AADT). For each measurement the percent of AADT that is heavy vehicles is indicated. It is widely accepted in engineering practice that heavy vehicles stress and damage roadways much more than normal passenger vehicles. Typical town pavement sections for local roads are normally designed for 2% heavy vehicle traffic. Anything over 2% would need a more substantial pavement section to last the wear-and-tear of excessive heavy vehicles.

- Chestnut Ridge Road (C.R. 23) – 2020 = 446 AADT with 8.7% Heavy Trucks
- State Route 343 – 2019 = 3204 AADT with 6.38% Heavy Trucks

Killearn Road provides access to sixty-five (65) tax parcels (2021 Tax Parcel Data). The Road also acts as a pass-through between the County and State Road, and a percentage of daily traffic from those adjacent roadways can be assumed to travel on Killearn Road, in addition to local traffic. Based on the number of vehicles and trucks witnessed during our site visits, and assuming two (2) vehicles trips per property per day on Killearn Road, we estimate Killearn Road's traffic count is likely 200 AADT

( $\pm 20\%$ ). We also estimate the road received at least 3 to 4% heavy vehicles trips as part of AADT. A 2% heavy vehicle level would be the maximum normal level for a local road like Killearn Rd.

The road is posted for 20 mph, and traffic was observed to drive moderately slow or appeared close to the speed limit. However, people normally drive slower when they are coming up to individuals (CED Staff) pulled off on the side of the road or walking in safety vests and hard hats. We expect unobserved vehicular traffic to travel well over the speed limit. A modern traffic count using sensory observation (radar or video) would show actual travel speeds.

Due to the substandard roadway curve radii and geometry, maintaining a low-speed limit for the road is recommended, unless the roadway is realigned and paved. Signage should also be added along the roadway to address the geometric deficiencies and properly warn drivers of hazardous driving conditions. The existing sharp curves along the road warrant directional Chevron signs (MUTCD sign W1-8) be installed on the outside edge of the roadway curve. "Roadway Narrows" signs may also be considered in sections where the road narrows to a 16ft wide one lane road.

Additional signage should be reviewed and installed if speeds increase on the roadway after improvements are made, either by widening the roadway, repairing rutting to provide a smoother compacted gravel riding surface, or installing an asphalt pavement section. In addition to signage, speed limits should be enforced by authorities as necessary to mitigate hazardous driving occurring along on the roadway.

### Roadway Drainage and Erosion

Killearn Road has multiple areas experiencing drainage issues and deterioration of the gravel surface within the travel lanes. Rutting occurs throughout the road length within the travel lane and just beyond the edge of the road. And built-up embankment sections at the gravel edge prevents runoff from properly leaving the roadway surface such as showing in **Figure 14** below. Water is forced to stay on the road and travel along the gravel edge, building up in velocity and eroding the road.



*Figure 14 – Built-up or Higher Embankment*

In addition, Killearn Road lacks an appropriate crown for much, but not all of the 3.29-mile alignment. A road crown helps to convey water off the travel way quickly. Without a crown ponding and potholing within the travel lanes at numerous locations has occurred along Killearn Road. Further, lack of a road crown also results in surface runoff leaving the roadway to concentrate and erosion through built-up embankment sides.

Rilling (a shallow channel no more than inches deep cut into soil by the erosive action of flowing water) in the side slopes has also occurred throughout the road length on each side of the roadway, most notably at the low points of the road, see **Figure 15** below. As erosion of the side slopes continues to expand, it is likely to undermine the roadway section and lead to road section failure. These conditions were observed during site visits conducted in summer and fall months on 2022. Through discussions with the Town, the deterioration and conditions are much worse during the winter and spring months, as a result of snow melt in addition to rainstorms.



*Figure 15 – Typical Rills and Soil Erosion at Low Points*

### Hydrologic Study

A hydrologic study was conducted to determine potential causes of road washout and identify low points where water could collect along the road. It was determined that the study area has 15 drainage areas comprised of 24 subbasins, ranging in size from 0.3 to 55.6 acres, with the land use primarily consisting of agricultural, brush, and wooded with sparse residential land use present.

The drainage areas around Killearn Road generally drain towards the road. Runoff then follows the road to the north or the south (see **Appendix B**) until it can enter a point of relief on adjacent properties. In the majority of drainage subbasins, runoff collects at Killearn Road and must flow parallel to the road until it reaches a culvert to pass under the road, or eventually overtops the roadway. This is likely a major factor in the deterioration and failure the road is experiencing.

According to the 2021 Dutchess County Soil Survey, the primary Hydrologic Soil Group in the study area is Group B, well-draining soil, comprising 84% of the study area and 69% of soils in the study area are classified with an Erosion Hazard Rating of Severe.

Contours at an interval of 2 feet were generated for the study area from publicly available USGS 1 meter LiDAR (laser imaging, detection, and ranging) data, dated 2014. Landcover data for the study area was generated from 2021 aerial imagery. A combination of aerial imagery and LiDAR data was used to identify low areas along Killearn Road where stormwater runoff would potentially concentrate

and overtop the road in the absence of a culvert. Areal imagery was used to identify culverts in some of these areas. See **Appendix B** for low area and culvert locations used in the hydrologic study.

**Table 1: Drainage Area Summary**

Drainage Area	Subbasin	Area (ac)	Runoff Coefficient, C	Time of Concentration (minutes) <sup>1</sup>	Maximum Flow Distance (ft)	Outlet Type
1	1A	10.8	0.25	17	1,198	Culvert
	1B	0.8	0.21	7	766	Culvert
2	2	18.5	0.21	27	2,243	Culvert
3	3A	23.3	0.14	29	2,609	Culvert
	3B	2.3	0.19	13	695	Culvert
4	3C	38.3	0.12	22	2,980	Culvert
	4	29.3	0.21	30	1,968	Culvert
5	5A	20.3	0.26	32	2,825	No Culvert
	5B	33.7	0.22	34	3,760	No Culvert
6	6A	12.0	0.10	28	1,552	No Culvert
	6B	15.9	0.12	31	1,785	No Culvert
7	7	22.7	0.10	65	1,662	Culvert
8	8	4.2	0.10	15	691	No Culvert
9	9A	8.1	0.10	23	1,715	Culvert
	9B	29.2	0.16	30	1,993	Culvert
10	10	0.5	0.28	7	456	Culvert
11	11A	0.6	0.25	6	203	No Culvert
	11B	53.4	0.11	57	3,702	No Culvert
12	12	4.4	0.10	36	1,013	No Culvert
13	13A	19.6	0.16	62	2,509	No Culvert
	13B	0.3	0.11	5	680	No Culvert
14	14A	55.6	0.17	79	3,053	Culvert
	14B	6.4	0.20	24	1,544	Culvert
15	15	4.1	0.18	33	1,479	No Culvert

1. T<sub>c</sub>'s for all areas were increased to a minimum of 5 minutes.

The Rational Method was used for determining peak flows of the drainage areas. The study found that the majority of the drainage areas drain towards Killlearn Road, where it either outlets through existing culverts across the road or flows adjacent to the road until reaching another existing culvert along the road. It was found that 11 of the 24 subbasins did not have culverts at the outlets or low points.

Peak flows for all recurrence intervals were increased by 20% to account for anticipated increases in runoff over 20 years. See **Table 2**. These flows should be used in any selected Alternative.

**Table 2: Design Flows**

(Includes 20% increase)

Drainage Area	Subbasin	Flow (cfs) <sup>2</sup>					
		1-year storm	5-year storm	10-year storm	25-year storm	50-year storm	100-year storm
1	1A	7	10	12	14	17	19
	1B	1	1	1	2	2	2
2	2	7	12	13	17	19	23
3	3A	6	10	11	13	16	19
	3B	1	2	2	2	4	4
	3C	11	16	18	22	25	30
4	4	12	18	20	26	30	36
5	5A	10	14	17	20	25	29
	5B	13	19	23	29	34	40
6	6A	2	4	4	5	6	7
	6B	4	6	6	8	10	11
7	7	2	4	5	6	7	8
8	8	1	1	2	2	2	4
9	9A	1	2	4	4	5	5
	9B	8	13	16	19	23	26
10	10	1	1	1	2	2	2
11	11A	1	1	1	2	2	2
	11B	7	11	13	16	19	23
12	12	1	1	1	2	2	2
13	13A	4	6	7	8	10	12
	13B	1	1	1	2	2	2
14	14A	8	13	17	20	24	29
	14B	2	4	5	6	7	8
15	15	1	2	2	2	4	4

Following the hydrology study, a third site visit was conducted to locate the existing driveway culverts and culvert pipes that cross beneath the roadway. We uncovered or observed twenty (20) culverts crossing underneath Killearn Road, and 11 driveway culverts were located, varying in size between 12" and 36" diameter, and material as either high-density polyethylene (HDPE) or corrugated metal pipes (CMP). The hydrologic study will be revised to account for the additional culverts that have been field located. Despite the additional culverts and outlets found, the majority of the culverts are crushed or damaged, preventing flow from entering the pipes at intended capacity, or undersized for the peak flow experienced. This still leads to the aforementioned result of runoff traveling parallel to the roadway and possibly overtopping or eroding the embankment and road edge. Nearly every culvert

located exhibited a lack of stone inlet or outlet protection, which has contributed to the erosion around the culvert pipes.

### Geotechnical Investigations

Geotechnical investigations were performed on September 27 & 28, 2022, by QCQA Labs. A Geotechnical Engineering Report was provided on October 25, 2022, included in **Appendix C** of this report.

Field work performed included fifteen (15) test borings. Boring locations were determined in the field by Colliers and QCQA Labs. Locations were selected based on “problem areas” along the road showing signs of deterioration and areas deemed to experience subgrade issues or failure. Boring locations are as shown in the ‘Boring Location Plans’, found in **Appendix C**. Borings B-1 through B-10 were spaced approximately 1,000ft along the roadway, starting at 592 Killearn Road to 252 Killearn Road (Sta. 17+00 to Sta. 106+00). Boring B-11 was located approximately 300ft south of the driveway entrance to 197 Killearn Road (Sta. 122+00) and B-12 was located in front of 108 Killearn Road and 99 Killearn Road (Sta. 142+00).

Groundwater was not encountered in any of the borings. Rock coring was not performed to confirm bedrock however, auger refusal of the borings was encountered a depth shallower than 4-ft within borings B-2, B-3, B-5, B-11, and B-15. The existing gravel wearing course surface was found to vary in thickness from as low as 8 inches at Boring 13 to 30” at Boring 2. The density of the gravel surface varied from “firm” to “very compact”, while the subgrade soils varied from “loose” to “very compact” based on Standard Penetration Tests conducted.

Borings B-13 through B-15 (Sta. 157+00 to 168+00) were located in a section of roadway that has previously experienced failure and washout. These borings were spaced approximately 500ft apart, starting at 48 Killearn Road heading east to Chestnut Ridge Road (C.R. 23). Discussions with the Town Highway Superintendent indicate this section of the road has previously experienced severe washout multiple times and has been closed off to be fully repaired and reinstalled. An excerpt of the Geotechnical results is displayed in **Table 3** below.

Table 3 – Results of Soil Borings B-13 through B-15						
Boring Number	Boring Depth	Gravel Road Section Depth	N Subgrade (Blow Count)	Subgrade Condition	% Fines in Subgrade Soils	Depth to Refusal
B-13	4-ft	8 Inches	28	Firm	47.3%	N/A
B-14	4-ft	24 inches	16	Medium	73.0%	N/A
B-15	2.5-ft	24 inches	N/A	Bedrock	24.3%	2.5-Ft

The gravel road section was thin near B-13, only 8-inches thick and the subgrade was poor material with 43% silt content. The subgrade under the road at B-14 near 16-22 Killearn Road was found to be a **very poor material**, with **73%** silt content. The material was also on the threshold between loose



and medium density meaning it has little strength for a road foundation. At B-15, the 24- gravel road section is only 6-inches from bedrock.

We anticipate this area will continue to experience issues and potential severe frost heave due to poor subgrade conditions. The near unconfined soil under the road section at B-14 may settle or heave more severely due to its' medium density condition and extremely high level of fines. At B-15, there is not enough room between the bottom of the gravel section and bedrock for water to expand when it freezes. This may deteriorate the gravel section quicker when water becomes trapped in the road section with nowhere to expand/heave due to the underlying bedrock.

It should be understood that both the gravel and asphalt pavement road sections will experience seasonal frost heaving. Seasonal frost heaving is typically more pronounced in areas with poor drainage. Gravel road sections can also be particularly impacted by loss of support in the spring as frost leaves the ground. As the soil thaws from the top down, water gets trapped above the frozen soil zone and causes the thawed soil above to become super-saturated and thus creates loss of support and deformation of the road surface. Frost heaving, and loss of soil support during the spring thaw, can be eliminated by placing non-frost susceptible materials (such as clean crushed stone) beneath the road section extending below the frost depth. This would require placing non-frost susceptible material to a depth of at least 4 feet below the road surface, which we anticipate is not a feasible option in all areas.

### Existing Utilities

A utility mark out was performed by CED on October 10<sup>th</sup>, 2022, for the first 4,000ft along Killearn Road, up to 471 Killearn Road. A sketch of the existing underground utilities located is sketched as shown in **Appendix D**. Colliers was hired by the Town to perform subsurface utility investigation due to the existing utilities being classified as 'private' by local utility companies within the first 4,000ft. Without a full boundary survey along Killearn Road, the location of the existing underground utilities inside or outside of the highway boundary could not be verified. Verizon, however, located their existing under lines within this section of road to avoid conflicts with the proposed geotechnical investigations. But no other utility did so.

All existing utilities within the first 4,000ft of road appear to be underground. Lines for cable, telephone, and electric were located on both the east and west side of Killearn Road running parallel to the road. There are five (5) telephone and one (1) power underground crossings of the road inside the 4,000ft area that was checked. At each end, telephone and electric lines are both directed towards a riser pole that ties into the first utility pole located along the roadway at 471 Killearn Road. Both lines appear to continue as overhead for the remaining length of Killearn Road to Chestnut Ridge Road.

Relocation of existing underground lines and some utility poles would be required to install proper roadside drainage swales. Coordination with the applicable utility companies will also be needed.

Please note, if the existing underground utilities are in fact on private land and require relocation, utility companies may seek compensation from the Town for relocations. If the utilities are within

Town owned ROW, relocations are typically free if accommodations (a new location) are made available for the utility to move into.

### Environmental Considerations

A preliminary screening was done for the project area to assess potential permitting requirements that may result from existing wetlands, endangered species, or historic preservation area within the proposed limits of disturbance. Preliminary desktop review of environmental information and mapping can be found in **Appendix E**.

The following two permits may be required for work near of in streams and wetlands where roadside area drain to.

- Section 401 – Water Quality Cert.
- Section 404 Nationwide Permit #3 or #14

Other involved agencies or utilities to be coordinated with are:

- NYSDEC & USACE
- US Fish and Wildlife Service
- Town of Union Vale
- Central Hudson Gas & Elec.
- Verizon

### State Environmental Quality Review Act (SEQRA)

If an alternative is selected by the Town to proceed forward with, a SEQR determination may be required for the potential project. After our initial review, we believe the Alternatives 1, 2 and 3 (detailed later in this report) would be classified as a Type II action and would not require further processing, per 6 NYCRR Part 617.5, subdivision (c), items (5): Repaving of existing highways not involving the addition of new travel lanes.

Alternatives 4 and 5 may be a unlisted action because they would uniformly widen the road, and change the designation of “One-lane” to two lanes. By doing so the project would no longer classify under NYCRR Part 617.5, subdivision (c), items (5): Repaving of existing highways not involving the addition of new travel lanes.

Due to the scenic road designation, the Town’s Planning Board may be the Lead Agency under SEQR. We would defer to Town Counsel for this process.

### Threatened and Endangered Species

U.S. Fish & Wildlife’s (USFWS) ‘Information and Planning Consultation’ (IPAC) tool was used to preliminarily screen the project area for endangered, threatened, or protected species. The results generated note that there is potential for endangered (**Indiana Bat**), threatened (**Bog Turtle**) and

candidate (Monarch Butterfly) species to exist within the project area. Candidate species do not have restrictions or regulations to adhere to during design or construction. However, threatened, and endangered species do. This may require the project to adhere to specific permitting regulations and restrictions during construction.

Please note, these preliminary screenings often indicate species known to exist within the County. If an alternative is selected by the Town, a project specific inquiry can be made to determine if either the **Indiana Bat** or **Bog Turtle** are actually present along Killlearn Road. This screening cannot be done until the scope of a project is determined.

### Federally Regulated Wetlands

The National Wetlands Inventory mapper was used to screen for wetlands under Federal jurisdiction along the roadway. There are numerous wetlands and riverine areas along the roadway length on both sides of Killlearn Road. Two federal wetlands located approximately at 333 Killlearn Road are the closest in proximity to the project area and could result in wetland disturbance, requiring permitting with the U.S. Army Corps of Engineers (USACE).

### State Regulated Wetlands & Streams

The project was reviewed for existing wetlands along the road using New York State Department of Environmental Conservation's (NYSDEC) 'Environmental Resource Mapper'. Mill Brook is a NYSDEC **Class 'A' (Drinking Water)** stream that runs adjacent to the road, to the east, outside of the assumed Right-of-Way. Mill Brook does not intersect with Killlearn Road however, watersheds from the roadway may connect to unnamed tributaries of the Mill Brook. Stony Brook is a NYSDEC **Class 'C' (Non-regulated)** stream that crosses the road near the intersection to Chestnut Ridge Road. There are multiple culvert crossings throughout the length of the road, however there are no mapped wetlands under State jurisdiction currently recorded within the project area.

### Cultural Resources

New York State's State Historic Preservation Office (SHPO) was reviewed for cultural or historically sensitive areas within the project limits utilizing NYS's Cultural Resource Information System (CRIS) mapper. The mapper only noted an existing cemetery, Haight Cemetery, located at 452-460 Killlearn Road, setback from the roadway on private property, and no other archaeological sensitive areas that appeared within the project.

### Right-of-Way

ROW determinations were not included in the scope of this study. Therefore, CED cannot make any determinations on road and roadside ownership. However, incidental evidence found during due diligence led us to believe some sections of Killlearn Road may be a "User Road". User roads are:

"Highways "by public use," governed by § 189 of the Highway Law of New York State, which defines them as all lands which have been used by the public as a highway for a period of 10 years or more."

Typically, the boundary of a user road is limited to an area operated and maintained by the Public. If there are no roadside ditches or areas regularly used by the Public to the side of the road, the user road bounds may only extend to the edge of gravel. This severely limits the Town's ability to expand the road or add roadside drainage without property acquisitions.

The incidental evidence we discovered includes tax maps bisected by the road with the same tax ID number on either side, record mapping listing property lines along the road as "assumed", testimony from the Highway Superintendent stating that utility companies claim underground utilities along some of the road are privately owned, and *Call Before You Dig* services denying requests to locate utilities for the first 4000-ft of Killearn road (Sta 0+00 to 40+00). However, some record mapping recovered from the County shows a variable width ROW does exist for large portions of the road. Calls for concrete monuments – indicator of official ROW – were also noted on record mapping. In these areas the width appears to be near 50ft wide but does vary.

A boundary survey along Killearn Road is recommended to discern existing Right-of-Way limits. Should a property's boundary extend to the travel way, road centerline, or within a proposed repair limit, an acquisition may be necessary. Just compensation to the property owners would be paid for by the Town for any temporary easements, permanent easements, or fee takings deemed necessary for repairs. If Federal funding is obtained on any repair or reconstruction efforts, the process for obtaining ROW acquisitions would need to follow the *Real Property Acquisition Policies Act of 1970* a.k.a., "Uniform Act". The Uniform Act is a rigorous policy requiring survey, two levels of property appraisals, attorney review, just compensation, clear title, ROW certification, and process for eminent domain (if required) for any proposed acquisition.

The section of road from 133 Killearn Road to the intersection with Chestnut Ridge Road runs along the Town boundary line with the Town of Union Vale, for approximately 3,500ft (Sta. 135+00 to Sta. 170+00). The Town Boundary line appears to run along the southern roadway edge of Killearn Road. The southern embankment of the road may stretch outside of the Town's maintenance jurisdiction. Again, if Federal funding is obtained and the Uniform Act applies, coordination with Town of Union Vale on granting official maintenance jurisdiction to the Town may be required along the southern most portion of Killearn Road.

## PROJECT ALTERNATIVES

CED proposes five (5) alternatives, varying in scope and cost be considered for Killearn Road

1. Alternative 1 – Basic Repairs
2. Alternative 2 – Drainage Ditches
3. Alternative 3 – Mill & Fill with Drainage Improvements
4. Alternative 4 – Reconstruction – Gravel Road
5. Alternative 5 – Reconstruction – Asphalt Road

### Alternative 1 – Basic Repairs

Alternative 1 would involve repairing and improving the existing roadway section in limited areas, determined necessary by the Town and CED.

#### Repairs

The following locations are recommended for repair and/or improvement at a minimum:

- Gravel surface rutting near 596, 452, 430, 68, & 48 Killearn Road
- Settlement at 252 Killearn Road existing culvert crossing
- Embankment erosion at 623 & 387 Killearn Road
- Culvert repair/replacement at 387 & 108 Killearn Road, and all others as deemed necessary
- All potholes, rills and erosion encountered on the road by spot-filled and compacted with a 10-ton roller.
- A layer or topping stone placed along the entire road and graded with crown.
- Post a weight limit on the road and establish a permitting process for larger vehicles.

In repair sections, the existing gravel surface would be excavated to subgrade to allow for the new gravel wearing course installation, while maintaining existing roadway grade. Sections where there has previously been roadway and slope failure could be undercut (over excavated) in order to improve underlying soils that may be the cause of settlement. New backfill, subbase and surface stone would be installed to grade. Last, install a layer of topping stone from the Town's stockpile and grade with a uniform crown for the entire length of the road.

This alternative also recommends replacement of existing culverts that are crushed or do not appear to be sufficiently sized for the peak flow received. It is recommended that replacement of existing culverts and installation of new additional culverts occur in each of the remaining Alternatives.

The Town can consider posting a weight limit on the road to limit heavy vehicular traffic. We suggest a weight limit of 12.5 tons. A fully loaded school bus usually weights no more than 12 tons, and a typical empty dump truck wights 13 tons. Any trucks heavier then 13 tons would require a permit. Fees from that permit can be placed in the Town's Highway budget for maintenance from the damage heavy vehicles place on roads like Killearn. Normal vehicular traffic would not be affected.

It should be noted that problems will still occur with the roadway if Alternative 1 is the only improvement the Town executes.

### Alternative 2 – Drainage Ditches

Alternative 2 would include all repairs mentioned in Alternative 1 and would propose the installation of roadside ditches for a majority of the 3.29-mile road. As stated in FHWA's *'Gravel Roads Construction Manual'*, drainage is key to a gravel road's life cycle and operation. There are currently no appreciable ditch lines along the majority of Killearn Road.

This Alternative would require a boundary survey to assure all proposed work is within the Town ROW. If sections of the road are found to have inadequate ROW width, acquisitions of land would be required.

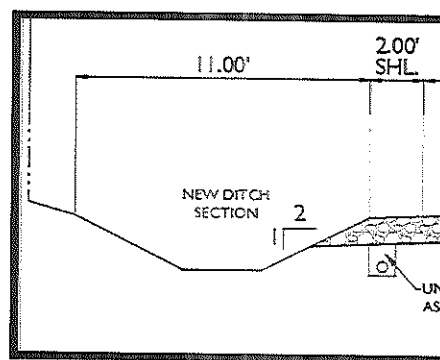


Figure 16 – Typical Ditch Section

New drainage ditches would be excavated and installed adjacent to the proposed roadway shoulders. Drainage ditches would consist of a 3ft wide grassed bottom, approximately 1.5ft deep. Beyond the ditch backslope, embankment will be graded to meet existing ground within the Right-of-Way. These ditches can intercept water from adjacent properties from entering and damaging the road and drain the road surface as well. This can lead to improved site and roadway conditions, while minimizing actual roadway repairs and preventing future deterioration of the existing gravel road.

### Alternative 3 – Mill & Fill with Drainage Improvements

Alternative 3 would include all repairs mentioned in above Alternative 1 & 2 and revitalize the existing road without expansion of full reconstruction. This improvement to Killearn Road would be performed by way of gravel reclamation. This process, sometimes called "Mill & Fill".

To conduct a Mill & Fill, a reclamation process would be utilized to rehabilitate and compact the existing gravel into a new road section. This option provides a more uniform compaction and graded installation of the entire road. A surface topping stone meeting recommended specifications would then be used to uniformly grade the entire road with a 4% minimum crown.

The depth of a Mill & Fill can be as little as 8 inches (partial) to 24 inches (full) in depth and would reuse the material already in the road section. Material that is milled would be watered and compacted with appropriate type of roller. A layer of topping stone can be added at the end to give the road a final grade and shape.

As referenced by FHWA's 'Gravel Roads Construction Manual' in Chapter 3.18, properly shaping and compacting the subgrade prior to placing the gravel wearing surface is vital to the maintaining the integrity of the gravel road and preventing future drainage and deterioration conditions from reoccurring.

Full depth reclamation may also prove to be most useful for the portion of Killearn Road that has previously experienced multiple collapse failures, between Chestnut Ridge Road and 48 Killearn Road. The existing gravel surface and subgrade would be pulverized and tilled, mixing the existing material with water and cement to enhance its structural integrity as a base course.

This Alternative reduces the amount of new material needed, by reusing the existing material as new subgrade and only requiring new surface course to be applied. This Alternative also allows for the repair of surface drainage problems such as lack of crown, high shoulder build-up, and severe rutting along the road edges. Additional culverts should be installed, and existing culverts should be analyzed and upsized though for this Alternative, to account for the large-scale drainage issues affecting Killearn Road.

FHWA also recommends stabilization of subgrades by way of chemical modification. This process involves application of chemical additives such as lime, fly ash, or Portland cement to the subgrade to increase structural properties of the soil. These additives help to increase material performance and can mitigate problems that occur from insufficient soil strength, such as settlement, collapse, slope failure, and shrinking/swelling.

#### Alternative 4 – Reconstruction with Gravel Road

Alternative 4 would involve the reconstruction of Killearn Road with a new gravel road section and drainage ditches for the full length of the road from Hoxie Road to Chestnut Ridge Road. The proposed travel way would be uniformly widened to include two (2) 10ft wide travel lanes and 2ft shoulders. The existing road gravel would be milled in-place to become the new road subbase. Additional subbase would be added where the road is widened. The subbase would then be watered, chemically treated, and compacted thoroughly. A new 6 inch wearing course of gravel would be applied to the road and shaped with a 4% crown.

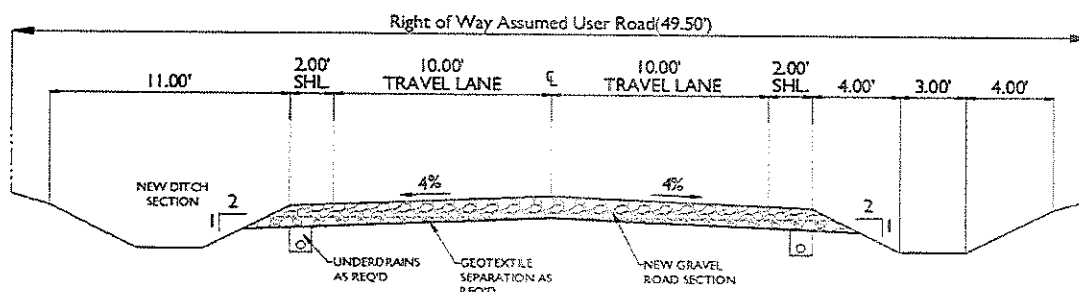


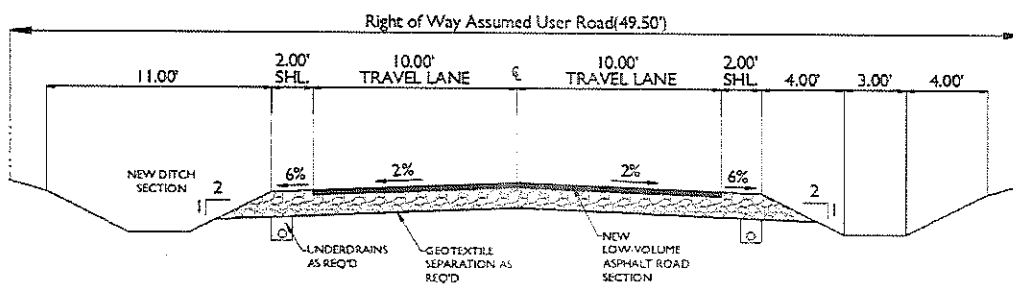
Figure 17 – Typical Section of Gravel Road Reconstruction

New drainage ditches would be excavated and installed adjacent to the proposed roadway shoulders. Drainage ditches would consist of a 3ft wide grassed bottom, approximately 1.5ft deep. Beyond the ditch backslope, embankment will be graded to meet existing ground within the Right-of-Way. Underdrains would be installed along the shoulders of the roadway utilizing a trenched 4" diameter perforated underdrain pipe and backfilled with clean crushed stone, daylighting into the proposed drainage ditches. Catch basins and closed storm sewers can be used in limited areas where ditches cannot be placed within the ROW.

The intent of this Alternative would be to install the proposed road section and drainage ditches, then grade back to meet existing ground, all within the Highway Boundary. The existing Right-of-Way is assumed as a three-rod road Right-of-Way of 49.5' wide but needs verification. It is very likely that the proposed section will result in grading beyond the Right-of-Way and will require acquisitions from landowners. The number of acquisitions cannot be determined or estimated at this time without a full Boundary survey along the road.

#### Alternative 5 – Reconstruction with Paved Road

Alternative 5 would involve the reconstruction of Killlearn Road with a new asphalt road section and drainage ditches for the full length of the road from Hoxie Road to Chestnut Ridge Road. The proposed travel way will include two (2) 10ft wide travel lanes and 2ft shoulders, with a 6.5" thick asphalt pavement section on new subbase course. The pavement section will consist of 8" of new subbase course installed on exposed subgrade, 3" of NYSDOT asphalt Base Course, 2" of Binder Course, and 1.5" of Top Course. The proposed asphalt pavement section would be installed on excavated subgrade, after removing the existing gravel wearing surface. This will result in more excavation needed to install the roadway section compared to previous alternatives.



*Figure 18 – Typical Section – Paved Road*

New drainage ditches and underdrains would be installed as mentioned in previous alternatives. This alternative would result in the largest cost for improving Killlearn Road based on material pricing, as well as other factors such as possible realignment of the roadway to improve sight distance and curve geometry to meet AASHTO's minimum standards for paved roads and possibly for increased design speeds, and additional roadway signage required by the Manual for Uniform Traffic Control Devices (MUTCD).





Engineering  
& Design

The intent of this Alternative would be to install the proposed road section and drainage ditches, then grade back to meet existing ground, all within the Highway Boundary. The existing Right-of-Way is assumed as a three-rod road Right-of-Way of 49.5' wide but needs verification. It is very likely that the proposed section will result in grading beyond the Right-of-Way and will require acquisitions from landowners. The number of acquisitions cannot be determined or estimated at this time without a full Boundary survey along the road.

### Staging

CED is conscience that funding is hard to come by and our proposed alternatives are expensive. To help mitigate these issues, the Town may consider staging improvements over time. For example, an alternative may be chosen and built in 0.5-mile segments over the course of 5-6 years. Or, as repairs are needed, the Town builds a new section of widened roadway for a length that fits into that year's budget.

We recognize this piecemeal approach is not ideal, and the optics from residents may be poor. Communication with the residents will be vital to explain a multiyear program and gain buy-in from all stakeholders in the process. But this segmenting approach may best fit into available funding sources.

### Proposed Work Zone Traffic Control

An offsite detour is the recommended method of traffic control for the project, utilizing State Route 343 and Chestnut Ridge Road. Traffic going eastbound on SR 343 may continue East to the intersection of Chestnut Ridge Road and turn South. Traffic going northbound on Chestnut Ridge Road may continue North before turning West onto SR 343. The road would remain open to local traffic and residents along Killearn Road.



*Figure 19 – Proposed Detour Plan*

Coordination should occur with local emergency services to ensure response times will be acceptable during construction. The local school district, postal service, and local residents will all be contacted to coordinate bus routes, postal delivery, and residential access during the road closure. The details for the work zone traffic control should be prepared and evaluated during final design.

## Cost Comparison

Table 4 - Project Costs						
Activities		Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Construction Costs	Highway	\$132,171	\$466,152	\$1,279,534	\$2,245,101	\$5,244,457
	Field Change Item (5%)	\$6,609	\$23,308	\$63,977	\$112,255	\$262,223
	Mobilization (4%)	\$0	\$0	\$51,181	\$89,804	\$209,778
<b>Total Construction Costs</b>		<b>\$138,780</b>	<b>\$489,459</b>	<b>\$1,394,692</b>	<b>\$2,447,160</b>	<b>\$5,716,458</b>
Design Contingency (10%)		\$13,878	\$48,946	\$139,469	\$244,716	\$571,646
Construction Inspection (10%)		\$0	\$0	\$139,469	\$244,716	\$571,646
<b>Total Alternative Costs</b>		<b>\$152,658</b>	<b>\$538,405</b>	<b>\$1,673,631</b>	<b>\$2,936,592</b>	<b>\$6,859,750</b>

## Project Funding

Colliers has performed due diligence into the costs associated with the project and has taken an economic approach to each alternative. Gravel wearing surfaces were selected for most proposed alternatives as a cost-effective alternative to asphalt, in accordance with the Federal Highway Administration's (FHWA) 'Gravel Roads & Construction Maintenance Guide'. Design parameters were based on AASHTO's Geometric Design for 'Very Low-Volume Roads' to help control project costs.

Due to Killearn Road classified as a local rural road, it is not eligible for most Federal aid funding programs. Alternative sources of funding for road repairs will be needed. A limited search of possible funding sources was conducted. The more promising programs include:

- **NYSDEC's Water Quality Improvement Project (WQIP):** The project, or parts of a project on Killearn Road may qualify under the WQIP's *Non-Agricultural Nonpoint Source Abatement and Control* section. In particular, "Road ditch stabilization" and/or Culvert repair and/or replacement. The Road may qualify based on being within a watershed of the Mill Brook (**Class A** drinking water stream). Maximum awards are capped at \$1.0 million with a 25% required match by the Town.
- **Multimodal Project Discretionary Grant (MPDG):** The project, or parts of a project on Killearn Road may qualify under the MPDG's "A project on a publicly owned highway or bridge that provides or increases access to an agricultural, energy, or intermodal facility that supports the economy of a rural area". To utilize this grant, the road must prove to be vital for agriculture that supports the local economy. More research on admissibility is needed for this grant as most MPDG funding is provided to roads meeting Federal eligibility requirements, and Killearn Road is not.

- **Infrastructure Investment and Jobs Act** - According to the Office of New York State Comptroller, the State is expected to receive \$13.5 billion over a five-year program for highway and bridge programs<sup>5</sup>. In addition, the State will have access to competitive grants and other funding programs not included in the \$13.5 billion figure. As a result, aid may be available in coming years through an unlisted program in which Killearn Road may be eligible, or through increases in State Specific programming such as CHIPS and PAVE-NY.
- **Bonding** - The Town may wish to explore municipal bonding to finance an alternative to repair Killearn Road. This can be done by itself or in conjunction with any grants received to reduce the total amount of financing needed through bonds.
- **Discretionary Spending** - Funding may be more directly obtained through a process of lobbying State departments and Federal officials for qualifying programs.

CED is currently conducting a more thorough review of upcoming Grant programs for 2023 that may be applicable to Killearn Road. Updates will be included in the final version of this report. Please note, grant programs are fluid in nature and not always part of continuous programs. Screening for grant funding should be an on-going process by the Town after this report is finalized.

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<sup>5</sup> "Locally Owned Roads by the Numbers" Jan. 2022, Office of New York State Comptroller