

**Fiscal Year 2026  
Warrant Article 10**

**Lowell Road and Birch Street Intersection  
Improvements**

Shall the Town of Hudson vote to raise and appropriate the sum of \$2,553,000 for construction of intersection improvements? This project will be funded \$2,042,400 (80%) from NHDOT federal grant and \$510,600 from the Lowell Road Corridor Fund, Zone 1 and Zone 2. This is a Special Warrant Article, per RSA 32:7 VI, reflecting an appropriation that will not lapse until the monies are expended, or June 30, 2031, whichever is the earliest. This appropriation is in addition to Article 2, the Operating Budget.

Tax Rate Impact is \$0.00

Recommended by the Board of Selectmen 5-0

Recommended/Not Recommended by the Budget Committee

Date: **12/20/2024**

Project No.: **21971**

To: **Elvis Dhima, Town Engineer**

From: **Jason Gallant, PE and Westley Nuhn, PE**

Subject: **Belknap Road Extension – Preliminary Design Report**

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Wright-Pierce contracted with the Town of Hudson to review previous design concepts and provide a preliminary design for the Belknap Road Extension project. The scope of the project includes the extension of Belknap Road to the Lowell Road/Birch Street intersection creating a four-leg intersection. The goal of the project is to reduce left-turn movements from County Road to Lowell Road.

### Existing Conditions

A survey of the site between the Belknap Road/County Road intersection and Lowell Road/Birch Street intersection was completed in October 2024 to document the existing conditions. Below is a summary of the existing conditions.

### Site Conditions

The site of the proposed roadway extension is located along Belknap Road over Second Brook between the Lowell Road bridge (NHDOT Bridge 125/082) to the west and the County Road bridge (NHDOT Bridge 126/083) to the east. The site is forested and contains large boulders throughout. The site is located along two privately owned parcels, one to each side of Second Brook. The parcel to the north is located at 46 Lowell Road (Tax Map 198 Lot 22) and the parcel to the south at 88 Lowell Road (Tax Map 198 Lot 21). The parcel located on the north side of the project has a paved parking lot and overhead and underground utilities parallel to the brook. The west end of the site is a 3-way signalized intersection between Lowell Road and Birch Street. The east end of the site is a 3-way stop condition intersection between Belknap Road and County Road.

### Belknap Road

Belknap Road generally runs from northeast to southwest. The roadway measures approximately 30'-0" wide with two 12'-0" travel lanes and variable width shoulders. The NHDOT classified Belknap Road as an urban, minor arterial roadway with an Average Daily Traffic (ADT) of 4,439 according to the Traffic Data Management System. The existing roadway connects to Central Street on the northern end and terminates at a 3-way intersection with County Road on the southern end.

### Second Brook

Second Brook flows from East-to-West under Lowell and County Road with an overall channel width was measured with a range of 8-12 feet within the project area. The project is located within FEMA Special Flood Hazard Areas including the 100-year floodplain (Zone AE) and the regulatory floodway of Second Brook, between cross sections 'H' and 'I', shown in FIRMette map and flood profile (Hillsborough County FIS) in Appendix D. The base flood elevation at the project location is interpolated at elevation 148.5' (NAVD88) based on the FEMA flood profile of Second Brook.

### **Utilities**

Underground utilities and overhead wires are present along Belknap Road and at both intersections. Sewer, storm drain, and overhead utilities cross through the northern parcel from the County Road to Lowell Road intersection. The sewer crosses under Second Brook just upstream of the Lowell Road bridge. There are twelve (12) 4-inch diameter conduits along the upstream fascia of the Lowell Road bridge that runs south to north along Lowell Road.

### **Subsurface Exploration**

On October 15, 16, and 21, 2024, SW Cole performed a subsurface exploration program consisting of six borings and one streambed sample within the project area. Borings were advanced to a depth of approximately 19 to 26 ft. Four test borings were drilled at each corner of the Lowell Road and Birch Street intersection, and two were drilled along the proposed alignment of Belknap Road Extension. The streambed sample was taken just upstream of the proposed culvert location.

The borings at the intersection generally consisted of 3 to 8 feet of very loose to dense granular fill material with silt and gravel over organic material at depths of 5 to 8.3 feet. This was underlain by medium to very dense granular soils with cobbles and boulders. These test borings terminated at depths of 25.1 to 26.3 feet until refusal, likely upon encountering cobbles or boulders. The borings drilled along the proposed alignment consisted of organic and granular fill material to a depth of 2.3 and 5 feet over very loose to medium dense native gravelly sand soils to 10 and 15 feet. This was underlain by medium to very dense silty gravelly sand with cobbles and boulders. The borings were terminated upon refusal at 19 and 25.1 feet, likely as a result of encountering cobbles or boulders.

Refer to Appendix E for the Exploration Location Plan, Boring Logs, and Gradation Results.

### **Wetland Delineation**

Jurisdictional wetlands were delineated by Marc Jacobs, Certified Wetland Scientist No. 090 on October 2, 2024. The area-of-interest (AOI) includes jurisdictional wetlands along Second Brook between County and Lowell Roads. Flag series A-F are summarized in further detail in the Wetland Report included in Appendix C. Consultation with NHDES regarding NHDES jurisdiction along the location of the bank is recommended during the pre-application process. Additionally, the floodplain wetlands adjacent to the Tier 3 stream are considered a priority resource area (PRA) and may trigger mitigation requirements with NHDES Wetlands Bureau.

### **Proposed Work**

Wright-Pierce has developed a preliminary design plan to extend Belknap Road to connect into a 4-way signalized intersection with Lowell Road and Birch Street in accordance with a Conceptual Plan developed in August 2019 by the Town of Hudson. A summary of the proposed work is provided below:

### **Roadway**

The proposed roadway will measure 26'-0" curb-to-curb with two 11'-0" travel lanes and two 2'-0" shoulders. There will be a 5'-6" wide bituminous sidewalk with granite curb on the south side of the roadway, a crosswalk at the intersection of Belknap and Lowell Road, and 5'-6" wide bituminous sidewalk at the northwest corner to be tied into the existing concrete sidewalk on the Lowell Road bridge. The existing grade is proposed to be striped of topsoil and forest mat to an average depth of 3 feet to reach the gravelly sand native soils. The new roadway is proposed to be built up with a granular borrow up to the new roadway base.

The proposed guardrail will consist of standard 31" W-beam guardrail with EAGRT TL2 treatments at the northeast and southwest corners. The northwest corner will be tied into the existing bridge railing on the Lowell Road bridge and will be coordinated with the Lowell Road bridge rehabilitation project. The southeast corner will be tied into existing guardrail along County Road and will be coordinated with the County Road bridge rehabilitation project.

The horizontal alignment of Belknap Road is shifted to the south near the County Road intersection and consists of a series of curves to minimize impacts to the adjacent private parking area, wetlands, and Second Brook. The vertical alignment is a tangent from County Road to Lowell Road and is sloped at 0.58%. The grades within both intersections are intended to remain the same by cold planing and paving in-kind.

### **Culvert**

The proposed culvert will be a 72 inch diameter reinforced concrete pipe (RCP), AASHTO Designation Class III. A minimum cover of 12 inches is provided over the pipe in accordance with Table 12.6.6.3-1 of the AASHTO Bridge Design Specifications, 9<sup>th</sup> Edition. The culvert will be supported on a minimum of 18" of structural fill wrapped in a non-woven geotextile fabric and backfilled with granular backfill. The culvert will be infilled with native streambed material. Large boulders (Class IX Riprap) will be placed around each end of the culvert to direct streamflow into the proposed culvert and scour protection.

### **Retaining Wall**

The proposed retaining wall will be constructed along either side of the proposed roadway in locations shown on the plans. The retaining wall will be a precast T-Wall with cast-in-place headwalls around the culvert on the inlet and outlet ends. The purpose is to support the roadway and limit the impact to the surrounding wetland area. The retaining wall will be embedded a minimum of 5'-0" in accordance with the NHDOT requirement for frost depth.

### **Traffic Signals**

The proposed roadway extension will connect to a new 4-way signalized intersection between Lowell Road, Birch Street, and Belknap Road. Traffic signals will be designed in accordance with NHDOT Traffic Signal Specifications and Standard Details. Traffic signal design will be part of the final design scope.

### **Utilities**

Currently, Wright-Pierce has identified two areas where there are potential utility conflicts that require further coordination. One potential conflict is located near the utility duct bank on the south side of the Lowell Road bridge. The new bridge approach guardrail appears to be conflicting with the duct bank. Another potential conflict is with SMH 2363 and the new sidewalk and guardrail within the area. One utility modification is proposed to include relocation of the utility pole within the parking lot area to facilitate the extension of Belknap Road.

### **Second Brook**

The proposed roadway construction will require tree clearing within 5'-0" from the proposed toe of slope or the front face of the retaining wall. Large boulders within the project limits will be removed and reused as appropriate. While completing the work, cofferdams will be installed on both the upstream and downstream ends with a water diversion pipe to maintain brook flow. Turbidity barriers and compost filter socks will be installed to control sediment and erosion. The work area within the cofferdam limits will be continuously dewatered throughout construction. The roadway embankment will be constructed with granular backfill with 2:1 side slopes and precast retaining walls.

**Hydrologic and Hydraulic Analysis**

Second Brook headwaters originate south of Bush Hill Road in the Town of Hudson and flow west before discharging to the Merrimack River. Flow is conveyed through a series of wetland complexes before receiving confluent flow from the Beaver Ponds and flowing west to the project location through stream crossings located on Pelham Road and County Road. The watershed area reported by USGS StreamStats is 4.94 square miles (3,162 acres) as shown in Appendix D. The proposed stream crossing associated with the Belknap Road Extension is located between the existing County Road Bridge and Lowell Road / T-Bones culvert. The County Road Bridge consists of a 10-ft clear span and approximate 4.5-ft rise. 300-ft downstream of County Road, Second Brook is conveyed through a 350-ft long culvert beginning at Lowell Road and discharging south of T-Bones. The inlet consists of a 30-ft long concrete box culvert before transitioning to a 72 inch steel pipe. This pipe was approved by the NHDES Wetlands Bureau for lining in September 2024. The proposed 72 inch RCP culvert for the Belknap Road Extension matches the hydraulic capacity of the existing downstream steel culvert which has a slope of ~1% and manning’s ‘n’ of 0.012.

Flows were obtained and verified using StreamStats, FEMA Flood Insurance Study (FIS) Hillsborough County (Effective September 25, 2009) and USGS Regression Equation (Leblanc, 1978). Second Brook peak flows from FEMA FIS were reported upstream of the Pelham Bridge and downstream at the confluence with the Merrimack River and interpolated for the proposed crossing location. FEMA values are used for Q50 and Q100 peak flows. USGS Regression Equation peak flow statistics align relatively consistent with those interpolated from FEMA and is used to determine Q25 peak flow.

**Table 1 – Peak Flow Statistics (cfs)**

Recurrence Interval	StreamStats	USGS Regression Eqn. (Leblanc, 1978)	FEMA FIS	Peak Flow Used for Design	Velocity (ft/s)
Q25	396	338	<i>Not reported</i>	338	18
Q50	480	406	420	420	19
Q100	581	493	500	500	18

FEMA flood profiles, including modeled water surface elevations during peak flow events are included in Appendix D. Based on review of the flood profiles, peak water surface elevations of Second Brook throughout the project area are controlled by a downstream constriction at the Winnhaven Drive culvert crossing. The hydraulic capacity is sized to accommodate 50-year peak flows (Q50) shown in Manning’s calculations provided in Appendix D. The Manning’s equation was also used to calculate velocities for each peak design flow provided in Table 1. NHDOT Manual on Drainage Design for Highways requires culverts convey flow associated with a minimum 25-year design storm frequency and checking for the 50-year design frequency for new culverts on minor state aid highways and betterments. Note, hydraulic calculations do not take into account tailwater impacts from the Winnhaven Drive culvert crossing at Second Brook.

## Permitting

- **Local Permits:** Local permitting including proposed work within special flood hazard areas to be facilitated by the Town during final design.
- **State Environmental Permits:**
  - **Wetlands** – Impacts within jurisdictional wetland resources will require a Standard Dredge and Fill application based on the Tier 3 classification of the contributing watershed area at the stream crossing location. The application fee required by the NH Department of Environmental Services (NHDES) is \$0.40 per square foot and includes a 50-day initial review period from the issuance of an Administrative Completion Notice. An evaluation for the presence of threatened and endangered species from the Natural Heritage Bureau and Request for Project Review with the New Hampshire Department of Historical Resources is also required. Additionally, a functional assessment completed by a certified wetland scientist will be required prior to submission. The requirement for compensatory mitigation is anticipated due to PRA impacts (floodplain adjacent to Tier 3 stream) and the proposed stream crossing does not meet tier-specific requirements for a new Tier 3 stream crossing per Env-Wt 904.05(f). Compensatory mitigation should be confirmed during a pre-application meeting with NHDES during final design. Compensatory mitigation could include payment into the in-lieu fee program. An Alternative Design Request is anticipated as the proposed stream crossing does not meet Env-Wt 904.05 tier-specific requirements.
  - **Shoreland** – Second Brook is not subject to Shoreland Water Quality Protection Act (RSA 483-B) based on screening completed using the NHDES Permit Planning Tool. Shoreland permitting is not anticipated.
  - **Alteration of Terrain (AOT) Permit** – The proposed project meets the criteria for a General Permit by Rule per Env-Wq 1503.03. An AOT permit application is not anticipated.
- **Federal Permits:**
  - Army Corps of Engineers (ACOE): Authorization under ACOE General Permit 23 “Wetland, Stream, River & Brook Crossings” (GP 23) is anticipated during the Standard Dredge and Fill pre-construction notification permitting process for minor and major projects. ACOE Appendix B is required as part of the NHDES Wetlands Bureau application for coverage under ACOE GP 23.
  - NPDES General Permit for Dewatering: Construction dewatering activities in New Hampshire are subject to a General Permit for Dewatering. The depth of excavation will require a Dewatering Permit. This permit is applied for by the General Contractor as part of construction and will be covered in the Construction Costs.
  - NPDES Construction General Permit: Construction sites of greater than one acre is subject to a National Pollutant Discharge Elimination System (NPDES) Stormwater Permit for construction. The proposed disturbed area is less than one acre therefore coverage under the CGP is not anticipated.
  - The proposed project includes constructing two new outfalls discharging to Second Brook. The Town should evaluate if these outfalls should be added to the Town’s list of MS4 outfalls.

## Right-of-Way Impacts

Construction easements and right-of-way (ROW) acquisitions/permanent easements will need to be obtained prior to permitting and construction. The project includes temporary construction impacts and the establishment of a permanent ROW corridor associated with the Belknap Road Extension. Construction easements and ROW acquisition or permanent easements are required at the following properties (Map-Lot): 88 Lowell Road (198-21) and 76 Lowell Road (198-22).

Impacts to the adjacent parking lot located on Map-Lot 198-22 were minimized during preliminary design to maintain the number of parking spots in the existing paved parking lot. A portion of pavement is impacted by the proposed alignment along the southwest corner of the parking lot. Vertical granite curbing and riprap is proposed

to grade down to existing pavement grade. Angled parking is proposed to avoid a loss in parking spaces and minimize disruption to traffic flow within the existing parking lot. Mill and overlay are proposed within the extents shown in the drawings for restriping of the pavement. There are no proposed grade changes or impacts to the existing direction of stormwater sheet flow across the parking lot. A temporary construction easement will be required to restore the parking spaces.

ROW acquisition or permanent easements are required for usage and maintenance of the proposed Belknap Road extension. The limits of the proposed ROW will be identified in final design in coordination with the Town. Additional areas may be recommended for a temporary construction easement for construction considerations.

### **Engineer's Cost Opinion**

The Engineer's Opinion of Construction Cost developed for the proposed work includes mobilization, the work to construct the roadway, the culvert construction, associated work, and 25% contingency. Traffic signal modifications are not explicitly included within this preliminary cost opinion and will be provided during the final design. Roadway striping is not shown on the preliminary design plans but is accounted for within the cost opinion. The cost opinion was developed using NHDOT Weighted Average Unit Prices for projects between December 1, 2023, and December 1, 2024. WP's cost opinion projects the anticipated cost of the work to be \$2,553,000.

### **Attachments:**

- Appendix A: Preliminary Design Plans
- Appendix B: Opinion of Probable Construction Cost
- Appendix C: Wetlands Report
- Appendix D: Hydraulics and Hydrology
- Appendix E: Subsurface Exploration Results