

APPENDIX B

PROBLEM CULVERT IDENTIFICATION

Jewett Brook Stream Crossing Assessments
Data collection by Bear Creek Environmental, LLC
Assessment Conducted during August 2010

**Trail Below Davis Street (Victoria Woods Senior Housing)
Laconia, NH**

Reach Location: Jewett Brook M01
Bridge Width: 25 feet
Bridge Clearance: 3.6 feet
Bridge Span: 26 feet
Material: Concrete



Channel above inlet



Inlet



Channel below outlet



Outlet

Geomorphic Compatibility – Not Applicable

Percent Bankfull Width – Undersized (93%)

Approach Angle – Sharp bend

Erosion and Armoring – hard bank armoring not associated with bridge is failing above structure; bank erosion is low upstream and downstream of bridge.

Sediment Continuity – No sediment deposits (bars) noted.

Additional problems noted: Upstream alignment is poor; water hits the wing wall above the structure at the south side.

Aquatic Organism Passage – Not applicable

Priority for Replacement – Low

Jewett Brook Stream Crossing Assessments
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**Davis Street and Mill Building
Laconia, NH**

Reach Location: Jewett Brook M01
Bridge Width: not available
Bridge Clearance: 3.3 feet
Bridge Span: 24 feet
Material: Concrete



Side bar above Davis Street Bridge



Side bar inside of and below Mill building



Outlet



Channel below Davis Street

Geomorphic Compatibility – Not Applicable

Percent Bankfull Width – Undersized (86%)

Approach Angle – Channelized straight

Erosion and Armoring – Armoring intact upstream and failing downstream; bank erosion low in channel below bridge.

Sediment Continuity – Elevation of sediment deposits (side bars) upstream is greater than 1/2 bankfull elevation

Notes: Scour below structure

Aquatic Organism Passage – Not applicable

Priority for Replacement - High

Jewett Brook Stream Crossing Assessments
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**Union Avenue
Laconia, NH**

Reach Location: Jewett Brook M01
Bridge Width: 60 feet
Bridge Clearance: 2.7 feet
Bridge Span: 18.3 feet
Material: Concrete



Channel above inlet



Inlet



Channel below Outlet



Below Union Street Bridge

Geomorphic Compatibility – Not Applicable

Percent Bankfull Width – Undersized (66%)

Approach Angle – Channelized straight

Erosion and Armoring – Hard bank armoring intact at upstream end

Sediment Continuity – Mid- channel bar upstream of bridge and within the structure; sediment deposits are not greater than ½ bankfull.

Notes: Deposition above and below bridge

Aquatic Organism Passage – Not applicable

Priority for Replacement – Low

Jewett Brook Stream Crossing Assessments
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Assessment Conducted during August 2010

**Pedestrian Bridge above Union Avenue
Laconia, NH**

Reach Location: Jewett Brook M01
Bridge Width: 14.1 feet
Bridge Clearance: 4.4 feet
Bridge Span: 13.0 feet
Material: Concrete



Channel above inlet



Inlet



Chanel below Outlet



Outlet

Geomorphic Compatibility – Not Applicable

Percent Bankfull Width – Significantly undersized (47%)

Approach Angle – Channelized straight

Erosion and Armoring – Hard bank armoring failing above and below structure; streambed scour undermining abutments at both upstream and downstream ends.

Sediment Continuity – Side bars above and below bridge; depositional feature above structure is greater than 1/2 bankfull elevation.

Notes: Water overtopped the banks during spring 2010 and flowed into parking lot below bridge.

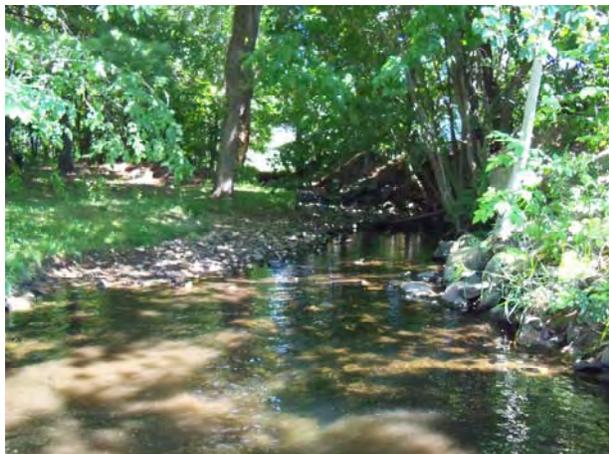
Aquatic Organism Passage – Not applicable

Priority for Replacement – Low (no room to increase span of bridge)

Jewett Brook Stream Crossing Assessments
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**Highland Street
Laconia, NH**

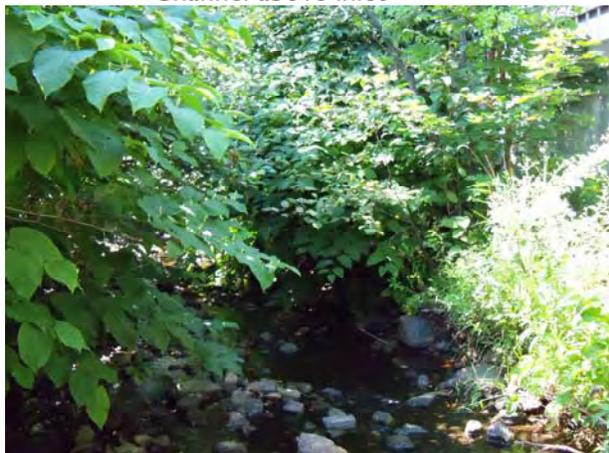
Reach Location: Jewett Brook M01
Bridge Width: 40 feet
Bridge Clearance: 6 feet
Bridge Span: 25 feet
Material: Concrete



Channel above inlet



Inlet



Chanel below Outlet



Outlet

Geomorphic Compatibility – Not Applicable

Percent Bankfull Width – Undersized (90%)

Approach Angle – Channelized straight

Erosion and Armoring – Hard bank armoring along banks above bridge is failing; high bank erosion above the structure; low bank erosion below structure with hard bank armoring intact.

Sediment Continuity – High side bars (greater than ½ bankfull) on both sides below bridge

Notes: Structure looks relatively new. No major problems noted other than significant deposition below the bridge. Japanese knotweed (invasive plant) is growing on bars.

Aquatic Organism Passage – Not applicable

Priority for Replacement – Low (structure looks new and in good condition)

Jewett Brook Stream Crossing Assessments
Data collection by Bear Creek Environmental, LLC
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**Pedestrian Crossing at Private Home
Laconia, NH**

Reach Location: Jewett Brook M01
Bridge Width: 2.6 feet
Bridge Clearance: 4.9 feet
Bridge Span: 23.5 feet
Material: Timber



Channel above inlet



Inlet



Chanel below Outlet



Outlet

Geomorphic Compatibility – Not Applicable

Percent Bankfull Width – Undersized (84%)

Approach Angle – Channelized straight

Erosion and Armoring – Hard bank armoring failing above and below structure; high bank erosion upstream and downstream; scour causing undermining around/under structure at upstream end.

Sediment Continuity – Mid-channel bar above structure with deposits less than ½ bankfull.

Notes: Some scour on north bank under abutment; slight scour above bridge. Bridge is a not a floodprone constriction.

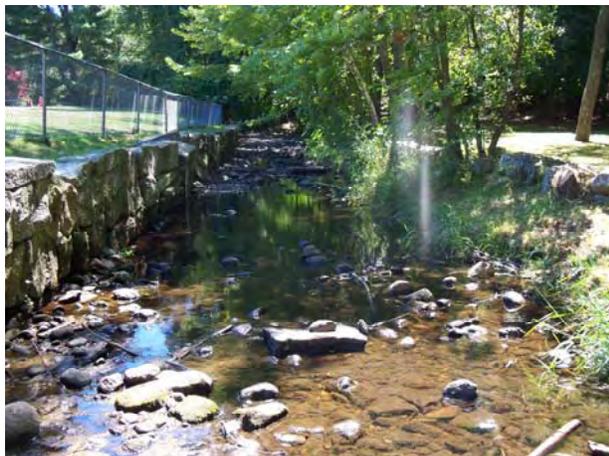
Aquatic Organism Passage – Not applicable

Priority for Replacement – Low

Jewett Brook Stream Crossing Assessments
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Assessment Conducted during August 2010

**Pedestrian Trail at Tardiff Park
Laconia, NH**

Reach Location: Jewett Brook M02-A
Bridge Width: 5.2 feet
Bridge Clearance: 4.0 feet
Bridge Span: 20.0 feet
Material: Timber



Channel above inlet



Inlet



Channel below Outlet



Outlet

Geomorphic Compatibility – Not Applicable

Percent Bankfull Width – Undersized (76%)

Approach Angle – Channelized straight

Erosion and Armoring – Very little erosion --- banks are armored

Sediment Continuity – Side bars above and below structure are less than ½ bankfull.

Notes: Bridge is minimally impacting the channel. Bank armoring and channelization is much more significant in terms of geomorphic issues. Some deposition was observed about 100 feet upstream of the bridge; however, this deposition did not appear to be due to the bridge.

Aquatic Organism Passage – Not applicable

Priority for Replacement – Low

Jewett Brook Stream Crossing Assessments
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**Hounsell Avenue
Gilford, NH**

Reach Location: Jewett Brook M03-A
Arch Width: 57 feet
Arch Clearance: 7.1 feet
Arch Span: 20.0 feet
Material: Concrete (looks new)



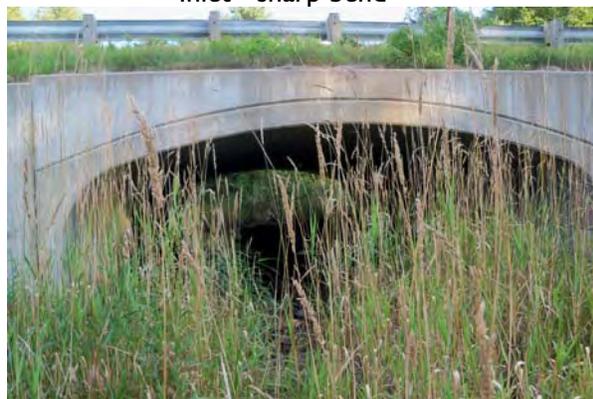
Channel above inlet



Inlet - sharp bend



Channel below Outlet



Outlet

Geomorphic Compatibility – Not Applicable

Percent Bankfull Width – Adequate (97%)

Approach Angle – Sharp bend

Erosion and Armoring – No bank erosion noted above and below structure; hard bank armoring failing upstream and intact downstream.

Sediment Continuity – Very high side bar (greater than 1/2 bankfull) upstream, within and downstream of the arch.

Notes: Structure appears to be adequately sized relative to the bankfull width, but the alignment is poor. Significant sediment deposition above and below the arch.

Aquatic Organism Passage – Not applicable

Priority for Replacement – Low (structure is causing localized instability, but structure looks new and is not a fish passage barrier)

Jewett Brook Stream Crossing Assessments
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**Route 3 & 11
Gilford, NH**

Reach Location: Jewett Brook M03-A

Culvert Length: 280 feet

Culvert Height: 9.9 feet

Culvert Width: 11.0 feet

Material: Concrete bottom, steel corrugated top, rock and concrete wing wall



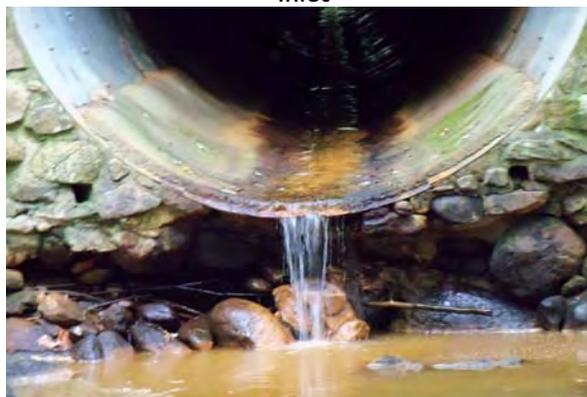
Channel above inlet



Inlet



Channel below Outlet



Outlet

Geomorphic Compatibility – Mostly Incompatible

Percent Bankfull Width – Undersized (53%)

Slope – Culvert slope higher than the channel slope

Approach Angle – Channelized straight

Erosion and Armoring – Bank erosion is high below structure and hard bank armoring is failing

Sediment Continuity – Side bar upstream of culvert is greater than ½ bankfull elevation

Notes: Culvert is in good to fair condition. The steep riffle and high side bar upstream of the structure indicate the culvert is undersized. Downstream bank heights are substantially higher than upstream bank heights. Iron precipitate in pipe.

Aquatic Organism Passage – No AOP including adult salmonids

Notes: Culvert is perched with a drop of 2.3 feet from invert to water surface. There is fast, shallow flow in culvert. Retrofit would be difficult given the significant perch.

Priority for Replacement – High

Jewett Brook Stream Crossing Assessments
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**Country Club Road
Gilford, NH**

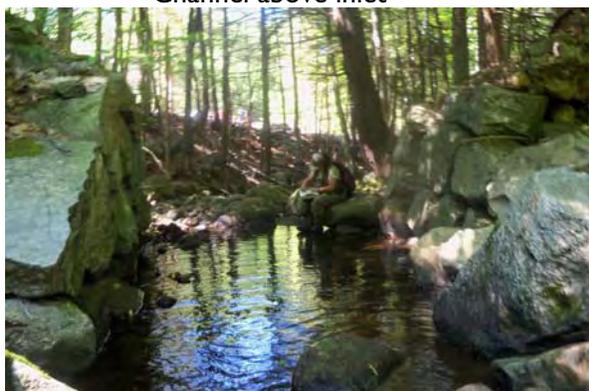
Reach Location: Jewett Brook M04-A
Culvert Length: 45 feet
Culvert Height: 4 feet
Culvert Width: 8 feet (4 foot diameter twin culverts)
Material: Concrete bottom



Channel above inlet



Inlet



Channel below Outlet



Outlet

Geomorphic Compatibility – Mostly Incompatible

Percent Bankfull Width – Significantly Undersized (41%)

Slope – Culvert slope lower than the channel slope

Approach Angle – Channelized straight

Erosion and Armoring – Low erosion upstream and high erosion downstream; hard bank armoring is failing above and below structure.

Sediment Continuity – Steep riffle upstream of twin culverts indicating structure is undersized

Notes: Debris and sediment at upstream end of structure. Riprap on north bank is failing – severe bank erosion. Riprap is slightly blocking the south outlet.

Aquatic Organism Passage – No AOP including adult salmonids

Notes: North culvert has 0.25 foot perch (invert to water surface), while perch on south culvert is 0.02 feet. The water depth in the culverts is very shallow (0.02 feet).

Priority for Replacement – High

Jewett Brook Stream Crossing Assessments
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**Swain Road
Gilford, NH**

Reach Location: Jewett Brook M05
Culvert Length: 66 feet
Culvert Height: 5.6 feet
Culvert Width: 4 feet (2.5 foot wide at footers)
Material: Concrete



Channel above inlet



Inlet



Channel below Outlet



Outlet

Geomorphic Compatibility – Partially Compatible

Percent Bankfull Width – Significantly Undersized (26%)

Slope – Culvert slope same as channel slope

Approach Angle – Naturally straight

Erosion and Armoring – Low bank erosion above and below box culvert; streambed scouring causing undermining around/under culvert and footer at upstream end and wing walls at downstream end.

Sediment Continuity – No sediment deposits greater than 1/2 bankfull elevation

Notes: Culvert appears to be old; concrete is deteriorating on bottom. Significant scouring of wingwalls at downstream end.

Aquatic Organism Passage – Reduced

Concrete on bottom of box culvert is reducing aquatic organism passage. Culvert is at grade.

Priority for Replacement – High (structure in poor condition and reducing AOP)

**Hounsell Avenue
Gilford, NH**

Reach Location: Unnamed Tributary M02T1.01-A
Culvert Length: 120 feet
Culvert Height: 4 feet
Culvert Width: 4 feet
Material: Plastic smooth, stone headwalls, concrete



Channel above inlet



Inlet



Channel below Outlet



Outlet

Geomorphic Compatibility – Partially Compatible

Percent Bankfull Width – Significantly Undersized (26%)

Slope – Culvert slope same as channel slope

Approach Angle – Mild bend

Erosion and Armoring – Low bank erosion upstream and no bank erosion noted downstream of structure. Hard bank armoring is intact.

Sediment Continuity – Side bar greater than 1/2 bankfull elevation above structure.

Notes: Culvert is in good condition, but is very undersized. Significant aggradation at upstream end (with sediment obstructing the inlet) and scour below structure.

Aquatic Organism Passage – No AOP including adult salmonids

Water depth in culvert is 0.1 feet. Culvert has slight perch of 0.2 feet and is free fall.

Priority for Replacement – High (structure in good condition – consider retrofit options)

**Trail at Private House
Gilford, NH**

Reach Location: Unnamed Tributary M02T1.01-A
Bridge Width: 2.5 feet
Bridge Clearance: 3 feet
Bridge Span: 15.3 feet
Material: Timber



Channel above inlet



Inlet



Channel below Outlet



Outlet

Geomorphic Compatibility – Not applicable

Percent Bankfull Width – Adequate (101%)

Approach Angle – Sharp bend

Erosion and Armoring – High bank erosion upstream and downstream of bridge; however, structure is causing minimal erosion.

Sediment Continuity – Side bar and mid-channel bar upstream of bridge have sediment deposits greater than ½ bankfull elevation. Sharp bend appears to be contributing to deposition.

Notes: Bank erosion on north bank

Aquatic Organism Passage – Not applicable

Priority for Replacement – low

**Bypass #2 (West of Route 3 and 11)
Gilford, NH**

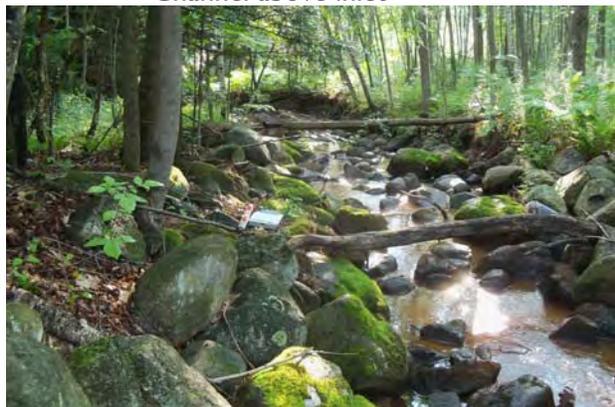
Reach Location: Unnamed Tributary M02T1.01-B
Culvert Length: 126 feet
Culvert Height: 7.2 feet
Culvert Width: 6.3 feet
Material: Steel corrugated



Channel above inlet



Inlet



Chanel below Outlet



Outlet

Geomorphic Compatibility – Partially Compatible

Percent Bankfull Width – Undersized (52%)

Slope – Culvert slope same as channel slope

Approach Angle – Channelized straight

Erosion and Armoring – Low bank erosion downstream, none noted upstream. Hard bank armoring above and below structure is failing.

Sediment Continuity – No sediment deposits noted.

Notes: Channel below structure has good floodplain access. Culvert is rusted out on bottom.

Aquatic Organism Passage – Reduced AOP

Water depth in culvert is 0.3 feet. Culvert is at grade. Water depth in culvert is shallow and velocity is fast relative to stream channel.

Priority for Replacement – High priority (structure in poor condition)

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**Route 3 and 11
Gilford, NH**

Reach Location: Unnamed Tributary M02T1.01-B
Culvert Length: 220 feet
Culvert Height: 7.2 feet
Culvert Width: 7.1 feet
Material: Steel corrugated



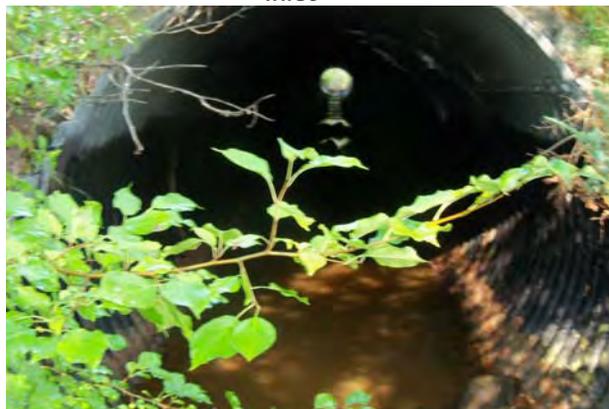
Channel above inlet



Inlet



Channel below Outlet



Outlet

Geomorphic Compatibility – Partially Compatible

Percent Bankfull Width – Undersized (58%)

Slope – Culvert slope same as channel slope

Approach Angle – Channelized straight

Erosion and Armoring – No bank erosion noted upstream and low bank erosion downstream. Hard bank armoring is failing above and below structure.

Sediment Continuity – No sediment deposits noted.

Notes: Culvert is in poor condition – rusted out on bottom near inlet.

Aquatic Organism Passage – Reduced AOP

Water depth in culvert is 0.3 feet. Culvert is at grade.

Priority for Replacement – High (structure is in poor condition)

**Bypass #1 (East of Route 3 and 11)
Gilford, NH**

Reach Location: Unnamed Tributary M02T1.01-B
Culvert Length: 209 feet
Culvert Height: 7.1 feet
Culvert Width: 7.0 feet
Material: Steel corrugated



Channel above inlet



Inlet



Channel below Outlet



Outlet

Geomorphic Compatibility – Partially Compatible

Percent Bankfull Width – Undersized (57.4%)

Slope – Culvert slope same as channel slope

Approach Angle – Channelized straight

Erosion and Armoring – Bank erosion low upstream and none observed downstream. Hard bank armoring failing above structure and intact below.

Sediment Continuity – No sediment deposits noted.

Notes: Very long culvert. Stormwater drainage at downstream end is causing scour around culvert.

Aquatic Organism Passage – No AOP including Adult Salmonids

Water depth in culvert is 0.1 feet. Culvert is free fall and perch is 0.3 feet.

Priority for Replacement – High

**Sawmill Road
Gilford, NH**

Reach Location: Unnamed Tributary M02T1.01-B

Culvert Length: 90 feet

Culvert Height: 7.1 feet

Culvert Width: 6.4 feet

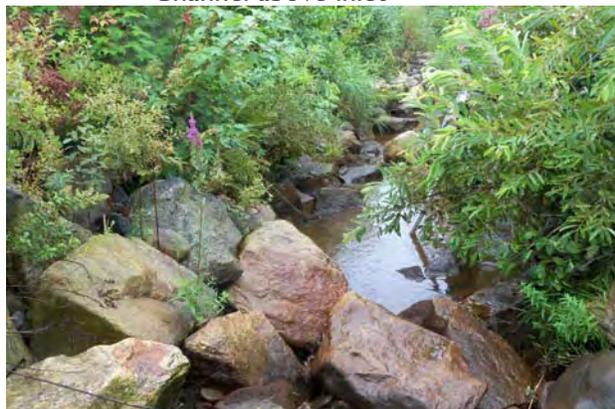
Material: Steel corrugated pipe and stone headwalls



Channel above inlet



Inlet



Channel below Outlet



Outlet

Geomorphic Compatibility – Mostly Incompatible

Percent Bankfull Width – Undersized (52%)

Slope – Culvert slope higher than channel slope

Approach Angle – Channelized straight

Erosion and Armoring – No bank erosion noted above and below culvert. Hard bank armoring is failing at upstream and downstream ends. Streambed scour causing undermining around/under culvert at both ends.

Sediment Continuity – No sediment deposits noted.

Notes: Culvert is becoming deformed by weight of riprap cemented around it. Two overflow pipes are associated with the structure. Crossing is channelized with extensive riprap.

Aquatic Organism Passage – Reduced AOP

Water depth in culvert is 0.4 feet. Outlet is cascade with estimated drop of two feet.

Priority for Replacement – High

Jewett Brook Stream Crossing Assessments
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**Maple Street
Gilford, NH**

Reach Location: Unnamed Tributary M02T1.01-D
Culvert Length: 60 feet
Culvert Height: 3.5 feet
Culvert Width: 3.5 feet
Material: Concrete



Channel above inlet



Inlet



Channel below Outlet



Outlet

Geomorphic Compatibility – Mostly Incompatible

Percent Bankfull Width –Significantly Undersized (32%)

Slope – Culvert slope higher than channel slope

Approach Angle – Channelized straight

Erosion and Armoring –No bank erosion noted upstream and downstream of culvert.

Sediment Continuity – No sediment deposits noted.

Notes: No significant issues noted other than culvert is perched.

Aquatic Organism Passage – No AOP including Adult Salmonids

Water depth in culvert is 0.05 feet. Culvert outlet invert is free fall and is perched (0.3 feet from invert to water surface).

Priority for Replacement – High (if culvert cannot be replaced consider retrofit options)

**Wesley Road
Gilford, NH**

Reach Location: Unnamed Tributary M02T1.01-D

Culvert Length: 70 feet

Culvert Height: 3.9 feet

Culvert Width: 4.0 feet

Material: Steel Corrugated



Channel above inlet



Inlet



Channel below Outlet



Outlet

Geomorphic Compatibility – Partially Compatible

Percent Bankfull Width – Significantly Undersized (37%)

Slope – Culvert slope is same as channel slope

Approach Angle – Channelized straight

Erosion and Armoring – No bank erosion noted upstream of structure and bank erosion below culvert is high. Hard bank armoring is failing above and below culvert. Streambed scour is causing undermining around/under culvert at downstream end.

Sediment Continuity – No sediment deposits noted.

Notes: Wetland approximately 100 feet upstream of culvert crossing. Culvert is in poor condition (rusted).

Aquatic Organism Passage – No AOP including Adult Salmonids

Water depth in culvert is 0.1 feet. Culvert outlet invert is free fall and has perch of 0.9 feet.

Priority for Replacement – High

**Snowmobile Trail
Gilford, NH**

Reach Location: Unnamed Tributary M02T1.02

Bridge Width: 11 feet

Bridge Clearance: 2.0 feet

Bridge Span: 10 feet effective width (bridge is longer than channel – 22 feet total)

Material: Timber



Channel above inlet



Inlet



Channel below Outlet



Outlet

Geomorphic Compatibility – Not applicable

Percent Bankfull Width – Adequate (110%)

Approach Angle – Naturally straight

Erosion and Armoring – Low bank erosion upstream and no bank erosion noted downstream; no hard bank armoring.

Sediment Continuity – No sediment deposits noted.

Notes: Iron precipitate within structure. Some minor erosion above bridge on east bank. Minor scour associated with bridge.

Aquatic Organism Passage – Not applicable

Priority for Replacement – Low

Jewett Brook Stream Crossing Assessments
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**Crescent Street
Laconia, NH**

Reach Location: Unnamed Tributary M01S1.01

Culvert Length: 120 feet

Culvert Height: 3.0 feet

Culvert Width: 3.0 feet

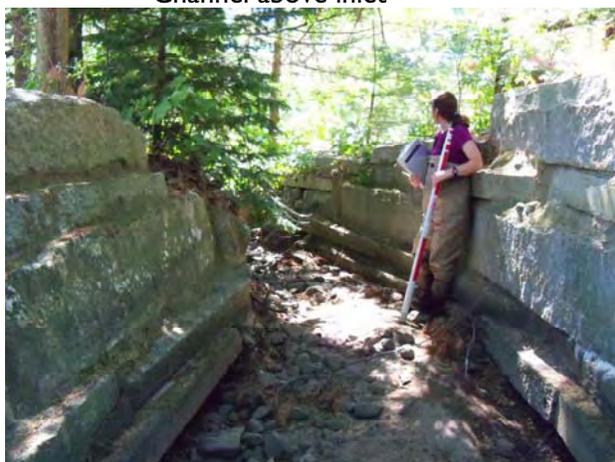
Material: Steel corrugated (downstream) and concrete (upstream)



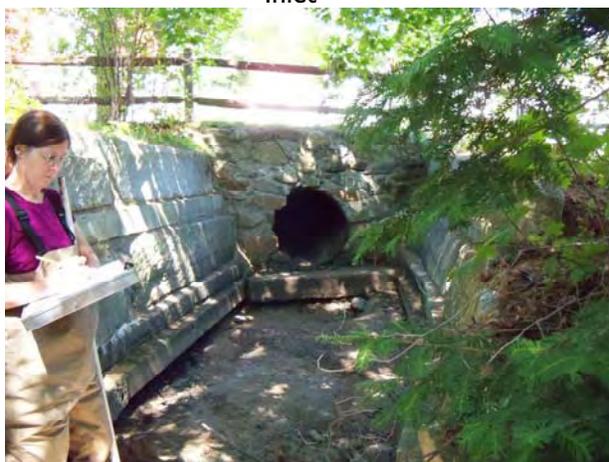
Channel above inlet



Inlet



Channel below Outlet



Outlet

Geomorphic Compatibility – Partially Compatible

Percent Bankfull Width –Significantly Undersized (36%)

Slope – Culvert slope is same as channel slope

Approach Angle – Channelized straight

Erosion and Armoring –High bank erosion above and below culvert; upstream hard bank armoring failing; streambed scouring around culvert upstream and around wing walls downstream.

Sediment Continuity – No sediment deposits noted

Notes: Landowner reports this tributary is typically dry during the summer months.

Aquatic Organism Passage – No AOP including Adult Salmonids

Water depth in culvert is 0.0 feet. Culvert outlet invert is free fall and is perched (1.0 feet from invert to water surface).

Priority for Replacement – Moderate (tributary is intermittent)

**Gilford Avenue
Laconia, NH**

Reach Location: Unnamed Tributary M01S1.01

Culvert Length: 54 feet

Culvert Height: 3.0 feet

Culvert Width: 4.5 feet

Material: Concrete box culvert



Channel above inlet



Inlet



Channel below Outlet



Outlet

Geomorphic Compatibility – Partially Compatible

Percent Bankfull Width –Undersized (54%)

Slope – Culvert slope is same as channel slope

Approach Angle – Channelized straight

Erosion and Armoring –Low bank erosion above and below culvert; hard bank armoring is intact; streambed scour causing undermining around/under wing walls at both ends.

Sediment Continuity – No sediment deposits noted

Notes: Check dams upstream of culvert

Aquatic Organism Passage – Full AOP

Gravel substrate throughout structure. Culvert is at grade.

Priority for Replacement – Low

**Gilman Street
Laconia, NH**

Reach Location: Unnamed Tributary M01SI.01
Culvert Length: 60 feet
Culvert Height: 2.0 feet
Culvert Width: 2.5 feet
Material: Concrete with stone headwall



Channel above inlet



Inlet



Channel below Outlet



Outlet

Geomorphic Compatibility – Fully Incompatible

Percent Bankfull Width –Significantly Undersized (24%)

Slope – Culvert slope is lower than channel slope at upstream end, but is similar downstream.

Approach Angle – Sharp bend

Erosion and Armoring –High bank erosion upstream and low erosion downstream; hard bank armoring is failing; streambed scour causing undermining around/under culvert at upstream end.

Sediment Continuity – No sediment deposits noted

Notes: Scour below; very narrow and armored channel downstream of culvert.

Aquatic Organism Passage – Reduced AOP

Culvert outlet is at grade; no material within structure

Priority for Replacement – Moderate (tributary is intermittent)

**Liberty Hill Road
Gilford, NH**

Reach Location: Unnamed Tributary M04T2.01-A
Culvert Length: 105 feet
Culvert Height: 3.0 feet
Culvert Width: 3.0 feet
Material: Concrete



Wetland above inlet



Inlet



Chanel below Outlet



Outlet

Geomorphic Compatibility – Partially Compatible

Percent Bankfull Width –Significantly Undersized (28%)

Slope – Culvert slope is higher than channel slope

Approach Angle – Naturally straight

Erosion and Armoring –No bank erosion upstream and high erosion downstream; hard bank armoring is failing.

Sediment Continuity – Side bar downstream (elevation is less than ½ bankfull)

Notes: Iron precipitate in culvert; beaver dam just upstream of structure; large boulders placed above inlet; no flow out of culvert.

Aquatic Organism Passage – No AOP including adult salmonids

Culvert outlet is free fall (0.25 perch from invert to water surface)

Priority for Replacement – High