Appendix C:

Stream Surveys in the Waukewan Watershed

NH Fish & Game

Stream Surveys in the Lake Waukewan Watershed

NH Fish & Game 2010

Northern Winona Tributary

We surveyed upstream from the Winona Rd Crossing in New Hampton. Only wild brook trout (11 total) were found in this stream. The crossing appears to be passable for brook trout but may be undersized to convey sediment and handle higher flows during flooding events. This likely causes the upstream side of the culvert to backwater and deposit sediment. Overtime, this may cause the loss of a defined channel. The stream has a low gradient in this section and has signs of historical beaver presence. A large abundance of wood in the stream provides good habitat features for wild brook trout. The stream has a somewhat early successional riparian area (likely beginning to regrow since beavers have left the area). It would be very beneficial for both fish and water quality if this riparian area was allowed to grow. This stream originates from the Homestead Forest Property (Lakes Region Conservation Trust). There may be a good opportunity to connect the stream corridor to this conserved property in this area.

Figure 1. Northern Winona tributary

Figure 2. Undersized culvert crossing Winona Road

Southern Waukewan Tributary (Reservoir Brook)

We surveyed upstream from the Reservoir Rd Crossing in Meredith. This is the outlet of the Meredith Reservoir. Only wild brook trout (9 total) were found in this stream. The water level was very low in this stream. Perhaps it's worth looking into the water level management strategy in the reservoir to see if there's any possibility of providing a steadier flow. Ongoing construction (river left side) was encroaching on the stream. Efforts should be made to ensure the rest of the riparian area is left intact. The Reservoir road crossing is perched and likely undersized to accommodate high flows. It appears that fish passage is not possible here.

Figure 3. Southern Waukewan tributary (Reservoir Brook)

Figure 4. Inlet of undersized crossing on Reservoir Rd.

Figure 5. Outlet of perched crossing on Reservoir Rd.

Outlet of Hawkins Pond

Figure 6. Outlet of Hawkins Pond

We parked along Hawkins Pond Rd and walked to the site in Center Harbor. While no wild brook trout were found in the outlet of Hawkins Pond, both wild rainbow trout and common sunfish were found. The presence of common sunfish (a warm water species) usually indicates either wetlands or ponds are upstream and summer water temperatures that would be too warm for wild brook trout. The presence of wild rainbow trout in this stream indicates that the crossing on Winona Rd is passable, at least to some fish. The crossings should be assessed to ensure it is appropriately sized for geomorphic compatibility.

Central Waukewan Tributary (Otter Pond tributary) and Eastern Waukewan Tributary:

No fish were captured at the Central Waukewan tributary (upstream of Waukewan Rd) and the Eastern Waukewan tributary (walked in from Jenness Hill Rd). Flows in these two streams were very low. We thought there is a good chance that these streams are intermittent. Although no resident fish were found, these streams (along with the other tributaries in the system) may be used during the spring season as spawning location for both rainbow smelt and white suckers. Both of these species play an important role in aquatic systems (primarily being forage for other fish species). Efforts should be made to ensure no manmade barriers (perched culverts and dams) prevent the free movement into these streams. Successful reproduction can be compromised by sedimentation. This can be reduced by restoring riparian buffers along the streams.

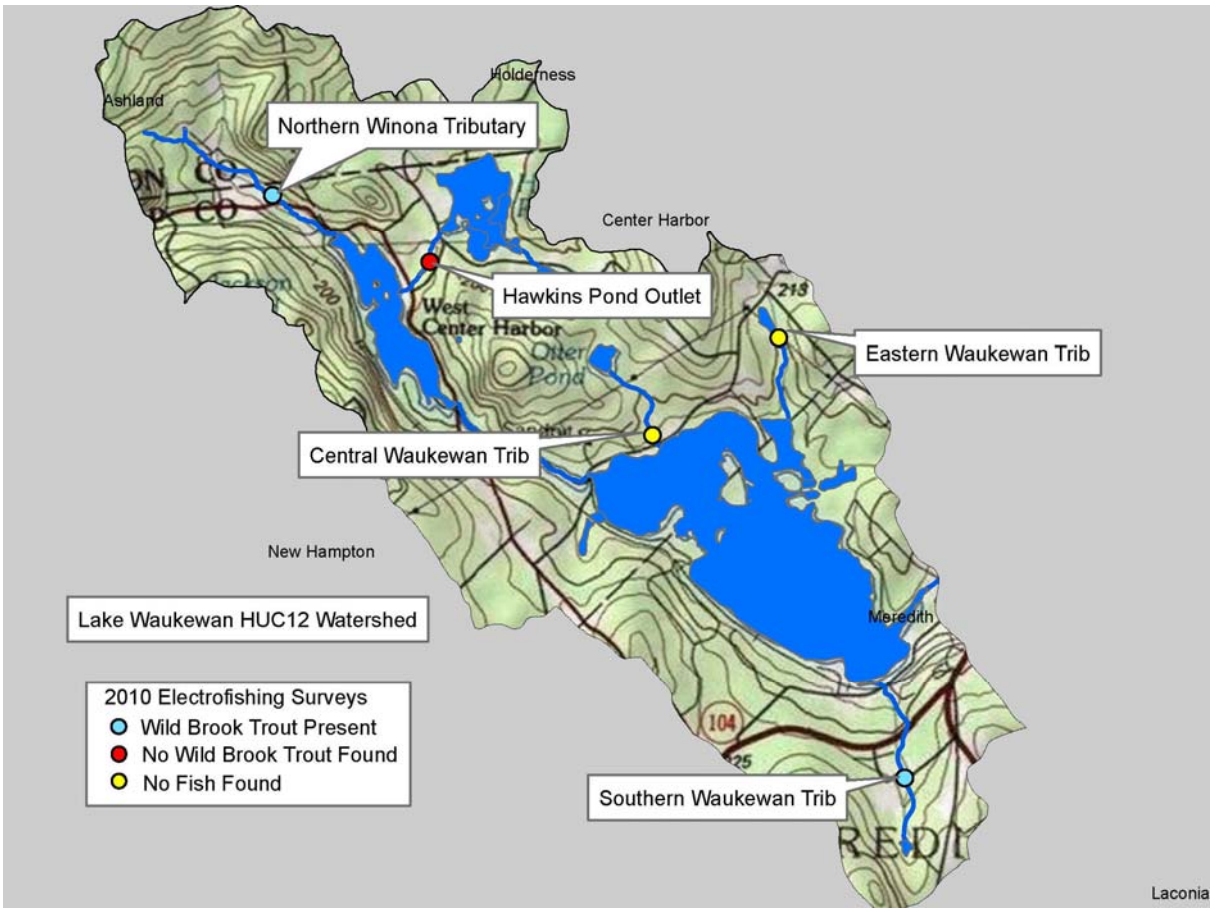

Figure 7. Map of stream survey locations in the Waukewan Watershed.

General Comments

Headwater Stream Protection

The level of protection for headwater streams varies by town and is usually accomplished through zoning ordinances. Local zoning ordinances should be reviewed to determine whether they provide sufficient protection. Future water quality in the Lake Waukewan Watershed will depend largely on the protection of headwater stream habitat in the upper subwatersheds. Despite their ecological value, the conservation of these smaller streams are sometimes overlooked.

Best management practices for agriculture and silviculture should also be promoted among landowners who abut headwater streams. Local environmental stewards need to be attentive and vocal when projects are proposed within the watershed that could impact aquatic systems. The Shoreland Water Quality Protection Act (RSA 483-B) already offers some regulatory protection for the lakes and ponds throughout this watershed and some towns may offer specific protection to smaller streams. The best way to avoid impacts to this habitat is to leave naturally vegetated buffers along the stream bank with a minimum width of 15 meters, but ideally 100 meters or more. The wider the buffer, the more species

that will use it as a travel corridor and the better protection it will serve against sedimentation and pollutants.

Additionally, riparian vegetation slows sediment and pollutant laden stormwater before it enters an aquatic system. Stormwater drainage designs that discharge directly into the stream should be avoided in favor of systems that filter stormwater into the ground (i.e. rain gardens, properly designed catch basins). Maintaining larger riparian areas also allow the ability for trees to fall into streams. The presence of large woody debris creates pools, cover, stream bank stability and complex habitat for fish species. When wood cover is allowed to persist in streams it may also slow and retain nutrient particulates. Taking steps to protect headwater streams will prevent irreversible losses to New Hampshire's biodiversity, as well as save countless dollars by protecting water quality and preventing flood damage. Therefore, communicating these protective measures to local policy makers is imperative.

Restoration

Efforts should also be implemented to restore riparian buffers and stabilize banks. These restoration efforts will protect both aquatic habitat and water quality. Since the demand for more development and land alteration and their subsequent strains put on aquatic systems is expected to continue throughout the area, the need to provide systems that slow, stabilize, and infiltrate flows will always be needed. There are several different options and resources available to help guide the reestablishment of riparian areas and bank stabilization. As fisheries resource managers, we believe prioritization should be given to those streams where wild brook trout and/or species found on the state's threatened, endangered, or species of greatest conservation need list exist.

Stream Crossing Inventories

Stream crossings should be evaluated within the drainage to determine if they are degrading habitat (altering sedimentation and erosion rates) and/or obstructing fish passage (fragmenting habitat). Stream crossing inventories used in conjunction with fish survey data can be used to determine the level of degradation of aquatic habitat as well as provide restoration focus priority areas. This should be communicated to local road agents and the New Hampshire Department of Transportation so that stream crossing upgrade projects can be developed, prioritized, and implemented.

Designing and Maintaining Transportation Infrastructures

Efforts should be made to minimize the number of stream crossings along a stream when a new travel corridor is proposed. This would minimize potential habitat fragmentation and impacts to aquatic systems. If a new crossing is unavoidable, the New *Hampshire Stream Crossing Guidelines* (2009) provides methodology to produce an environmental sound crossing structure.

It has been standard practice to divert stormwater from roads, parking lots, and driveways directly into rivers and streams. This leads to bank erosion, excess sediment loads, and elevated levels of pollutants, such as petroleum products, that wash in from pavement and other impervious surfaces. Stormwater retention ponds heat up in the summer and result in an influx of heated water when they overflow into streams.

New construction should use Low Impact Development (LID) techniques, which are based on the principal that stormwater should be filtered through the ground before it enters any surface waters. In some instances, areas with current stormwater runoff issues can be restored by retrofitting components with LID practices. The amount of base flow during the summer is determined by groundwater recharge from rain and snowfall during fall, winter and spring. Using LID practices, such as porous asphalt and gravel wetlands, rain gardens, bioretention systems, and tree filters, increases onsite infiltration of stormwater and improves groundwater recharge rates. The University of New Hampshire (UNH) Stormwater Center is a valuable local resource for technical assistance on LID practices.

Public Outreach and Education

Educational programs should be developed that inform both children and adults about the importance of the link between wild brook trout presence and good water quality. Educators should emphasize the realization that environmental impacts caused by one person or one family in the drainage could have a lasting effect on them and their neighbors downstream. The key is to stress the needs of the wild brook trout, a focal species that is the essence of New Hampshire's rich heritage.