



**Mount Allison  
Dendrochronology Lab**

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A Dendroarcheological Analysis of William Black Memorial Church:  
Glen Margaret, Nova Scotia

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# A Dendroarcheological Analysis of William Black Memorial Church: Glen Margaret, Nova Scotia

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### Abstract

Fourteen tree-ring samples were taken from beams in William Black Memorial Church in Glen Margaret, Nova Scotia. The sampling was conducted in efforts to extend the Mount Allison Dendrochronology (MAD) Lab chronologies for southwestern Nova Scotia using historic structures. Statistical analysis was conducted on the eastern hemlock (*Tsuga canadensis*) samples to deduce the tree-ring growth patterns of the species for the region. Based on analysis, it was determined that the trees used in the construction of the church were felled in 1820, supporting the records that the church was built in 1821.

## Introduction

Churches in Nova Scotia are the pride of many communities and as such have been maintained for many centuries by their parishioners. Southwestern Nova Scotia has a wealth of churches that have been built and cared for by the earliest settlers. Not only are these churches rich in cultural history, the wood used to construct them holds a wealth of information on the environment of the region up to the time of initial settlement.

Dendroarcheology is the study of tree rings taken from beams in historical structures. The purpose of this project is to understand how several tree species were growing in southwestern Nova Scotia at the time of settlement. Samples were taken from eight historical churches in the region to accomplish this goal. Master chronologies of radial growth from each tree species, at each church, were constructed, with the ultimate goal of adding growth patterns to existing regional chronologies to extend radial growth records for each tree species in the region. This method of collecting tree-rings is used in southwestern Nova Scotia because the majority of the region's old-growth forests have been cut down, and therefore shortening the length of the record accessible from live trees. Beams from historic churches provide records of tree-ring growth of what would be the region's old-growth forests, if they were standing today.

William Black Memorial Church in Glen Margaret, Nova Scotia (MAD Lab #06MS000) was one of the eight churches the Mount Allison Dendrochronology (MAD) Lab sampled in the summer of 2006 (Figure 1). According to church records and the book *Thy Dwellings Fair: Churches of Nova Scotia 1750-1830*, the church was constructed in 1821. (Duffus et al, 1982: 159.) Due to its age, there was potential for the tree-rings in the church beams to extend quite far into the past. With the support of the church's parishioners, sampling was conducted.



**Figure 1:** William Black Memorial Church, Glen Margaret, N.S.

## **Research Methods**

Fourteen samples were taken from a total of ten beams using an increment borer (see Appendix A). The diameter of each sample is 4.3 mm, approximately the size of a pencil (Figure 2). The sampling process has no negative effects on the structural integrity of the building. All of the beams sampled are located underneath the church, where they have not been altered since the initial construction of the church. Beams were selected for sampling according to their integrity (the absence of rot) and the presence of bark (indicating the last tree-ring has not been removed in the construction of the church).

Samples were stored in plastic straws and were transported back to the lab to be prepared for analysis. Each core was glued into a slotted mounting board. The cores were sanded using up to 600 grit sandpaper in order to ensure a clear cross-section of the rings. The cores were then measured using a 63x light microscope and the Velmex measuring system. This process produced measurements indicating the annual growth rates of the individual trees to 0.001 mm.

Prior to further analysis, it was important to determine the tree species used in the construction of the church. As all tree species have different growth responses to climatic factors, to compare growth patterns of a set of samples they must be of the same species. Although the bark on the samples collected gave some indication that beams were eastern hemlock (*Tsuga canadensis*), two samples were examined using a scanning electron microscope (SEM) to confirm the identification. Both samples were confirmed as to be eastern hemlock, and it was inferred from this that all ten beams were of the same species.

The process of analyzing archeological data requires two steps. The first is to crossdate the samples within the church to each other. This ensures that there is a significant correlation between the growth patterns of the trees within the building (representing a stand of trees that was growing together and thus should have similar growth trends). Once this was completed, the church beams were crossdated into an eastern hemlock chronology constructed by the MAD Lab from live trees obtained from Berwick, Nova Scotia sampled in the summer of 2006.

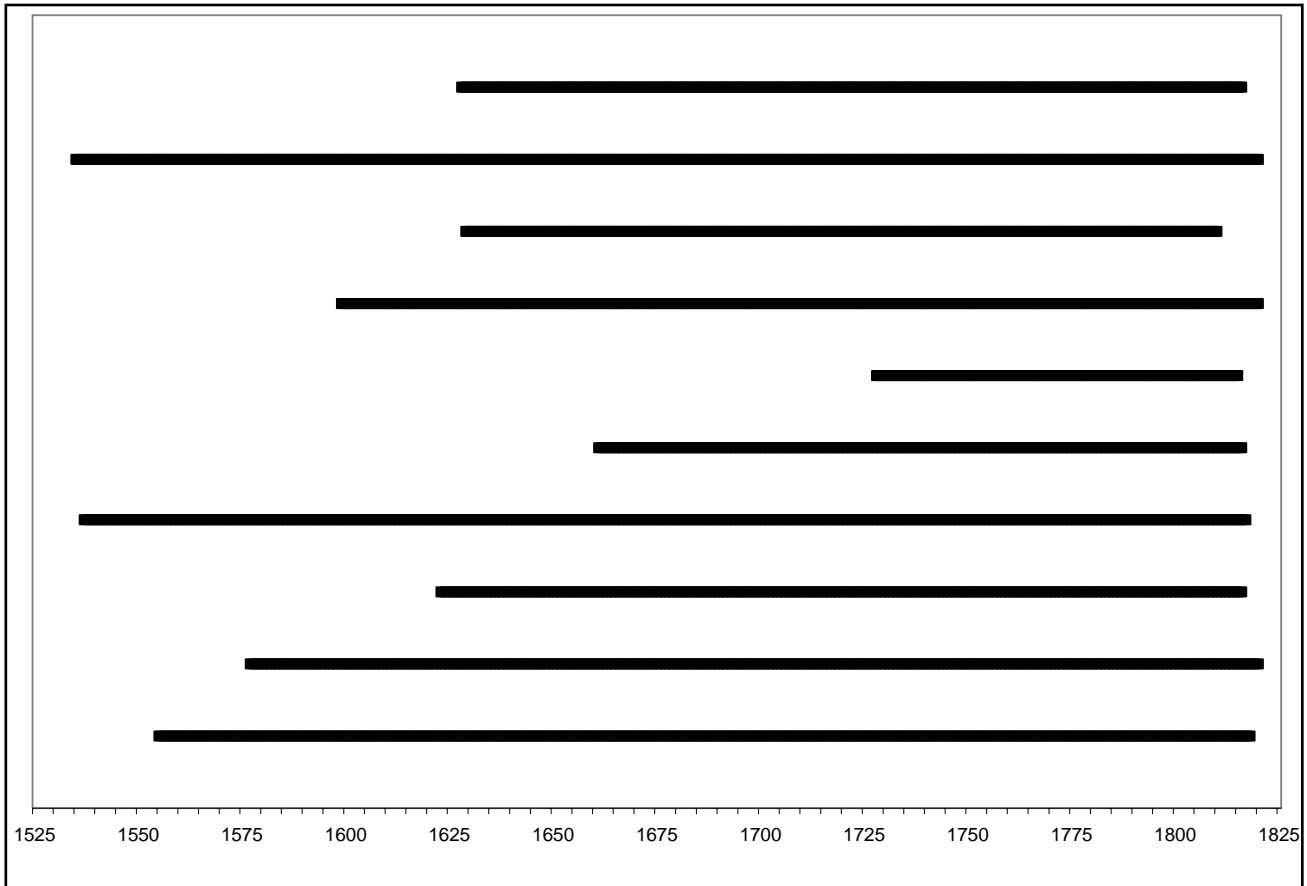


**Figure 2:** Sample extracted with an increment borer.

## **Results and Discussion**

Based on an analysis using COFECHA, it was determined that the last year of growth of the trees within the church beams was 1820 (Figure 3, Table 1). This suggests that the trees used in the construction of the church were cut down with the last growing year being 1820, approximately a year before the building was constructed. Based on construction and logistical

schedules of the time, it is reasonable to believe that the trees were felled in the fall/winter of the year before construction began. This fact confirms the parishioners' records of William Black Memorial Church being constructed in 1821.

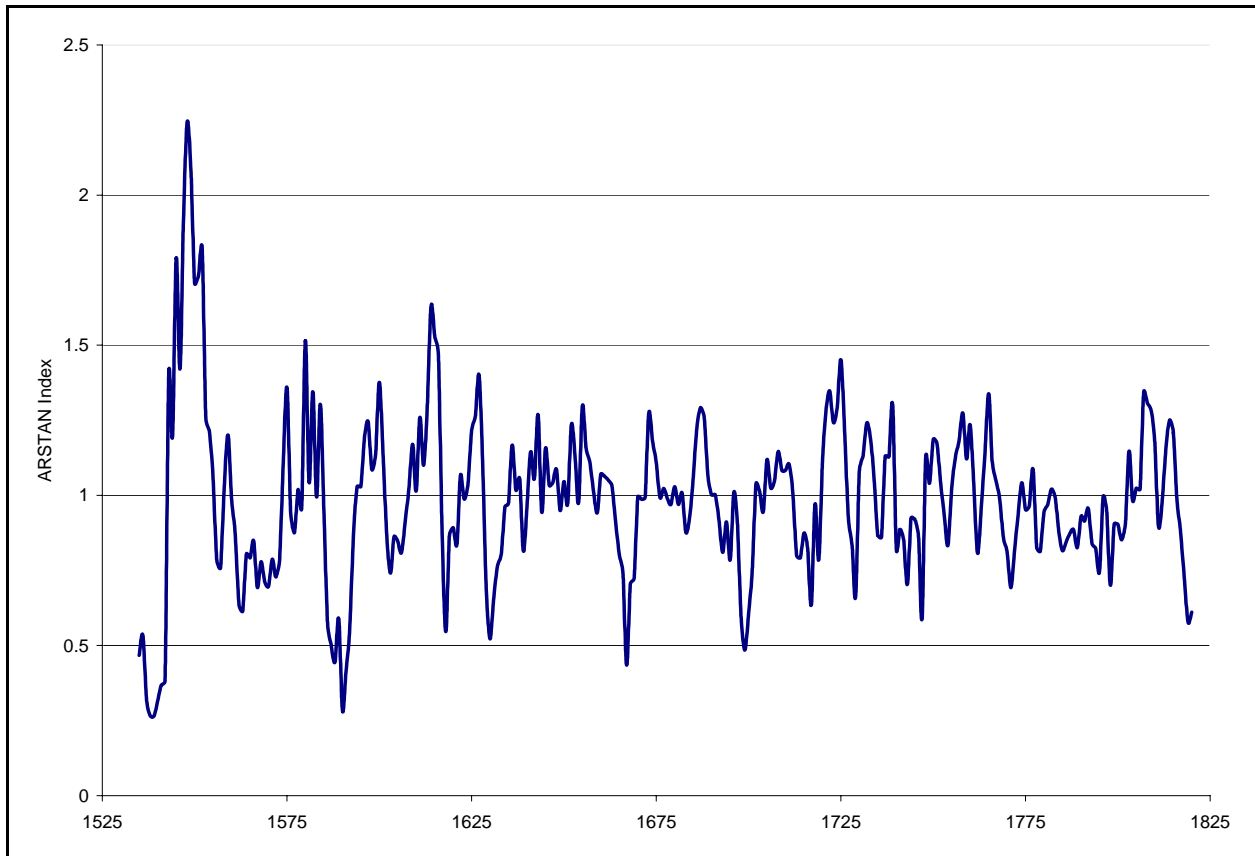


**Figure 3:** Life-spans of trees within beams of William Black Memorial Church.

<i>Sample Number</i>	<i>Location</i>	<i>Bark Condition</i>	<i>Species</i>	<i>Crossdated Interval</i>
06MS002a	crawl space	bark present	Eastern hemlock	1555-1818
06MS002b	crawl space	bark present	Eastern hemlock	1577-1820
06MS003b	crawl space	bark present	Eastern hemlock	1623-1816
06MS003c	crawl space	bark present	Eastern hemlock	1658-1817
06MS004	crawl space	no bark	Eastern hemlock	1537-1817
06MS005	crawl space	bark present	Eastern hemlock	1661-1816
06MS006	crawl space	bark present	Eastern hemlock	1728-1815
06MS007a	crawl space	bark present	Eastern hemlock	1599-1820
06MS007b	crawl space	bark present	Eastern hemlock	1629-1810
06MS009	crawl space	bark present	Eastern hemlock	1535-1820
06MS010	crawl space	bark present	Eastern hemlock	1628-1816

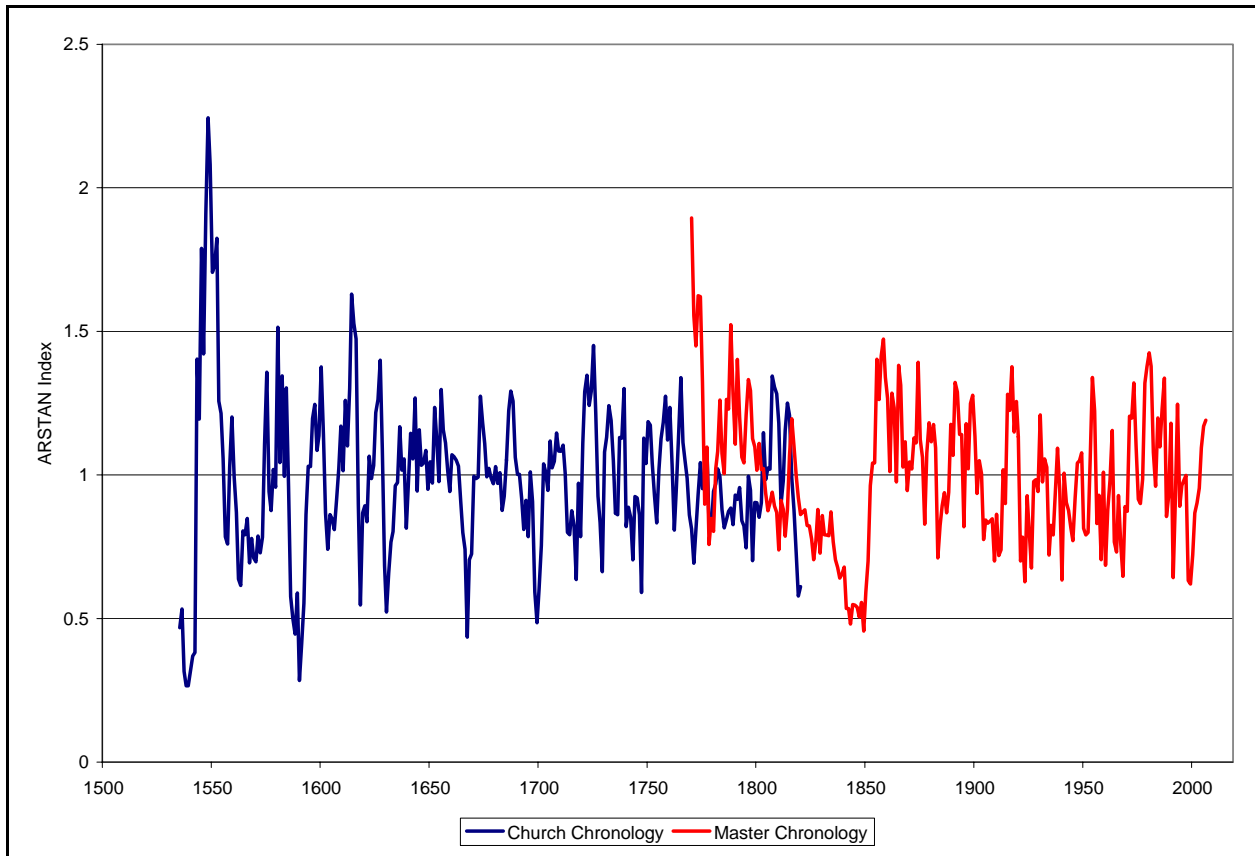
**Table 1:** Data on samples collected from beams within William Black Memorial Church.

Once the cut years of the trees were determined, it was possible to create a floating chronology for the “stand” (Figure 4). This shows the average growth patterns for all of the eastern hemlock samples within the beams of the church.



**Figure 4:** Floating chronology for eastern hemlock in William Black Memorial Church.

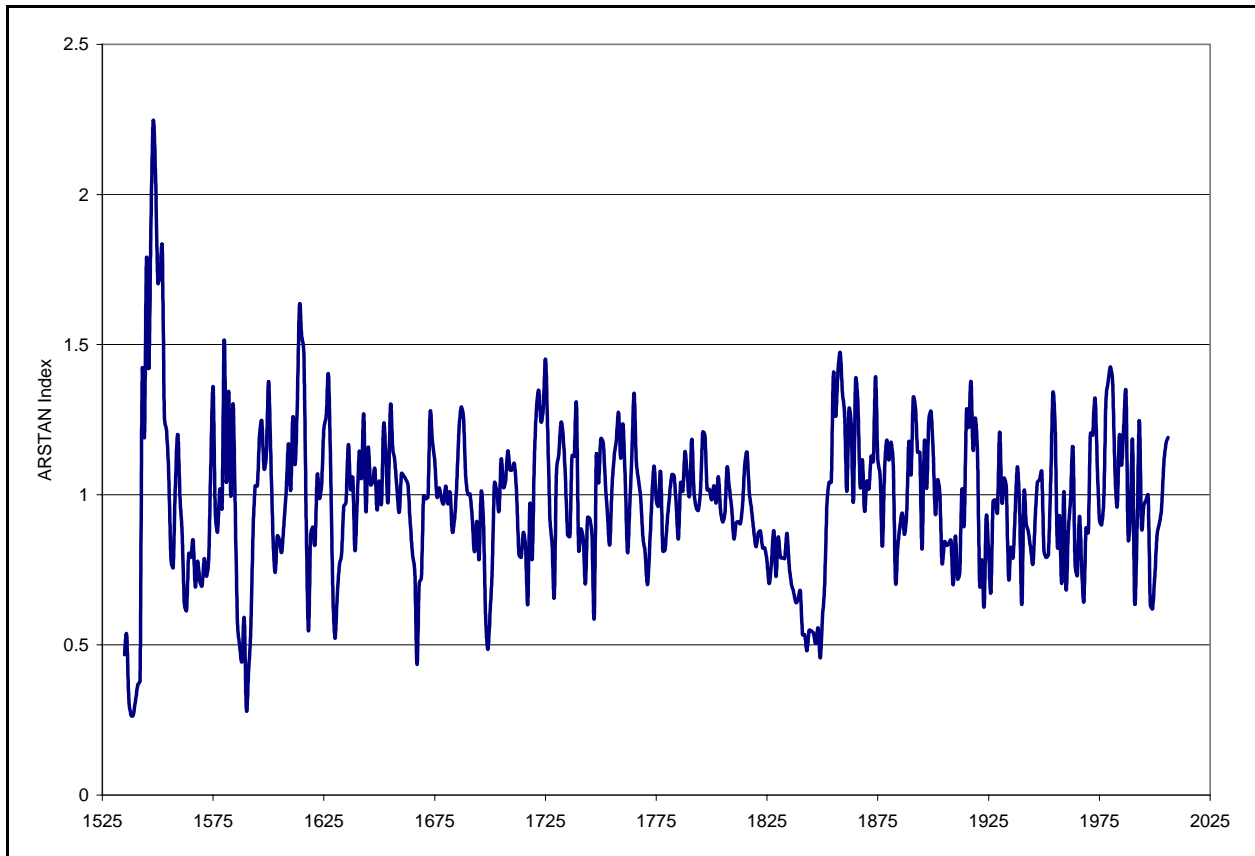
The beams from this church effectively contribute to the project’s objective (Figure 5). There is enough overlap between the live eastern hemlock stand and the eastern hemlock samples within the church to ensure a significant correlation. All beams crossdate into the live chronology with a significance ranging from 0.351 – 0.592 (99% confidence of significance at 0.3281). However, most of the church chronology does not overlap with the live chronology. This allows most of the growth-years of the trees within the beams to extend the total record of eastern hemlock growth-patterns in southwestern Nova Scotia back hundreds of years further than would be possible with live trees alone.



**Figure 5:** Overlap of the living and church chronologies shows similar growth patterns.

From this it was possible to develop a master chronology for eastern hemlock in southwestern Nova Scotia (Figure 6). The overall correlation of this chronology is 0.529, which is much higher than the 0.3281 required for 99% confidence of significance.





**Figure 6:** Master chronology for eastern hemlock in southwestern Nova Scotia.

## Conclusion

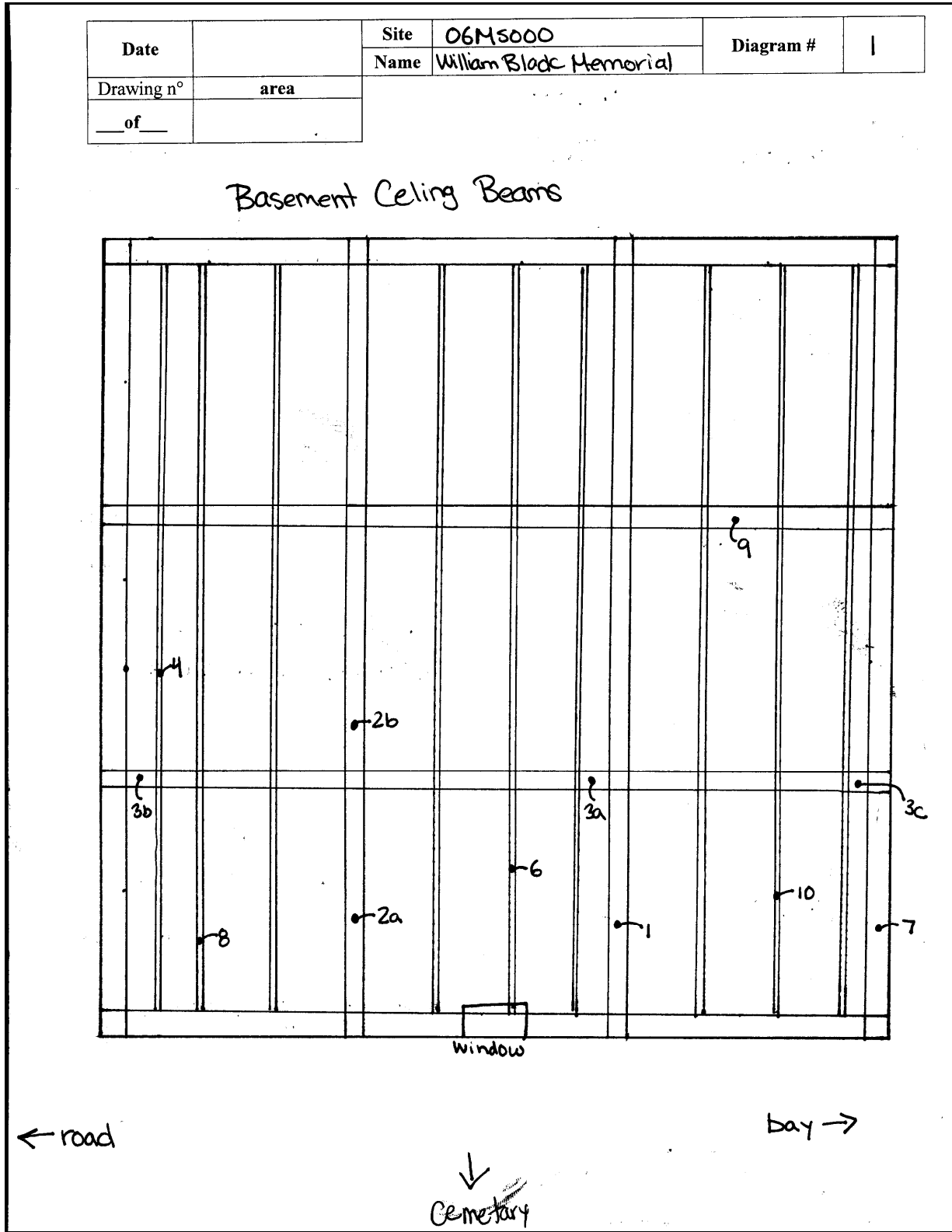
The master chronology for eastern hemlock in southwestern Nova Scotia will have a number of uses. If eastern hemlock samples from another structure in the region are found, it will be possible to place them in this chronology and thus determine the construction date of the structure. As well, this chronology can be used to learn about climatic trends in the past, enabling us both to have a better understanding about past climates and to compare these trends to the current Atlantic climate.

We found that the wood in the this church dated to the end of the growing season of 1820 and this means that the construction date of the church of 1821 given by the parish records, is confirmed.

## Works Cited

Duffus, Allan, Edward MacFarlane, Elizabeth Pacey and George Rogers. 1982. Thy Dwellings Fair: Churches of Nova Scotia 1750-1830. Hantsport: Lancelot Press.

Appendix



Appendix A: Diagram of William Black Memorial Church crawlspace.