

2018 Apple Hill Solar Rare Plant Monitoring Report

I. Introduction

The Apple Hill Solar Project (Project) is a proposed 2.0 MW solar electric generation facility at 1133 Willow Road in Bennington, Vermont. An application for a Certificate of Public Good was submitted in 2014. Arrowwood Environmental (AE) conducted an environmental review for the project in 2014 and submitted a report documenting the findings of that review (AE, 2014). At that time, multiple species of uncommon and rare plant species were documented on the site, including arrow-leaved aster (*Symphyotrichum urophyllum*) and nimblewill muhly (*Muhlenbergia schreberii*). Site redesign resulted in the avoidance of many of the uncommon and rare plant occurrences. As part of the application process the Project obtained a Memorandum of Understanding (MOU) with the Vermont Agency of Natural Resources (ANR) which outlined mitigation measures to protect RTE species on the site. These measures included the establishment of a Conservation Area, the transplantation of rare plants, avoidance protocol and a requirement to monitor the transplanted plants.

The purpose of this report is to document the progress of those mitigation measures as well as present the data on the transplantation monitoring efforts that occurred in 2018. The report is divided into two sections; the first addressing the nimblewill muhly populations and the second addressing the arrow-leaved aster populations.

II. Nimblewill Muhly

Four populations of nimblewill muhly were documented on the Project site and are shown in Figure 1. Site A consists of an old logging road with hundreds of plants scattered in loose mats along the road. Site B is also an old logging road which widens near the northern end. This area contains dense mats of nimblewill muhly likely containing many hundreds of plants. Both of these populations occur in mixed sun and shade conditions growing in slightly compacted soil. The plants appear to be vigorous and in

good health with many showing signs of reproduction. Site C consists of 29 stems in two separate clumps (genets) in the shade beneath a canopy of buckthorn and northern hardwoods. Site D consists of a woods-edge in partial sun and contains two clumps with 30 stems. Plants from Sites C and D appeared to be less vigorous and showing only minor signs of reproduction.

Avoidance/Mitigation

The locations of the four nimblewill muhly sites are shown in Figure 1. As outlined in previous monitoring reports, areas A and B contain many hundreds of plants. Some of these plants were transplanted into the conservation area. Given the mixed success of transplantation and the large number of plants in these locations, many plants were left in place. In order to protect these populations during construction, the boundaries were staked out in the field by AE personnel. Timber mats will be placed over these areas during construction. AE personnel are working with site developers to ensure that the timber mats are installed in the correct location and are removed promptly when construction in that area is completed.

As outlined in the MOU, Population D in Figure 1 was also not transplanted. The boundaries of the population, however, were staked by AE personnel on 10/17/18. These boundaries will be flagged with highly visible flagging for avoidance/minimization during construction as outlined in the MOU.

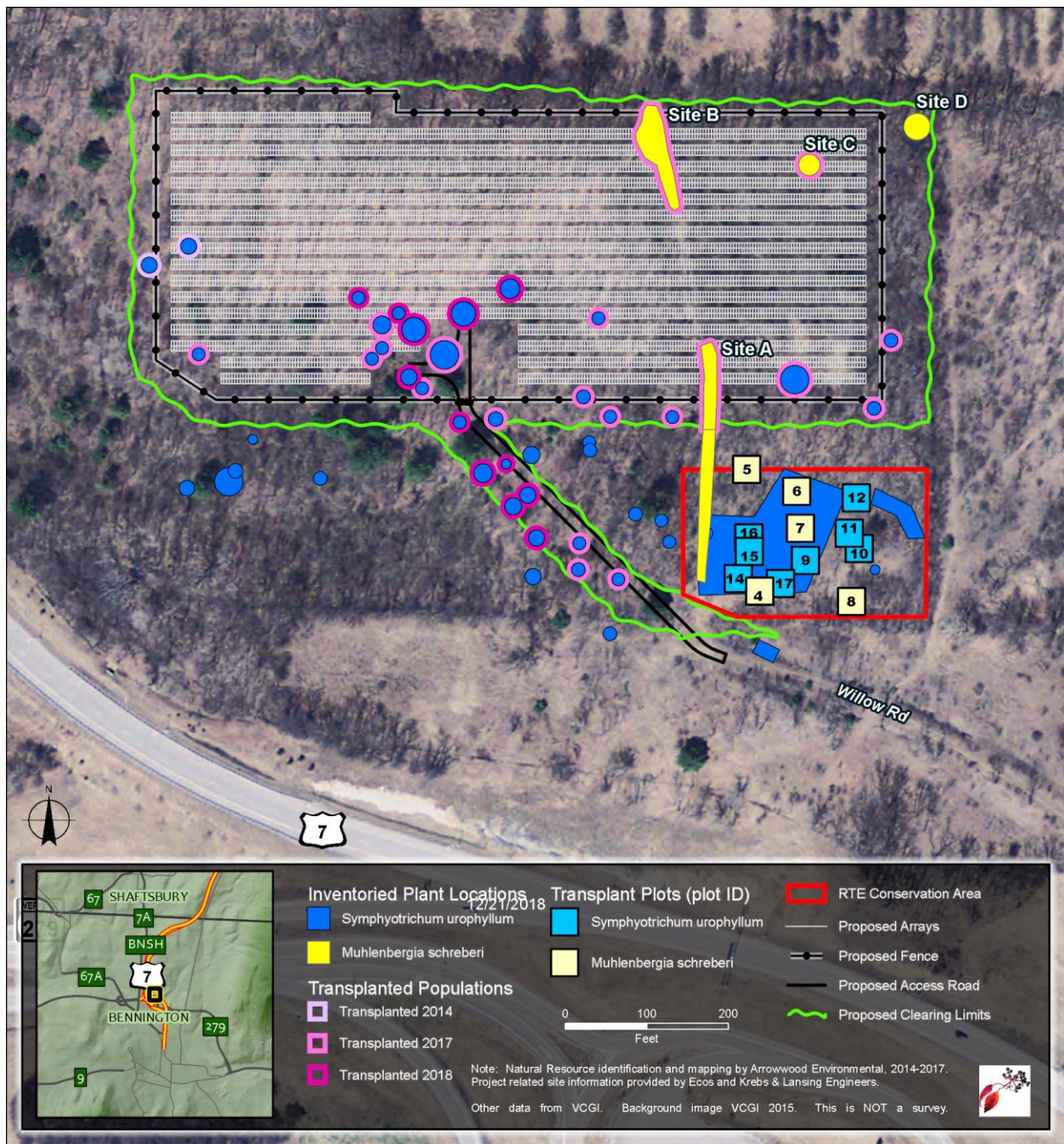


Figure 1. Map of rare plant populations and transplant plots

Monitoring

Monitoring of the nimblewill muhly transplant plots has occurred once per year since transplantation in 2014. Monitoring consists of documenting the percent cover of nimblewill muhly plants as well notes on the health, vigor and evidence of reproduction. Weeding of the monitoring plots occurred in 2017 and 2018. Appendix 2 consists of a photo log of the transplant plots.

Table 1 summarizes the nimblewill muhly transplant data. Since stem counts of this species are difficult, the main metric used for determining success of the transplants is percent cover. Additional information on plant health is also noted.

Table 1. Summary of Transplant Data for Nimblewill Muhly

Plot#	2015 % Cover	2016 % Cover	2017 % Cover	2018 % Cover	Notes
4	75%	50%	80%	85%	Plot in sun. Plants appear healthy and exhibit vigorous growth, most flowering/fruiting in 2018.
5	85%	65%	70%	60%	Plants appear healthy and exhibit vigorous growth, most flowering/fruiting in 2018.
6	90%	50%	25%	25%	Plot in partial shade, plants appear moderately healthy; 75% are fruiting; bare soil 30%
7	70%	30%	15%	15%	Plot in shade; 30% bare soil; no evidence of nimblewill muhly reproduction in 2018.
8	80%	65%	8-10%	10%	Plot in shade; Deer trail established through plot; 2 clumps of nimblewill muhly plants remain, no evidence of reproduction.

As can be seen from this table, success of the transplant plots has been mixed. Plots 7-8 were located in shade and showed a significant decrease in percent cover since transplantation occurred. This decline appears to have levelled off, with stable percent cover in 2017-2018. Plots 4 and 5, on the other hand, were established in full sun and appear to have done well. After a slight initial decline in 2016, percent cover values in these two plots appear to be stable. Plot 6 saw the same initial decline in 2015, but nimblewill muhly plants appear to have rebounded and percent cover remains relatively high.

The Memorandum of Understanding (MOU) calls for the clearing of selected woody vegetation in the Conservation Area. It is possible that selectively clearing woody vegetation that is shading Plots 6-8 will have a positive impact on nimblewill muhly plant survivorship. Transplant plots will continue to be monitored for a period of three years post-construction to comply with the MOU.

In previous monitoring reports, plot vegetation data was presented in the Appendix. Since regular weeding of the transplant plots has occurred, only the transplanted species remain in the plots. The plot vegetation data therefore consists of the abundance values shown in Table 1 and is not included separately in the Appendix.

III. Arrow-leaved Aster

In the fall of 2018, AE personnel re-inventoried targeted areas within the Project site and along the interconnection route for the presence of arrow-leaved aster. Mitigation measures to avoid the plants along the interconnection route are described in the Avoidance/Mitigation section below. Additional transplantation occurred of plants from within the Project area and is described in the Transplantation/Monitoring section below.

Avoidance/Mitigation

In October of 2018, AE personnel flagged the population boundaries of the arrow-leaved aster plants that had been previously documented along the interconnection route. Wooden grade stakes were placed at edges of each population and high-visibility flagging was strung between the stakes. On October 17, 2018, AE personnel met with Green Mountain Power (GMP) personnel regarding the rare plant locations along the interconnection route. The need to avoid impact to these areas was discussed. Clearing was planned to occur in November or December and plans were made for AE personnel to be present during that work. However, clearing did not occur in 2018 and is planned for 2019. AE will continue to coordinate with GMP to be present when clearing along the interconnection route occurs.

Transplantation/Monitoring

In August of 2018, prior to construction activities, AE personnel conducted a final targeted search of the proposed disturbance area and documented 72 arrow-leaved aster plants. The arrow-leaved aster plants were dug up with accompanying soil and transported to the Conservation Area in buckets. Four new transplant plots (Numbers 14-17) were established using the same methods outlined in previous reports. On September 27, 2018 aster plants were planted into the newly turned soil and watered at the time of transplanting. Watering occurred multiple times in subsequent weeks when significant rainfall did not occur. Plants included both basal rosettes and individuals that had flowered in 2018. Figure 1 shows the locations of transplanted plants and the new transplant plots in the Conservation Area.

Table 2 shows the number of plants present in the arrow-leaved aster transplant plots in 2017 and 2018. As can be seen from the monitoring data for the initial four transplant plots, there was a slight decrease in number of aster plants in plots 9-12 in 2018. This can likely be attributed to transplant shock. Other than this slight decrease, survivorship appears remains relatively high when comparing with the 2018 data. The transplant plots will continue to be monitored once per year for a period of three years post-construction to comply with the MOU.

Table 2. 2017-2018 Arrow-leaved Aster Transplant Summary Data

Year Established	Plot	# Plants in 2017	# Plants in 2018
2017	9	32	30
	10	45	44
	11	32	26
	12	21	20
2018	14	NA	15
	15	NA	19
	16	NA	18
	17	NA	20

In previous monitoring reports, plot vegetation data was presented in the Appendix. Since regular weeding of the transplant plots has occurred, only the transplanted species remain in the plots. The plot vegetation data therefore consists of the abundance values shown in Table 2 and is not included separately in the Appendix.

Appendix 1:

Nimblewill Muhly Transplant Plot Photo Log



T4 Nimblewill Muhly Transplant Plot 10/7/15 Looking North



T4 Nimblewill Muhly Transplant Plot 9/13/16 Looking North



T4 Nimblewill Muhly Transplant Plot 9/7/17 Looking North



T4 Nimblewill Muhly Transplant Plot 10/17/18 Looking North



T5 Nimblewill Muhly Transplant Plot 10/7/15 Looking North



T5 Nimblewill Muhly Transplant Plot 9/13/16 Looking North



T5 Nimblewill Muhly Transplant Plot 9/7/17 Looking North



T5 Nimblewill Muhly Transplant Plot 10/17/18 Looking North



T6 Nimblewill Muhly Transplant Plot 9/13/16 Looking North



T6 Nimblewill Muhly Transplant Plot 9/7/17 Looking North



T6 Nimblewill Muhly Transplant Plot 10/18/18 Looking North



T7 Nimblewill Muhly Transplant Plot 10/7/15 Looking North



T7 Nimblewill Muhly Transplant Plot 9/13/16 Looking North



T7 Nimblewill Muhly Transplant Plot 9/7/17 Looking North



T7 Nimblewill Muhly Transplant Plot 10/18/18 Looking North



T8 Nimblewill Muhly Transplant Plot 10/7/15 Looking North



T8 Nimblewill Muhly Transplant Plot 9/13/16 Looking North



T8 Nimblewill Muhly Transplant Plot 9/7/17 Looking North



T8 Nimblewill Muhly Transplant Plot 10/18/18 Looking North

Appendix 2:

Arrow-leaved Aster
Transplant Plot Photo Log

Note: 2018 photos are unavailable due to equipment malfunction, only 2017 photos are presented below



T9 Arrow-leaved Aster Transplant Plot 11/28/17 Looking North



T10 Arrow-leaved Aster Transplant Plot 11/28/17 Looking North



T11 Arrow-leaved Aster Transplant Plot 11/28/17 Looking North



T12 Arrow-leaved Aster Transplant Plot 11/28/17 Looking North