

APPENDIX

E

ECOLOGICAL
ENHANCEMENT AND
MITIGATION MONITORING
PROGRAM RESULTS



**Walker Aggregates Dunroon
Quarry Expansion, Reforestation
Monitoring Program: 2020 Annual
Monitoring Report**

FINAL REPORT

April 30, 2021

Prepared for:

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1.0 INTRODUCTION

Reforestation monitoring is a component of the Walker Aggregates Inc. Duntroon Expansion Quarry Adaptive Management Plan (AMP; Stantec and Hims Geoenvironmental 2019). The Ecological Enhancement and Mitigation Monitoring (EEMM) program was developed to oversee the ecological mitigation measures and ensure that the resulting features are managed and adapted with changing conditions and trends.

The purpose of the reforestation component of the Ecological Enhancement and Mitigation Monitoring (EEMM) program is to track the ecological development of the reforested areas and to compare the ecological characteristics to established targets for ecological form and function. If the monitored conditions differ from the target conditions, modifications to the enhancement plans are implemented. The objectives of the EEMM program are to:

- Properly implement mitigation measures (e.g. ensure that an appropriate number and species of trees are planted); and
- Manage the resulting features in adaptation with changing conditions and trends (e.g., replanting for dead trees, controlling pest damage, controlling/allowing public access, etc.).

Monitoring of the EEMM programs is ongoing to provide a quantitative measure of the success of the plans over time, and includes a mechanism for implementing additional efforts (i.e., adaptive management) when needed to ensure that the established restoration targets are achieved. The monitoring will be discontinued when the enhancement areas have met the established targets and are functioning as self-sustaining components of the local landscape. This monitoring includes the requirements of the forest monitoring and assessment required under the Agreement with the Township of Clearview dated January 25, 2010 and will form the basis for determining when extraction can commence within portions of the significant woodland (Phases 2B, 3A/3B).

1.1 OVERVIEW OF THE WOODLAND PROGRAM

The Duntroon Expansion Quarry includes removal of approximately 26.7 ha of woodland, of which approximately 25.6 ha is part of a contiguous woodland that includes many thousands of hectares along the Niagara Escarpment and associated landforms. As mitigation for this removal, a plan was developed for the license application (Stantec, 2009) to reforest approximately 52 ha of lands owned by Walker Aggregates. Requirements for the woodland program, including the areas to be reforested and the methods, are included in the AMP (Stantec and Hims Geoenvironmental 2019).

The Woodland Program will replace the forest cover removed in the extraction area through restoration of natural forest cover on lands in the adjacent landscape that were under agricultural production at the time of the quarry application. While the reforestation is guided by the general techniques and practices recommended in the ARA Site Plan notes and supporting documents, the site preparation, planting and



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management may be modified through the AMP process in consultation with the Ministry of Natural Resources and Forestry (MNRF) to ensure the practices and management properly respond to future forest dynamics such as pest infestations, changing climatic conditions and state-of-the-art restoration ecology. The goal of the Woodland Program is not merely to replace the features but to achieve a net gain in the ecological functions of the forested landscape.

The Woodland Program was initiated in 2015, with tree planting and other enhancement measures undertaken over three years from 2015 to 2017. Reforestation efforts were divided between areas of active reforestation and areas of natural regeneration, which were delineated in the field based on site conditions. Active reforestation lands included sodded fields, fallow fields, and worked fields which were treated with techniques including the planting and maintenance of varying sizes and species of trees. Natural regeneration lands consisted of areas of shallow soils, primary succession woodlots and naturalizing, disturbed areas. Tree health and mortality monitoring was conducted during the warranty period for two years following each planting year. For example, for plantings completed in 2015, tree health and mortality monitoring was conducted in 2016 and 2017. Monitoring reports were prepared during the warranty period in 2018 (Stantec 2019) and 2019 (Stantec 2020) and included in the annual AMP monitoring summary reports.

1.2 DEFINITION OF PLANTING TERMS

Plantings were completed in a checkerboard pattern of 1 ha Planting Units consisting of four 0.25 ha Quadrants. Planting Units were interspersed with 1 ha Natural Regeneration Units where site preparation and seeding were completed but no trees were directly planted, allowing natural regeneration to occur. This will ensure that a diverse, spatially heterogeneous, woodland, with a mix of tree densities, is established. The sampling protocol described below is applied to Planting Units only and not to Natural Regeneration Units.

Each Quadrant consists of sixteen 12.5 m x 12.5 m Planting Blocks. Each Planting Block has approximately 36 plantings (based on a 2.5 m spaced grid). However, as the outside edges of each planting block are typically shared with adjacent planting blocks, there is an average of approximately 24 unique trees per planting block.

At completion of the planting there were approximately 102 Planting Units established, interspersed with approximately 163 Natural Regeneration Units where natural tree regeneration will occur supported by seed supply from the Planting Units. Planting units along the edges of each general planting area are irregular in shape, consequently there can be more than four quadrants within a Planting Unit when partial quadrants are taken into account. Each Planting Unit has a unique grid number and the location is documented in a GIS database. A total of 35,904 trees were planted from 2015 to 2017.

In this monitoring program, the definition of Woodland is according to the *Forestry Act*:



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- a) 1,000 trees, of any size, per hectare;
- b) 750 trees, measuring over five centimetres in diameter, per hectare;
- c) 500 trees, measuring over 12 centimetres in diameter, per hectare; or
- d) 250 trees, measuring over 20 centimetres in diameter, per hectare.

1.3 FOREST RESTORATION MONITORING

Forest restoration monitoring is designed to track over time the degree to which the Woodland Program is replacing and enhancing the ecological function of the forest removed through extraction. Report Cards will be prepared, summarizing progress on the criteria, or functional indicators, presented in **Table 1**.

Table 1 identifies the purpose of the monitoring indicator used in the program, the method of measurement and the measurement target and the frequency of the monitoring activity.

Table 1: Monitoring Criteria, Methods and Targets for Duntroon Expansion Quarry Forest Restoration Program

Criteria / Functional Indicator	Method	2020-2024 Target from Township of Clearview Agreement	2025+ Target from Township of Clearview Agreement
Active Planting Blocks			
Survival rate of trees	Numeric counts of tree survival	60%	n/a
Tree species diversity	Numeric count of tree species	Min. 12 species present	Min. 10 species present
Canopy closure (%)	Qualitative observation of % closure supplemented with aerial photo interpretation	n/a	50%
Basal area	Standard forest sampling methods (sub samples for dbh and/or prism sweeps)	n/a	15 m ² /ha
Canopy height	Stand and overall species height measurements in metres	2-3 m	4-5.5 m
Presence of tolerant hardwood understorey	Qualitative observation	n/a	Min 2 species present in 50% of sample plots
Presence of coarse woody debris	Qualitative observation	Present	Naturally increasing in 50% of sample plots
Presence of snag trees	Qualitative observation	n/a	presence
Natural Regeneration Blocks			
Number of trees	Numeric counts of tree stems	50% of “woodlands” definition	100% of “woodlands” definition



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1.4 INTERPRETATION OF RESULTS

As noted in the AMP, given the natural variability inherent in the environment, the criteria outlined in **Table 1** should be interpreted with a degree of flexibility and expert judgment. The expert judgment should reflect the fact that the intent of the reforestation plan is not to create a static predetermined ecosystem stage, but is to maximize the degree to which natural self-sustaining vegetation dynamics are operating in the reforested areas. If the reforestation area is developing with a healthy mix of native plants, is not dominated by aggressive non-native species and provides a range of high-quality habitats for local wildlife, it can be considered a success and strict adherence to predetermined criteria is ecologically irrelevant.



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2.0 METHODS

For the monitoring of all regular forest restoration parameters (per **Table 1**), twenty active planting units were randomly selected for sampling. Assuming 36 trees per block, a total of 720 trees were assessed during the 2020 sampling period (see **Figure 1, Appendix A**). The general location of the randomly selected blocks were marked in the field by selecting a corner and marking a 12.5 m x 12.5 m square. Within this square all trees were assessed according to the criteria presented in **Table 1**.

Survival percentages and average heights are based on the 36 tree count for each planting block. Canopy closure was estimated visually for each sample plot. Natural regeneration and coarse woody debris were documented as present or absent with each sample plot. Tree cover was estimated by counting the total number of trees in a plot. Total tree cover in Natural Regeneration Units was estimated by multiplying the average of the five plots by 64 to determine trees per hectare.

Basal area is the sum of trees by hectare measured at 1.3m, known as Diameter at Breast Height (DBH). The DBH of trees within an area are summed to give an overall measure of tree density for woodlots, forests, or managed habitats (Bettinger et al. 2017). Total basal area for Natural Regeneration Units and Active Planting Units was calculated per tree using the following equation:

- Basal area in square metres = $\pi * (\text{DBH cm})^2 / 40,000$

The sum of basal area per plot was then multiplied by 64 to extrapolate basal area per hectare. This was then averaged per Natural Regeneration Units and Active Planting Units to get an overall estimate of tree density for the entire reforestation area.



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3.0 RESULTS AND DISCUSSION

Overall results have been provided in a report card format (**Table 2**) to demonstrate if targets for years 2020-2024 from the Township Agreement have been met. **Table 3** provides a summary of field observations from each Active Planting Unit. Results and outliers are discussed below. Data are provided in **Appendix B**.

Table 2: Overall Results from 2020 Reforestation Monitoring

Criteria / Functional Indicator	2020-2024 Target from Township of Clearview Agreement	2020 Results	2020-2024 Target Achieved
Active Planting Blocks			
Survival rate of trees	60%	70%	Yes
Tree species diversity	Min. 12 species present	23 species present	Yes
Canopy closure (%)	n/a	17.40%	n/a
Basal area	n/a	1.86 m ² per hectare	n/a
Canopy height	2-3 m	3.0 m	Yes
Presence of tolerant hardwood understorey	n/a	Present in 5 plots	n/a
Presence of coarse woody debris	Present	Present in 6 plots	Yes
Presence of snag trees	n/a	Present in 3 plots	n/a
Natural Regeneration Blocks			
Number of trees	50% of "woodlands" definition	Average of 730 trees of all diameter per ha	Criteria achieved (woodland criteria is 1000 trees/ha. Results achieve 75%)



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Table 3: Average quantitative results per Active Planting Units

Active Planting Units Quantitative Data and Overall Averages				
Unit #	Year Planted	Average Canopy Height	Survival rate (%)	Basal Area per ha
A310	2015	4.5	100%	3.94
B267	2015	3.5	53%	1.23
C118	2015	3	67%	2.16
C123	2015	3	67%	2.61
C142	2015	3.5	72%	2.72
C161	2015	2.5	89%	1.61
C174	2015	2	61%	0.86
C176	2015	2.5	69%	1.72
C189	2016	4	58%	1.91
C207	2016	2	53%	1.13
C213	2016	4	86%	1.98
C216	2016	3	75%	4.03
C231	2016	4	100%	2.76
C255	2016	2.5	64%	1.19
C235	2016	2.5	89%	2.28
F5	2017	4	44%	1.42
F16	2017	2.5	66%	1.03
F31	2017	2	50%	0.66
F36	2017	2	61%	0.99
F37	2017	2.5	56%	0.91
Overall Average		3.0	70%	1.86

3.1 DIVERSITY AND SURVIVAL RATE OF TREES

As per the 2019 Duntroon Woodland Program Summary (Stantec 2020), the cumulative mortality incurred up to July 2019 was 5.4%, which translates to a survival rate of 94.6%. Adding in the replacements, which outnumber the mortality, survivability was currently greater than 100%, with 23 species present including: Balsam Fir (*Abies balsamea*), Red Maple, (*Acer rubrum*), Sugar Maple (*Acer saccharum*), Yellow Birch (*Betula allegheniensis*), Paper Birch (*Betula papyrifera*), Bitternut Hickory (*Carya cordiformis*), American Beech (*Fagus grandifolia*), White Ash (*Fraxinus americana*), Green Ash (*Fraxinus pennsylvanica*), Black Walnut (*Juglans nigra*), Tamarack (*Larix laricina*), White Spruce (*Picea glauca*), Red Pine (*Pinus resinosa*), White Pine (*Pinus strobus*), Trembling Aspen (*Populus tremuloides*), Black Cherry (*Prunus serotina*), White Oak (*Quercus alba*), Bur Oak (*Quercus macrocarpa*), Red Oak (*Quercus rubra*), Eastern White Cedar (*Thuja occidentalis*), Basswood (*Tilia americana*), Eastern Hemlock (*Tsuga canadensis*) and White Elm (*Ulmus americana*).



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During the 2020 Reforestation monitoring, the total average survival rate of trees per Active Planting Unit was 70%. Survival rate of trees per unit ranged from 44-100%. The lowest survival rates occurred in zone F, where 3/5 of those units were below the 60% survival rate target. Due to the valley topography and ice storms in winter 2019/2020 (J. Forbes, personal communication August 13, 2020), many saplings perished or cracked in the harsh conditions. In contrast, plantings in zone A were more successful with an average survival rate of 100%. It was noted throughout the site that many saplings still retained tie strings, and some were cracked from lack of mobility to sway during windstorms. It is recommended that all ties be removed from saplings where feasible to avoid girdling or snapping during windstorms.

3.2 CANOPY HEIGHT AND CLOSURE

The canopy height across Active Planting Units averaged 3.0 m, meeting the 2020-2024 target height of 2-3 m. The average height among Active Planting Units ranged from 2-4.5 m. Unit A310 had the tallest average, in part to the species composition and canopy being dominated by Poplar (*Populus* sp.), which are a fast-growing pioneer species. Canopy closure averaged 17% across Active Planting Units and ranged from 8-30%. Unit A310 had the greatest overall canopy closure, which also be attributed to the rapid growth of Poplar species within the unit. Unit F31 had the lowest canopy closure which is related to low survival rates and ice damage, as discussed in Section 3.1.

The canopy height across Natural Regeneration Units averaged 4.6 m. Height ranged from 0-6 m within the Natural Regeneration Units. Unit C137 had the tallest average height at 6 m as the area was situated within a regenerating White ash woodland. Unit C209 did not have any trees. This unit was located within a cultural meadow with low natural regeneration, and surrounded by dead saplings overrun by riverbank grape (*Vitis riparia*). Canopy closure across Natural Regeneration Units averaged 33.8% and ranged from 0-60%. Again, unit C209 did not have any trees to provide canopy cover. In contrast unit E57 had 60% canopy closure due to mature sugar maples that overlapped the regeneration plot.

3.3 BASAL AREA

Basal area (in m^2) was calculated per Active Planting Units and Natural Regeneration Units and averaged as basal area per hectare. The overall basal area across Active Planting Units averaged $1.86\text{ m}^2/\text{ha}$. The average basal area amongst Active Planting Units ranged from $0.66\text{-}3.94\text{ m}^2/\text{ha}$. Unit A310 had the greatest basal area, again attributable to the Poplar species within the unit. Unit F31 had the lowest average basal area which can be related to harsh growing conditions and environmental factors.

The overall basal area across Natural Regeneration Units averaged $3.55\text{ m}^2/\text{ha}$ and ranged from $0\text{-}11\text{ m}^2/\text{ha}$. Unit B279 had the greatest basal area, due to the presence of well-established Ash trees. Unit C209 had a basal area of zero, as it did not contain any trees.



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3.4 PRESENCE OF TOLERANT HARDWOOD UNDERSTOREY

Presence of tolerant hardwood understorey plants was documented in five of the twenty Active Planting Units: C118, C161, C176, C189 and C216. Understorey species observed included white ash saplings, raspberry (*Rubus* sp.), and dogwood (*Cornus* sp.). It is anticipated that presence of understorey species will increase across all units as greater canopy closure and shading is achieved with tree growth.

3.5 PRESENCE OF COARSE WOODY DEBRIS

Presence of coarse woody debris was documented in six of the twenty Active Planting Units: C161, C174, C207, C213, C216 and F5. The majority of coarse woody debris within the units originated from stumps placed during restoration or deceased saplings from woodland plantings.

3.6 PRESENCE OF SNAG TREES

Presence of snag trees were documented in three of the twenty Active Planting Units: C216, F31, F36. Snag trees were typically mortality from woodland plantings. These trees provide open perches which may be utilized by predatory birds to catch prey, and will support an insect community as the wood decays.

3.7 NUMBER OF TREES

Tree cover was estimated by counting the total number of trees in a Natural Regeneration Unit as per the *Forestry Act*. Tree tally results are presented for each of the 5 Passive Regeneration Units.

Table 4: Woodland Threshold for Passive Regeneration Units

Passive	Tree Tally (number of stems per 156m ²)				
	Diameter in cm (dbh)				
Unit #	<=5	>5 <=12	>12 <=20	>20	All Diam.
B279 raw	5	2	5	1	13
B279 estimated total / ha	320	128	320	64	832
C137 raw	21	7	2		30
C137 estimated total / ha	1344	448	128	0	1920
C209 raw	0				
C209 estimated total / ha	0	0	0	0	0
E57 raw	6				6
E57 estimated total / ha	384	0	0	0	384
F7 raw	8				8
F7 estimated total / ha	512	0	0	0	512
Threshold trees / ha		750	500	250	1000



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The average number of trees for all diameter from the five Natural Regeneration Units is 750 trees per hectare which is greater than the targeted '50% of woodlands definition' from the Township Agreement, regardless of the absence of trees in one unit.



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4.0 RECOMMENDATIONS AND CONCLUSION

On average, the Active Planting Units and Passive Regeneration Units have met the 2020-2024 targets established in Township Agreement, as shown in the report card in **Table 2**. The degree to which the Planting Units meet the reforestation targets is a reasonable indication of the ecological function of the reforested areas. The current results suggest that the reforestation areas are contributing to local forest function and on a trajectory to becoming self-sustaining components of the woodland landscape through establishment of a healthy woodlot with enhanced species diversity, a shade-tolerant understorey and wildlife habitat.

If monitoring in 2023 demonstrates that any functional indicators of forest regeneration are lagging, remedial measures such as supplemental planting may be undertaken at that time



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5.0 REFERENCES

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APPENDIX A:
FIGURE 1: RESTORATION PLOTS -
2020 MONITORING

Legend

Proposed Dunroon Quarry Expansion License Area
Limit of Extraction - Walker

Phase Boundary
Phase 4 - Lower Bench
Walker Owned Lands

Randomly Selected Reforestation Plots

Active
Natural

Reforestation Plots

Active
Natural

0 250 500 metres
1:10,000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2018.
3. Orthoimagery © First Base Solutions, 2018. Imagery Date, 2016, 2010.

Project Location
Grey County

62602732 REVA

Prepared by DH on 2021-03-02

Technical Review by ABC on yyyy-mm-dd

Independent Review by ABC on yyyy-mm-dd

Client/Project
WALKER AGGREGATES INC.
DUNTRON QUARRY EXPANSION
ADAPTIVE MANAGEMENT PLAN

Figure No.

1

Title
Reforestation Plots- 2020 Monitoring



APPENDIX B: DATA ANALYSIS

Tree Tally (number of stems per 156m ²)					
Active	Diametre cm (dbh)				
Plot #	≤5	>5 ≤12	>12 ≤20	>20	All Diam.
A310	33	8	0	0	41
Total / ha	2112	512	0	0	2624
Threshold trees/ha		750	500	250	1000

Tree Tally (number of stems per 156m ²)					
Active	Diametre cm (dbh)				
Plot #	≤5	>5 ≤12	>12 ≤20	>20	All Diam.
C189	15	6			21
Total / ha	960	384	0	0	1344
Threshold trees/ha		750	500	250	1000

Tree Tally (number of stems per 156m ²)					
Active	Diametre cm (dbh)				
Plot #	≤5	>5 ≤12	>12 ≤20	>20	All Diam.
B267	19				19
Total / ha	1216	0	0	0	1216
Threshold trees/ha		750	500	250	1000

Tree Tally (number of stems per 156m ²)					
Active	Diametre cm (dbh)				
Plot #	≤5	>5 ≤12	>12 ≤20	>20	All Diam.
C118	20	4			24
Total / ha	1280	256	0	0	1536
Threshold trees/ha		750	500	250	1000

Tree Tally (number of stems per 156m ²)					
Active	Diametre cm (dbh)				
Plot #	≤5	>5 ≤12	>12 ≤20	>20	All Diam.
C123	16	8			24
Total / ha	1024	512	0	0	1536
Threshold trees/ha		750	500	250	1000

Tree Tally (number of stems per 156m ²)						
Active	Diametre cm (dbh)					
	Plot #	≤5	>5 ≤12	>12 ≤20	>20	All Diam.
C142		13	13			26
Total / ha		832	832	0	0	1664
Threshold trees/ha		750	500	250	1000	

Tree Tally (number of stems per 156m ²)						
Active	Diametre cm (dbh)					
	Plot #	≤5	>5 ≤12	>12 ≤20	>20	All Diam.
C161		31	4			35
Total / ha		1984	256	0	0	2240
Threshold trees/ha		750	500	250	1000	

Tree Tally (number of stems per 156m ²)						
Active	Diametre cm (dbh)					
	Plot #	≤5	>5 ≤12	>12 ≤20	>20	All Diam.
C174		23				23
Total / ha		1472	0	0	0	1472
Threshold trees/ha		750	500	250	1000	

Tree Tally (number of stems per 156m ²)						
Active	Diametre cm (dbh)					
	Plot #	≤5	>5 ≤12	>12 ≤20	>20	All Diam.
C176		21	4			25
Total / ha		1344	256	0	0	1600
Threshold trees/ha		750	500	250	1000	

Tree Tally (number of stems per 156m ²)						
Active	Diametre cm (dbh)					
	Plot #	≤5	>5 ≤12	>12 ≤20	>20	All Diam.
C207		17	2			19
Total / ha		1088	128	0	0	1216

Threshold trees/ha		750	500	250	1000
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Tree Tally (number of stems per 156m ²)					
Active	Diametre cm (dbh)				
Plot #	≤5	>5 ≤12	>12 ≤20	>20	All Diam.
C213	29	2			31
Total / ha	1856	128	0	0	1984
Threshold trees/ha		750	500	250	1000

Tree Tally (number of stems per 156m ²)					
Active	Diametre cm (dbh)				
Plot #	≤5	>5 ≤12	>12 ≤20	>20	All Diam.
C216	18	9			27
Total / ha	1152	576	0	0	1728
Threshold trees/ha		750	500	250	1000

Tree Tally (number of stems per 156m ²)					
Active	Diametre cm (dbh)				
Plot #	≤5	>5 ≤12	>12 ≤20	>20	All Diam.
C231	35	3			38
Total / ha	2240	192	0	0	2432
Threshold trees/ha		750	500	250	1000

Tree Tally (number of stems per 156m ²)					
Active	Diametre cm (dbh)				
Plot #	≤5	>5 ≤12	>12 ≤20	>20	All Diam.
C255	21	2			23
Total / ha	1344	128	0	0	1472
Threshold trees/ha		750	500	250	1000

Tree Tally (number of stems per 156m ²)					
Active	Diametre cm (dbh)				
Plot #	≤5	>5 ≤12	>12 ≤20	>20	All Diam.

C500	26	6			32
Total / ha	1664	384	0	0	2048
Threshold trees/ha		750	500	250	1000

Tree Tally (number of stems per 156m ²)					
Active	Diametre cm (dbh)				
Plot #	≤5	>5 ≤12	>12 ≤20	>20	All Diam.
F5	12	4			16
Total / ha	768	256	0	0	1024
Threshold trees/ha		750	500	250	1000

Tree Tally (number of stems per 156m ²)					
Active	Diametre cm (dbh)				
Plot #	≤5	>5 ≤12	>12 ≤20	>20	All Diam.
F16	24				24
Total / ha	1536	0	0	0	1536
Threshold trees/ha		750	500	250	1000

Tree Tally (number of stems per 156m ²)					
Active	Diametre cm (dbh)				
Plot #	≤5	>5 ≤12	>12 ≤20	>20	All Diam.
F31	18				18
Total / ha	1152	0	0	0	1152
Threshold trees/ha		750	500	250	1000

Tree Tally (number of stems per 156m ²)					
Active	Diametre cm (dbh)				
Plot #	≤5	>5 ≤12	>12 ≤20	>20	All Diam.
F36	22				22
Total / ha	1408	0	0	0	1408
Threshold trees/ha		750	500	250	1000

Tree Tally (number of stems per 156m ²)					

Active	Diametre cm (dbh)					
	≤5	>5 ≤12	>12 ≤20	>20	All Diam.	
F37	20				20	
Total / ha	1280	0	0	0	1280	
Threshold trees/ha		750	500	250	1000	

Tree Tally (number of stems per 156m ²)					
Passive	Diametre cm (dbh)				
Plot #	≤5	>5 ≤12	>12 ≤20	>20	All Diam.
B279	5	2	5	1	13
Total / ha	320	128	320	64	832
Threshold trees/ha	750	500	250	1000	

Tree Tally (number of stems per 156m ²)					
Passive	Diametre cm (dbh)				
Plot #	≤5	>5 ≤12	>12 ≤20	>20	All Diam.
C137	21	7	2		30
Total / ha	1344	448	128	0	1920
Threshold trees/ha	750	500	250	1000	

Tree Tally (number of stems per 156m ²)					
Passive	Diametre cm (dbh)				
Plot #	≤5	>5 ≤12	>12 ≤20	>20	All Diam.
C209	0				0
Total / ha	0	0	0	0	0
Threshold trees/ha	750	500	250	1000	

Tree Tally (number of stems per 156m ²)					
Passive	Diametre cm (dbh)				
Plot #	≤5	>5 ≤12	>12 ≤20	>20	All Diam.
E57	6				6
Total / ha	384	0	0	0	384
Threshold trees/ha	750	500	250	1000	

Tree Tally (number of stems per 156m ²)					
Passive	Diametre cm (dbh)				
Plot #	≤5	>5 ≤12	>12 ≤20	>20	All Diam.
F7	8				8
Total / ha	512	0	0	0	512
Threshold trees/ha	750	500	250	1000	

Active Plots Quantitative Data and Overall Averages				
Plot #	Year Planted	Average Canopy Height	Survival rate (%)	Basal Area per ha
A310	2015	4.5	113.89	3.94
B267	2015	3.5	52.78	1.23
C118	2015	3	66.67	2.16
C123	2015	3	66.67	2.61
C142	2015	3.5	72.22	2.72
C161	2015	2.5	88.89	1.61
C174	2015	2	61.11	0.86
C176	2015	2.5	69.44	1.72
C189	2016	4	58.33	1.91
C207	2016	2	52.78	1.13
C213	2016	4	86.11	1.98
C216	2016	3	75	4.03
C231	2016	4	105.56	2.76
C255	2016	2.5	63.89	1.19
C500	2016	2.5	88.89	2.28
F5	2017	4	44.44	1.42
F16	2017	2.5	66.67	1.03
F31	2017	2	50	0.66
F36	2017	2	61.11	0.99
F37	2017	2.5	55.56	0.91
Overall Average		2.975	70	1.86

Active Plots Quantitative Data Averages Per Zone				
Zone	Year Planted	Average Canopy Height	Survival rate (%)	Basal Area per ha
A	2015	4.5	113.89	3.94
B	2015	3.5	52.78	1.23
C	2015/2016	2.96	73.50	2.07
F	2017	2.6	55.56	1.00
Overall Average		3.39	74	2.06

Passive Plots Quantitative Data and Overall Averages				
Plot #	Year Planted	Average Canopy Height	Survival rate (%)	Basal Area per ha
P1	2015	4.5	113.89	3.94
P2	2015	3.5	52.78	1.23
P3	2015	3	66.67	2.16
P4	2015	3	66.67	2.61
P5	2015	3.5	72.22	2.72
P6	2015	2.5	88.89	1.61
P7	2015	2	61.11	0.86
P8	2015	2.5	69.44	1.72
P9	2016	4	58.33	1.91
P10	2016	2	52.78	1.13
P11	2016	4	86.11	1.98
P12	2016	3	75	4.03
P13	2016	4	105.56	2.76
P14	2016	2.5	63.89	1.19
P15	2016	2.5	88.89	2.28
P16	2017	4	44.44	1.42
P17	2017	2.5	66.67	1.03
P18	2017	2	50	0.66
P19	2017	2	61.11	0.99
P20	2017	2.5	55.56	0.91
Overall Average		3.39	74	2.06

Plot #	Average Canop	Basal Area per ha
B279	5	10.998
C137	6	6.426
C209	0	0
E57	1.5	0.030
F7	2	0.291
Overall Average	2.9	3.549

