Arrow Lakes TFL 23
Spatial Silviculture Plan

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Summary

This report documents a forest-level modeling study that tracks and maps the spatial location of areas harvested and / or silviculturally treated for the first 20 years of the planning horizon. ArcGIS shapefiles have been produced that provide a spatial silviculture schedule for the two scenarios.

Based on analysis results from the previous study (Arrow Lakes TFL 23 Silviculture Strategy –Type 2, January 2003) Pope and Talbot Ltd. (P&T) proposed two scenarios for implementation on the Arrow Lakes Tree Farm Licence (TFL 23):

S02. Select Stock – This scenario assumes that select stock will be planted for species for which it is available. No incremental silviculture is scheduled. The management objective in this scenario is to maximize priority-structured timber supply.

S10. Preferred Management - The scenario is driven by the management objective of minimizing incremental silviculture costs. Select stock is planted, and spacing, fertilization and commercial thinning activities are available to the model. The harvest flow is constrained not to drop below the select stock scenario (S02) harvest level during all periods. The volume compiled at a utilization level of 32.5+ cm dbh must be non-declining from period 11 to the end of the planning horizon.

Since the previous strategic analysis was completed a new inventory has been compiled resulting in a reduction of 4 061 hectares in the timber harvesting land base. In addition to the new inventory the Sterling Wood site index adjustment study was completed. This study has shifted the site index of Cedar / Hemlock stands by 1.8m —Cedar / Hemlock stands comprise 28% of the timber harvesting land base.

Due to the changes in the inventory and the addition of the updated site index data, a new strategic silviculture planning model was developed using the Woodstock (Remsoft, 1997) modeling language. Both scenario S02 and S10 were analyzed using the updated strategic silviculture planning model.

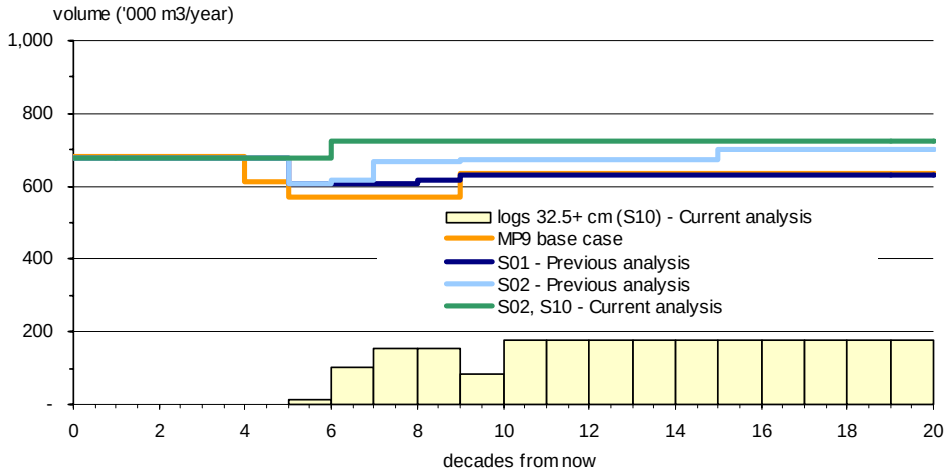
This model is still consistent with the landbase and management parameters described in the chief forester's Rationale for Allowable Annual Cut (AAC) Determination for TFL 23 (August 1999).

Benefits are to be evaluated against the previous strategic silviculture analysis.

Scenario S02 incorporates the silviculture history, analysis unit planting densities and genetic gain.

Benefits from shifting the site index for Cedar / Hemlock stands are first apparent in decade 6 (Figure E-1). The current analysis shows a 10% increment in volume harvest compared to the previous analysis. There is an additional 5% increment (15% in total) in period 7. The increment drops to 7% in total beginning in period 8 – this increment is maintained until period 16 when the total increment drops to 3% in total.

Figure E-1 Harvest forecasts, base case and incremental silviculture scenarios.



In the "preferred management scenario" (S10) select stock is planted, and spacing, fertilization and commercial thinning activities are available to the model. Harvest volume compiled at a utilization level of 32.5+ cm DBH (premium logs) is constrained to be non-declining from period 11 to the end of the planning horizon.

Figure E-1 demonstrates that the preferred management scenario harvest level follows the current S02 level for all planning periods. The harvest of stems with DBH > 32.5 averages 114 559 m³ per year, a slight increase from the previous analysis S10 level of 105 102 m³ per year.

After completion of the strategic analysis for scenarios S02 and S10, a spatially feasible explicit 20-year schedule was designed to be consistent with the harvest plan, silvicultural history, existing silvicultural commitments, deferrals, temporary and permanent reserves, and operational planning parameters. The spatially explicit schedule was developed using the spatial model Stanley (Remsoft, 1997).

Both scenarios were blocked 10 years at a time meaning that there will be small differences between the strategic and tactical levels by decade, and fluctuations between periods.

Table E-1 shows the results of the spatial modeling exercise. The "percent objective" is the difference between the strategic schedule and the tactical schedule —a percent increase indicates that more volume was harvested or increased area was treated when creating the spatial explicit schedule.

Table E-2 Summary of silviculture actions by scenario.

	Silviculture Action				
	Clearcut existing	Plant	Fertilization	Juvenile spacing	Juvenile space fertilization
	S02 and S10	S02 and S10	S10	S10	S10
Period	% Objective Volume	% Objective Area	% Objective Area	% Objective Area	% Objective Area
1	100%	102%	100%	90%	138%
2	100%	100%	99%	116%	62%
3	102%	103%	103%	109%	85%
4	101%	106%	90%	96%	100%
5	100%	100%	100%	115%	106%
6	100%	107%	94%	104%	97%
7	102%	107%	96%	106%	86%
8	101%	112%	110%	101%	112%
9	99%	105%	100%	96%	106%
10	100%	107%	96%	102%	102%
	100%	**105%**	**99%**	**104%**	**99%**
11	100%	111%	54%	122%	73%
12	100%	105%	69%	61%	120%
13	100%	108%	89%	140%	96%
14	100%	108%	73%	63%	125%
15	100%	104%	69%	132%	96%
16	100%	110%	67%	303%	68%
17	99%	110%	71%	0%	98%
18	99%	105%	98%	35%	88%
19	100%	109%	74%	0%	105%
20	101%	106%	0%	80%	115%
	100%	**108%**	**68%**	**109%**	**98%**

In the first decade (periods 1 to 10) there is very little difference in the strategic and tactical schedules as indicated by the percent objective. In the second decade (periods 11 to 20) the actions plant, fertilization, and juvenile spacing differed by as much as 32% (juvenile spacing) from the strategic schedule. In the case of juvenile spacing small amounts of area were scheduled by the strategic model. Stanley needed to find polygons which were less than or equal to the area scheduled since the spatial model cannot split polygons. In certain periods Stanley could not find polygons with the area required to meet the strategic schedule.

The implementation of the Sterling Wood study has allowed the S02 and S10 harvest schedules to increase by as much as 10% compared to the initial analysis. For scenario S10 the harvest from premium logs has increased by 9% compared to the initial analysis.

The translation of the aspatial strategic schedule to a spatially explicit tactical schedule was successful as indicated by the percent objective obtained for each decade.

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1.0 Introduction

The Forest Investment Account (FIA) Silviculture Strategy Development Standard recommends spatial tracking and mapping of areas harvested and / or silviculturally treated for at least the first 20 years of the planning period:

> (e) where data and harvest planning are sufficient, preferably be capable of tracking and mapping the spatial location of areas harvested and / or silviculturally treated for at least the first 20 years of the planning horizon.

The spatial silviculture plan must be operationally feasible and consistent with the existing Type II Strategy.

A spatial silviculture plan that is operationally feasible will recognize the spatial location of both existing and planned silvicultural opportunities, including past, current and future harvesting, planting, spacing, fertilization, and pruning.

A spatial silviculture plan that is consistent with the existing Type Silviculture Strategy will apply the same treatment types and areas according to the schedule specified in the Type 2 Strategy, or deviate from the Type 2 Strategy in a manner that minimizes the impact on the forest-level management objectives achieved by the Type 2 Strategy.

The Type 2 Strategy completed for TFL 23 (Arrow Lakes TFL Silviculture Strategy –Type 2) was undertaken with a linear programming (LP) model developed using the Woodstock (Remsoft, 1997) modeling language. The spatial silviculture plan described in this report was developed using Stanley (Remsoft 1997).

Section 2.0 of this document describes the information requirements and management assumptions for the analysis with special emphasis on changes to the initial analysis inventory and incorporation of the Sterling Wood site index study. Section 3.0 reports the long-term silviculture strategy for scenario S02 and S10. Section 4.0 explains the spatial analysis methodology and describes the spatially explicit silvicultural activities that are feasible in the first two decades. Section 5.0 describes the spatial data provided and the next steps in the spatial planning process.

2.0 Management Assumptions

This section describes the data and assumptions used in the present analysis that differ from those documented for the MP9 base case or differ from the previous silviculture analysis. Other forest management assumptions—including forest cover requirements, utilization levels and standards, un-salvaged losses, and green-up assumptions—are unchanged from the MP9 timber supply analysis.

2.1 Changes to the Type II Silviculture Analysis Landbase

The dataset provided to the analysis team has been updated since the aspatial Type II Silviculture Analysis. It was decided to include this landbase to ensure results reflected the most up-to-date inventory.

The current landbase contains 366 691 hectares of productive forest, of which 228 748 hectares are considered to be available for timber production. This difference in the previous analysis timber harvesting landbase and the current analysis is 4 061 hectares. Changes in the timber harvesting landbase are due to updates to resource emphasis areas, protected areas, and a recent revision of operability lines.

2.2 Silviculture Analysis Units - Adjusting the Site Indices (SI) of the TFL

The silviculture analysis units (SAUs) used in this analysis remain unchanged. Table 2.1 lists the previous and current analysis SAUs.

The current study includes site index adjustments completed by Sterling Wood. Table 2.1 demonstrates the shift in site index resulting from inclusion of the Sterling Wood data.

SI adjustment:
Cedar/Hemlcok +1.8m

Note that there has been a considerable shift in site index for Cedar / Hemlock stands—1.8m increase in site index for SAUs 4 to 6.

Table 2.1 Previous and current analysis silviculture analysis units.

				Previous Analysis			Current Analysis		
SAU	Type Group	Leading Species	Site Index Range	THLB (ha)	Weighted Average SI	THLB (%)	THLB (ha)	Weighted Average SI	THLB (%)
1	1-8, 33, 34	Douglas-fir	>21	16,348	23.6	7%	14,658	23.6	6.4%
2	1-8, 33, 34	Douglas-fir	15 - 21	46,798	18.2	21%	45,632	18.2	20.0%
3	1-8, 33, 34	Douglas-fir	< 15	11,239	13.0	5%	11,723	13.0	5.1%
4	9-17	Cedar/Hemlock	>19	10,062	21.4	4%	27,315	21.4	11.9%
5	9-17	Cedar/Hemlock	16-19	27,763	17.8	12%	23,030	17.9	10.1%
6	9-17	Cedar/Hemlock	<16	27,781	14.0	12%	14,338	14.4	6.3%
7	18-26	Spruce/Bal	>20	6,778	23.1	3%	7,773	23.2	3.4%
8	18-26	Spruce/Bal	17-20	9,839	18.2	4%	10,566	18.4	4.6%
9	18-26	Spruce/Bal	<17	43,127	12.8	19%	40,520	12.9	17.7%
10	27-32	Pine	>20	9,717	22.7	4%	9,685	22.7	4.2%
11	27-32	Pine	17-20	10,086	18.5	4%	11,432	18.6	5.0%
12	27-32	Pine	<17	7,113	14.9	3%	8,226	14.8	3.6%
13	35-42	Deciduous	All	-	-	-	3,760	21.9	1.6%
				231,617		**100%**	**228,657**		**100%**

2.3 Silviculture State of the Landbase

The silviculture history data used in this analysis is spatially exact (spatially linked from the inventory to the silviculture history data). The current analysis ensures previously harvested and planted stands are spatially represented as indicated by the silviculture history data. The current history data includes a small amount of planted juvenile spaced stands (71 hectares). The majority of juvenile spaced stands are natural stands (1651 hectares). The yield curves for these stands were modeled using TIPSY.

2.3 Management Practices

The current study models juvenile spacing, fertilization, and commercial thinning using the same assumptions as the previous analysis.

Natural and managed stand yield table were generated for each analysis where the site index has changed due to inventory updates and the inclusion of the Sterling Wood study. The yield tables were developed by Ken Pollson (MoF, Research Branch) using TASS. Yield tables for existing natural stands were developed using VDYP.

2.4 Genetic Gain and Cost/Labour

The genetic gain and cost / labour assumptions from the previous analysis were applied in the current analysis.

2.5 Spatial Parameters

The spatial parameters specify the effect on block layouts and the ability of the spatial model to achieve the aspatial Type 2 schedule. The parameters utilized in the current analysis are:

1. Minimum block size
2. Maximum block size
3. Green-up delay
4. Adjacency
5. Proximity

Minimum Block Size

If a polygon is smaller than this area the polygon will not be included in the creation of a neighbouring block. This value utilized in this analysis was 0, meaning that there is no minimum block size. This will allow the model increased flexibility when blocking silviculture activities.

Maximum Block Size

Blocks exceeding a certain size will not be created. In the current analysis this value varies depending on the resource emphasis area. Table 2.2 lists the maximum block size opening for the various resource emphasis areas.

Table 2.2 Maximum block size by resource emphasis area.

Resource emphasis area	Maximum opening size (ha's)
Caribou	250
Ungulate winter range	40
Community watersheds	20
Domestic watersheds	40
Visual quality objectives	20
IRM, ERDZ	250

Green-up delay

This parameter represents the amount of time which must pass before proximate blocks may be harvested which if scheduled together would exceed the maximum opening area. The green-up delay utilized in this analysis is 12 years – time need to achieve the KBLUP green-up height of 2.5 metres.

Adjacency

This parameter refers to polygons which are touching. Adjacent polygons can be combined into harvest blocks. If you have landscape features such as roads and waterways you must ensure that the adjacency distance exceeds the openings created by these features. The value utilized in this analysis was 100m. This means that operations is willing to travel 100m to harvest, plant, space, or fertilize stands scheduled in the same period. Setting this value to a high value will increase the ability of a spatial model to schedule the strategic silviculture schedule.

Proximity

This variable refers to nearness of polygons. If a value of 0m is specified this means that only polygons which share the same border are considered proximate. The current analysis used a value of 0m. If a value of 100m is specified this means that any polygon which is within 100m of the polygon in which proximity is being calculated are considered proximate. If a stand is proximate then the model must take into account the green-up delay specified. The higher the proximal distance the less the ability of a spatial model to schedule the strategic silviculture schedule.

3. Aspatial Analysis Results

This section will present the results from the aspatial strategic analysis of scenarios that quantify the impact of silviculture practices under different assumptions and objectives.

This proposed scenarios for this analysis are:

S02. Select Stock – This scenario assumes that select stock will be planted for species for which it is available. The management objective in this scenario is to maximize priority-structured timber supply.

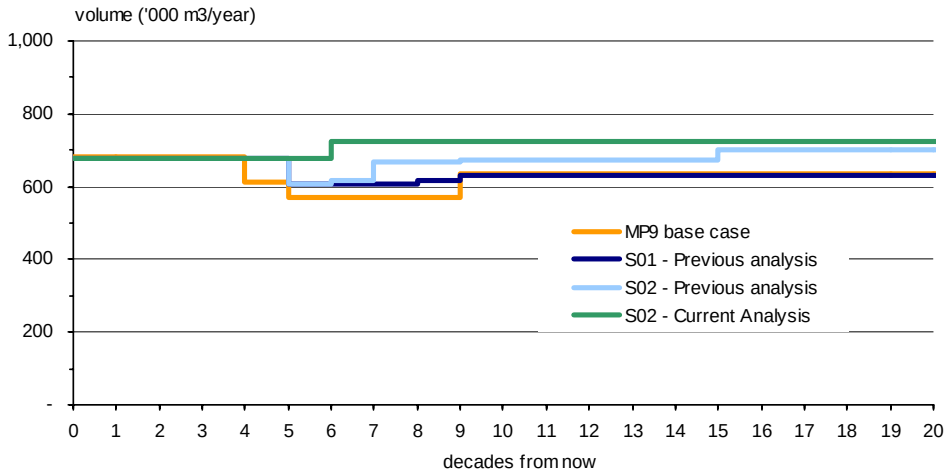
S10. Preferred Management - The scenario is driven by the management objective of minimizing incremental silviculture costs. Select stock is planted, and spacing, fertilization and commercial thinning activities are available to the model. The harvest flow is constrained not to drop below the select stock scenario (S02) harvest level during the all periods. The volume compiled at a utilization level of 32.5+ cm dbh must be non-declining from period 11 to the end of the planning horizon.

3.1 Scenario S02: Select Stock

Scenario S02 is the select stock scenario. It is intended to emulate, as closely as possible, the current and desired management for the unit. The scenario incorporates the silviculture history (Appendix A), the analysis unit planting densities outlined in the regime diagrams (Appendix B) and genetic gain (Appendix C).

Figure 3-1 shows the previous analysis scenario S01 and the incremental benefits from planting select stock (scenario S02) for the previous and current analysis. These scenarios were implemented with the management objective of maximizing the quantity of timber harvested, and assumed an unlimited silviculture budget.

Figure 3.1 Harvest forecasts, base case and incremental silviculture scenarios.



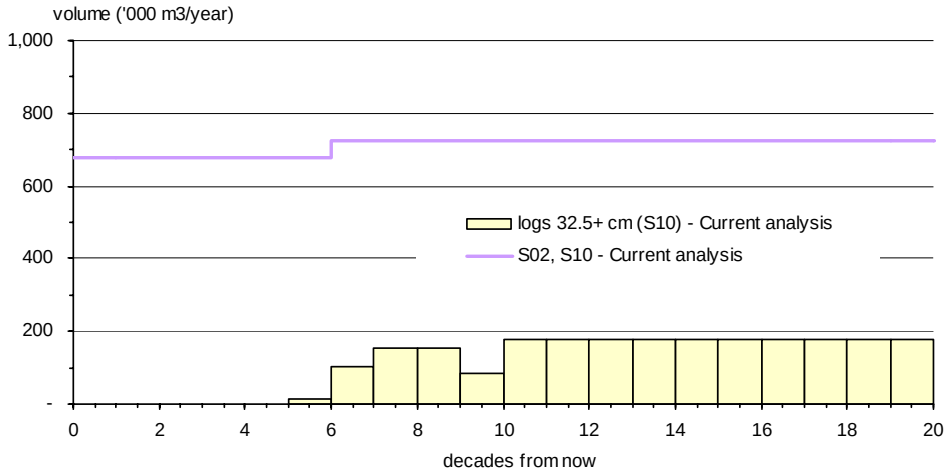
Benefits from shifting the site index for analysis units 4 to 6 are first apparent in decade 6. The current analysis has a 10% increment in volume harvest compared to the previous analysis. There is an additional 5% increment (15% in total) in period 7. The increment drops to 7% in total beginning in period 8 – this increment is maintained until period 16 when the total increment drops to 3% in total.

3.2 Scenario S10: Preferred Management Scenario

The scenario is driven by the management objective of minimizing incremental silviculture costs. Select stock is planted, and spacing, fertilization and commercial thinning activities are available to the model. The harvest flow is constrained not to drop below the select stock scenario (S02) harvest level during all periods. The volume compiled at a utilization level of 32.5+ cm dbh must be non-declining from period 11 to the end of the planning horizon.

The preferred management scenario harvest level follows the S02 level for all planning periods (Figure 3.2). The harvest of stems with DBH > 32.5 averages 114 559 m^3 per year a slight increase from the previous analysis S10 level of 105 102 m^3 per year.

Figure 3.2 Total harvest and harvest from logs >32.5 cm, preferred management scenario (S10).



4. Spatial Analysis Methodology and Results

P & T's silviculture staff expressed interesting in generating 20 year spatial plans for scenarios S02 and S10. This section will present the methodology and results from the spatial analysis.

4.2 Methodology

The process required to complete the current spatial analysis was as follows:

1. Obtain the 20-year aspatial schedule of silvicultural activities determined in the select stock (S02) and preferred management scenario (S10). The aspatial strategic silviculture strategy developed was over a planning horizon of 200 years.
2. Using the spatial model Stanley and the various spatial parameters listed in section 2.5, a feasible spatially-explicit 20-year schedule was designed to be consistent with the harvest plan, silvicultural history, existing silvicultural commitments, deferrals, temporary and permanent reserves, and operational planning parameters. Deviations from the aspatial strategic plan are expected given the various parameters and the model's inability to split possible scheduled polygons.
3. To ensure that the spatially explicit schedule is operationally feasible, the 20-year plan of silviculture activities and the associated spatial files are exported to the management unit planning staff, who adjust both the silviculture plan and the spatial files to reflect operational realities.
4. These adjustments are then imposed back onto the strategic level plan to evaluate the impact of the 20-year spatial silviculture plan on the 200-year aspatial strategy. This process may be repeated until a practical spatial silviculture plan is obtained that is compatible with the aspatial strategic plan.

4.3 Results

The spatial model Stanley allows the modeler to produce a spatial schedule for 20 one-year periods. In order to mirror as closely as possible the strategic schedule, similar activities were separately blocked with 10 periods blocked at a time.

Harvest schedule

Table 4.1 represents the results from blocking the strategic schedule obtained from S02 and S10[1]. The "percent objective" represents the tactical model's ability to achieve the strategic schedule. The percent objective for the volume harvested was 100% for periods 1 to 10 (decade 1) and 11 to 20 (decade 2). The percent objective for the area blocked fluctuates between decade 1 and 2 with the highest fluctuations occurring between periods 11 to 20.

[1] The S02 and S10 harvest and planting schedules are the same since the S10 model harvest activities were constrained to the S02 model for the first 20 year.

Table 4.1 Strategic and tactical harvest schedule (S02 and S10).

Period	Action	Strategic Area	Tactical Area	Strategic Volume	Tactical Volume	% Objective Area	% Objective Volume
1	CLC_EXISTING	1,857	1,900	704,900	705,460	102%	100%
2	CLC_EXISTING	1,862	1,868	704,900	705,167	100%	100%
3	CLC_EXISTING	1,879	1,933	704,900	691,222	103%	102%
4	CLC_EXISTING	1,898	2,018	704,900	695,990	106%	101%
5	CLC_EXISTING	1,912	1,918	704,900	706,650	100%	100%
6	CLC_EXISTING	1,913	2,040	704,900	702,540	107%	100%
7	CLC_EXISTING	1,923	2,063	704,900	692,977	107%	102%
8	CLC_EXISTING	1,980	2,215	704,900	700,053	112%	101%
9	CLC_EXISTING	1,988	2,088	704,900	713,526	105%	99%
10	CLC_EXISTING	1,995	2,143	704,900	704,350	107%	100%
		19,207	**20,185**	**7,049,000**	**7,017,936**	**105%**	**100%**
11	CLC_EXISTING	1,767	1,965	704,900	703,532	111%	100%
12	CLC_EXISTING	1,768	1,864	704,900	703,761	105%	100%
13	CLC_EXISTING	1,781	1,920	704,900	705,855	108%	100%
14	CLC_EXISTING	1,767	1,915	704,900	707,168	108%	100%
15	CLC_EXISTING	1,773	1,840	704,900	706,953	104%	100%
16	CLC_EXISTING	1,768	1,937	704,900	705,294	110%	100%
17	CLC_EXISTING	1,773	1,942	704,900	710,296	110%	99%
18	CLC_EXISTING	1,821	1,921	704,900	714,173	105%	99%
19	CLC_EXISTING	1,823	1,983	704,900	704,812	109%	100%
20	CLC_EXISTING	1,831	1,940	704,900	699,919	106%	101%
		17,871	**19,226**	**7,049,000**	**7,061,764**	**108%**	**100%**

The models priority is to meet the harvest volume objective. The model will aggregate stands, and if this aggregation exceeds the area harvested, it is accepted as long the harvest objective is near 100%. Due to parameters such as green-up delay and resource emphasis area maximum block size, the spatial model must deviate from the strategic schedule and block less productive stands in order to meet the harvest volume objective. The spatial model must harvest more area to account for the deviation from the strategic schedule.

Tables 4.2 and 4.3 represent the tactical results for planting and fertilization. The objective for planting and fertilization is area as opposed to Table 4.1 which was volume harvested.

Table 4.2 Strategic and tactical planting schedule (S02 and S10).

Period	Strategic PLNT_09	Tactical PLNT_09	% Objective PLNT_09	Strategic PLNT_17	Tactical PLNT_17	% Objective PLNT_17	Strategic PLNT_35	Tactical PLNT_35	% Objective PLNT_35	Strategic PLNT_70	Tactical PLNT_70	% Objective PLNT_70	Strategic NATURAL	Tactical NATURAL	% Objective NATURAL	Strategic ROADS	Tactical ROADS	% Objective ROADS	Strategic TOTAL	Tactical TOTAL	% Objective TOTAL
1	199	257	129%	464	530	114%	652	549	84%	468	536	115%	-	-	0%	74	28	37%	1,857	1,900	102%
2	200	219	110%	465	592	127%	649	596	92%	473	412	87%	-	-	0%	74	48	65%	1,862	1,868	100%
3	202	220	109%	467	439	94%	653	701	107%	482	437	91%	-	-	0%	75	136	182%	1,879	1,933	103%
4	205	230	113%	471	581	124%	651	643	99%	496	513	103%	-	-	0%	76	51	67%	1,898	2,018	106%
5	206	269	130%	473	584	124%	654	705	108%	503	303	60%	-	-	0%	76	57	74%	1,912	1,918	100%
6	204	297	145%	465	453	97%	657	727	111%	510	459	90%	-	-	0%	77	104	136%	1,913	2,040	107%
7	205	298	145%	466	525	113%	659	602	91%	516	549	106%	-	-	0%	77	88	115%	1,923	2,063	107%
8	211	295	140%	477	645	135%	678	818	121%	535	395	74%	-	2	200%	79	59	74%	1,980	2,215	112%
9	211	194	92%	476	554	116%	682	686	101%	539	604	112%	-	-	0%	80	50	63%	1,988	2,088	105%
10	212	297	140%	476	579	121%	684	627	92%	543	512	94%	-	-	0%	80	128	161%	1,995	2,143	107%
	2,055	**2,577**	**125%**	**4,700**	**5,483**	**117%**	**6,619**	**6,654**	**101%**	**5,065**	**4,719**	**93%**	**-**	**2**	**200%**	**768**	**750**	**98%**	**19,207**	**20,185**	**105%**
11	179	99	55%	432	629	145%	599	680	114%	486	392	81%	-	-	0%	71	165	233%	1,767	1,965	111%
12	180	169	94%	432	600	139%	599	492	82%	486	561	115%	-	6	600%	71	38	53%	1,768	1,864	105%
13	181	117	65%	434	713	164%	604	573	95%	491	485	99%	-	-	0%	71	33	46%	1,781	1,920	108%
14	180	141	78%	430	554	129%	600	610	102%	486	508	104%	-	-	0%	71	102	144%	1,767	1,915	108%
15	180	242	135%	431	476	110%	603	475	79%	488	573	117%	-	-	0%	71	73	103%	1,773	1,840	104%
16	180	366	204%	430	496	116%	602	524	87%	487	499	102%	-	-	0%	71	52	74%	1,768	1,937	110%
17	181	228	126%	432	538	125%	602	692	115%	487	383	79%	-	-	0%	71	99	140%	1,773	1,942	110%
18	186	265	143%	443	530	120%	620	586	94%	499	403	81%	-	-	0%	73	136	187%	1,821	1,921	105%
19	186	312	167%	444	449	101%	620	750	121%	500	409	82%	-	-	0%	73	64	88%	1,823	1,983	109%
20	187	177	95%	445	543	122%	624	609	98%	502	570	114%	-	-	0%	73	40	55%	1,831	1,940	106%
	1,820	**2,118**	**116%**	**4,352**	**5,527**	**127%**	**6,074**	**5,991**	**99%**	**4,911**	**4,782**	**97%**	**-**	**6**	**600%**	**715**	**803**	**112%**	**17,871**	**19,226**	**108%**

Table 4.3 Strategic and tactical fertilization schedule (S10).

Period	Strategic FERT2x	Tactical FERT2x	% Objective FERT2x	Strategic FERT3x	Tactical FERT3x	% Objective FERT3x	Strategic TOTAL	Tactical TOTAL	% Objective TOTAL
1	21	8	39%	101	114	113%	122	122	100%
2	21	-	0%	101	121	120%	122	121	99%
3	21	0	2%	101	125	124%	122	126	103%
4	21	45	215%	101	65	64%	122	110	90%
5	21	25	119%	101	97	96%	122	122	100%
6	21	19	89%	101	95	94%	122	114	94%
7	21	31	150%	101	85	85%	122	117	96%
8	21	25	120%	101	109	108%	122	135	110%
9	21	27	130%	101	95	94%	122	122	100%
10	21	28	131%	101	90	89%	122	118	96%
	210	**209**	**100%**	**1,010**	**998**	**99%**	**1,220**	**1,207**	**99%**
11	117	64	55%	34	18	53%	151	82	54%
12	70	61	87%	34	11	31%	104	72	69%
13	40	32	79%	23	24	106%	63	56	89%
14	26	23	87%	21	12	56%	47	34	73%
15	2	1	61%	28	20	70%	30	21	69%
16	35	23	66%	5	4	75%	40	27	67%
17	39	31	80%	24	13	55%	63	44	71%
18	5	5	98%	-	-	0%	5	5	98%
19	45	35	77%	2	-	0%	47	35	74%
20	-	-	0%	-	-	0%	-	-	0%
	379	**274**	**72%**	**171**	**101**	**59%**	**550**	**375**	**68%**

Planting schedule

It was assumed that all harvested area was planted. For all periods the total area harvested from Table 4.1 is exact compared to the total area planted in Table 4.2. There are differences between the strategic and tactical densities planted as specified in the regime diagrams described in the silviculture strategy report. The strategic model is deterministic, meaning that once a stand is harvested it will transition to the exact percentages specified for the various planting densities. The spatial tactical model is stochastic (random variation in the expected outcome), meaning that once a stand is harvested the model will attempt to meet the percentages for the various planting densities, but fluctuations can and will occur.

Fertilization schedule

The tactical area fertilized closely follows the strategic schedule for the first 10 periods (Table 4.3). The tactical schedule then deviates from the strategic schedule during periods 11 to 20. The difference in the percent objective can be attributed to the spatial model's inability to split polygons. Since the strategic model scheduled small amounts of area to be fertilized the spatial model must try and find polygons which have an area less than or equal to the area scheduled by the strategic model. The results demonstrate that the spatial model had difficulty finding polygons with area less than or equal to the area scheduled by the strategic model.

Tables 4.4 and 4.5 represent the juvenile space and juvenile space-fertilization strategic and tactical schedules respectively.

Table 4.4 Strategic and tactical juvenile spacing schedule (S10).

Period	Strategic SPACE1600	Tactical SPACE1600	% Objective SPACE1600	Strategic SPACE1800	Tactical SPACE1800	% Objective SPACE1800	Strategic TOTAL	Tactical TOTAL	% Objective TOTAL
1	37	36	97%	129	113	88%	166	149	90%
2	37	42	113%	129	151	117%	166	193	116%
3	37	33	90%	129	148	115%	166	181	109%
4	37	57	154%	129	103	80%	166	160	96%
5	37	49	131%	129	141	110%	166	190	115%
6	37	32	86%	129	141	109%	166	173	104%
7	37	16	44%	129	160	124%	166	176	106%
8	37	46	125%	129	122	95%	166	168	101%
9	37	5	14%	129	154	120%	166	159	96%
10	37	36	98%	129	134	104%	166	170	102%
	370	**352**	**95%**	**1290**	**1367**	**106%**	**1660**	**1720**	**104%**
11	4	1	14%	21	30	143%	25	31	122%
12	0	0	0%	12	7	61%	12	7	61%
13	0	0	0%	16	22	140%	16	22	140%
14	0	0	0%	12	8	63%	12	8	63%
15	0	0	0%	7	9	132%	7	9	132%
16	0	0	0%	6	18	303%	6	18	303%
17	0	0	0%	3	0	0%	3	0	0%
18	1	1	149%	6	1	16%	7	2	35%
19	0	0	0%	1	0	0%	1	0	0%
20	0	0	0%	2	2	80%	2	2	80%
	5	**2**	**41%**	**86**	**97**	**113%**	**91**	**99**	**109%**

Table 4.5 Strategic and tactical juvenile spacing, fertilization schedule (S10).

Period	Strategic SPACE1400 FERT3x	Tactical SPACE1400 FERT3x	% Objective SPACE1400 FERT3x	Strategic SPACE1500 FERT3x	Tactical SPACE1500 FERT3x	% Objective SPACE1500 FERT3x	Strategic SPACE1600 FERT2x	Tactical SPACE1600 FERT2x	% Objective SPACE1600 FERT2x	Strategic SPACE1800 FERT2x	Tactical SPACE1800 FERT2x	% Objective SPACE1800 FERT2x	Strategic TOTAL	Tactical TOTAL	% Objective TOTAL
1	48	52	109%	27	53	197%	5	5	99%	0	0	0%	80	110	138%
2	48	34	70%	27	10	38%	5	6	116%	0	0	0%	80	50	62%
3	48	36	74%	27	29	106%	5	4	83%	0	0	0%	80	68	85%
4	48	52	108%	27	25	91%	5	4	75%	0	0	0%	80	80	100%
5	48	48	101%	27	34	124%	5	3	60%	0	0	0%	80	85	106%
6	48	48	100%	27	25	92%	5	4	88%	0	0	0%	80	77	97%
7	48	33	69%	27	36	132%	5	0	0%	0	0	0%	80	69	86%
8	48	76	159%	27	13	50%	5	0	0%	0	0	0%	80	90	112%
9	48	60	126%	27	24	90%	5	0	0%	0	0	0%	80	85	106%
10	48	45	94%	27	30	112%	5	7	130%	0	0	0%	80	82	102%
	480	**485**	**101%**	**270**	**279**	**103%**	**50**	**33**	**65%**	**0**	**0**	**0%**	**800**	**796**	**99%**
11	23	0	0%	44	49	112%	3	2	67%	1	0	42%	71	52	73%
12	0	0	0%	44	54	122%	0	0	0%	1	0	15%	45	54	120%
13	0	0	0%	44	43	99%	0	0	0%	1	0	0%	45	43	96%
14	0	0	0%	44	56	128%	0	0	0%	1	0	0%	45	56	125%
15	2	0	0%	43	42	98%	0	0	0%	1	2	206%	46	44	96%
16	2	0	0%	26	19	73%	0	0	0%	0	0	0%	28	19	68%
17	0	0	0%	38	38	100%	0	0	0%	1	0	0%	39	38	98%
18	0	0	0%	38	33	88%	0	0	0%	0	0	0%	38	33	88%
19	0	0	0%	44	46	105%	0	0	0%	0	0	0%	44	46	105%
20	0	0	0%	43	45	105%	0	0	0%	0	4	0%	43	49	115%
	27	**0**	**0%**	**408**	**427**	**105%**	**3**	**2**	**67%**	**6**	**7**	**118%**	**444**	**436**	**98%**

Juvenile spacing schedule

The spatial model was able to develop a tactical schedule that meets or slightly exceeds the strategic schedule (Table 4.4). The total percent objective was 104% for the first 10 periods. The total percent objective then increased to 109% for the remaining 10 periods. The spatial model was able to find polygons that were close to the area scheduled by the strategic model.

Juvenile space-fertilization schedule

The juvenile space-fertilization tactical schedule closely follows the strategic schedule (Table 4.5). The total percent objective varied by 2% for periods 1 to 10 and 11 to 20.

5.0 Next Step

ArcGIS shapefiles have been produced for both scenarios S02 and S10. The shapefiles provide the spatial silviculture schedule for both scenarios. A data dictionary has been provided which describes the fields and codes found within the shapefile.

From the shapefile operations can ensure that the spatially explicit schedule is operationally feasible. Planning staff can adjust both the silviculture plan and the spatial files to reflect operational realities.

These adjustments are then imposed back onto the strategic level plan to evaluate the impact of the 20-year spatial silviculture plan on the 200-year aspatial strategy. This process may be repeated until a practical spatial silviculture plan is obtained that is compatible with the aspatial strategic plan.

Appendix A — The Current Silviculture State of TFL 23

Stand development occurs as a result of growth, competition, mortality, and silviculture actions (e.g., juvenile spacing). The silviculture state of a stand is described by an extensive list of variables (including species mix, age, density, basal area, and crown closure), which change over time with the development of a stand. These variables provide the silviculturist with the information needed to determine those silviculture activities that are immediately feasible (not including operational considerations such as harvesting restrictions, accessibility, terrain, or markets).

Describing the silviculture state in terms of the variables used by silviculturists may be appropriate for operational, program-level planning, but it is too detailed for strategic planning with a forest-level model.

The TSR2 timber supply analysis differentiates between stands in natural states and managed states in order to assign appropriate yield curves. A silviculture analysis requires a more complex definition of the silviculture state of each stand in order to determine feasible management actions and appropriate managed stand yield curves. The silviculture state of the land base for this study is approximated by tracking the history of the treatments applied to each stand, as well as species mix and age.

The initial silviculture state for TFL 23 has been developed by spatially integrating the inventory with the silviculture history of the TFL. Table A-1 presents the current siliculture state of the TFL.

Table A-1. Current silviculture state for TFL 23

Silviculture Analysis Units	Leading Species	Site Index Range	Silviculture State E09	E17	E35	E70	E7015	E7016	NIMMATURE	NMATURE	NS	Total
SAU1	FD,L	SI>21	465	902	1,579	1,507	-	54	10,803	387	24	15,722
SAU2	FD,L	15<=SI<=21	351	700	1,231	1,206	-	-	37,339	5,537	92	46,457
SAU3	FD,L	SI<15	22	43	77	74	-	-	4,616	6,973	43	11,847
SAU4	C,H	SI>19	206	514	720	615	-	-	21,592	2,880	808	27,336
SAU5	C,H	16<=SI<=19	106	254	359	283	-	1	8,795	13,105	183	23,087
SAU6	C,H	SI<16	26	64	89	74	-	-	3,454	10,317	340	14,365
SAU7	S,B	SI>20	271	681	1,220	537	-	-	2,293	2,868	-	7,870
SAU8	S,B	17<=SI<=20	674	1,680	3,024	1,341	-	-	3,393	482	15	10,610
SAU9	S,B	SI<17	1,011	2,518	1,015	491	-	-	11,696	23,781	25	40,536
SAU10	PL	SI>20	482	964	2,166	1,202	-	-	5,284	63	86	10,247
SAU11	PL	17<=SI<=20	187	367	819	430	15	-	9,880	11	21	11,730
SAU12	PL	SI<17	70	706	348	268	-	-	6,421	463	8	8,284
SAU13	Deciduous	All	-	-	-	-	-	-	651	-	6	657
SAUINOP	All	All	-	-	-	-	-	-		137,942	-	137,942
Total			**3,871**	**9,393**	**12,647**	**8,029**	**15**	**56**	**126,217**	**204,812**	**1,652**	**366,691**

Silviculture State	Description
e09	existing managed, established at 900 sph
e17	existing managed, established at 1700 sph
e35	existing managed, established at 3500 sph
e70	existing managed, established at > 7000 sph
e7014	existing managed, established at >7000 sph, juvenile spaced to 1400 sph
e7015	existing managed, established at >7000 sph, juvenile spaced to 1500 sph
e7016	existing managed, established at >7000 sph, juvenile spaced to 1600 sph
e7018	existing managed, established at >7000 sph, juvenile spaced to 1800 sph
NS	existing natural spaced
NImmature	natural, immature
NMature	natural, mature

Appendix B — Regimes Diagrams and Yield Model Specifications

This appendix documents the development of the yield tables for both existing and managed stands. The process requires four steps:

1. determine the multiple management objectives that drive silviculture on the TFL
2. develop silvicultural regimes that contribute towards these objectives and express them as regime diagrams
3. develop a spreadsheet of regime specifications to communicate the managed stand yield table requirements to Research Branch
4. generate the yield tables with TASS (managed stands) and VDYP (existing unmanaged stands). The yield tables developed for this study are included in Appendix E.

Management Objectives

The primary management objective identified by the TFL 23 planning staff is to maintain or increase the supply of timber from the TFL. The silvicultural regimes designed to contribute to this objective include planting select stock, alternative planting densities, juvenile spacing, fertilization, and commercial thinning.

The secondary silvicultural objective identified is to manage for machine stress rating (MSR). No specific regimes were developed to contribute to this objective, as the yield models available to this study (TASS, Prognosis) cannot forecast stand characteristics that could be related to MSR.

No other forest-level issues identified in the Type 1 Silviculture Strategy were determined to be addressable by incremental silviculture.

Regime Diagrams

Regime diagrams are the "blueprint" for the construction of the silviculture modules of the forest-level model.

Silviculture regimes specify a sequence of management actions that may be applied to stands within the silviculture analysis unit for which the regime was designed. Each of these actions change the silviculture state of the stands. Therefore, alternative silviculture regimes result in alternative stand development pathways that stands within a silviculture analysis unit may follow.

A series of alternative regimes was specified for each the 12 silviculture analysis units defined for TFL 23 by Pope and Talbot staff and the alternative stand development pathways were diagrammed (Figures B-1 to B-12). The lines (arcs) of these diagrams correspond to silviculture actions and the boxes (nodes) represent the silviculture state of the stand. Tables B-1 and B-2 explain the codes used in these diagrams. Note that clearcut harvesting (clc_m) may occur from any treatment state (including planting and ingress only), but the activity arcs that would lead back to regenerating (R) are not shown in the regime diagrams in order to maintain legibility. Also, forest stands are not required to progress along a pathway—a stand may remain in any state indefinitely.

Table B-1. State codes

Code	Treatment State
NImmature	Natural existing stands age 26-140
Nmature	Natural existing stands age 141+
NSR	In period 1 NSR will be converted to managed stands
09	Plant to 1600 sph, ingrowth to 900 sph
09x	Plant to 1600 sph, ingrowth to 900 sph - no further management
09--F2	Plant to 1600 sph, ingrowth to 900 sph, fertilize 2x
17	Plant to 1600 sph, ingrowth to 1700 sph
17x	Plant to 1600 sph, ingrowth to 1700 sph - no further management
17--F2	Plant to 1600 sph, ingrowth to 1700 sph, fertilize 2x
17--F2TF	Plant to 1600 sph, ingrowth to 1700 sph, fertilize 2x, CT fertilize
17--F3	Plant to 1600 sph, ingrowth to 1700 sph, fertilize 3x
17--F3TF	Plant to 1600 sph, ingrowth to 1700 sph, fertilize 3x, CT fertilize
17---T	Plant to 1600 sph, ingrowth to 1700 sph, CT
35	Plant to 1600 sph, ingrowth to 3500 sph
70	Plant to 1600 sph, ingrowth to 7000 sph
70x	Plant to 1600 sph, ingrowth to 7000 sph - no further management
7014	Plant to 1600 sph, ingrowth to 7000 sph, JS to 1400 sph
7014-F3	Plant to 1600 sph, ingrowth to 7000 sph, JS to 1400 sph, fertilize 3x
7015	Plant to 1600 sph, ingrowth to 7000 sph, JS to 1500 sph
7015-F3	Plant to 1600 sph, ingrowth to 7000 sph, JS to 1500 sph, fertilize 3x
7016	Plant to 1600 sph, ingrowth to 7000 sph, JS to 1600 sph
7016-F2	Plant to 1600 sph, ingrowth to 7000 sph, JS to 1600 sph, fertilize 2x
7016-F2TF	Plant to 1600 sph, ingrowth to 7000 sph, JS to 1600 sph, fertilize 2x, CT fertilize
7016--T	Plant to 1600 sph, ingrowth to 7000 sph, JS to 1600 sph, CT
7018	Plant to 1600 sph, ingrowth to 7000 sph, JS to 1800 sph
7018-F2	Plant to 1600 sph, ingrowth to 7000 sph, JS to 1800 sph, fertilize 2x
7018-F2TF	Plant to 1600 sph, ingrowth to 7000 sph, JS to 1800 sph, fertilize 2x, CT fertilize
7018--T	Plant to 1600 sph, ingrowth to 7000 sph, JS to 1800 sph, CT

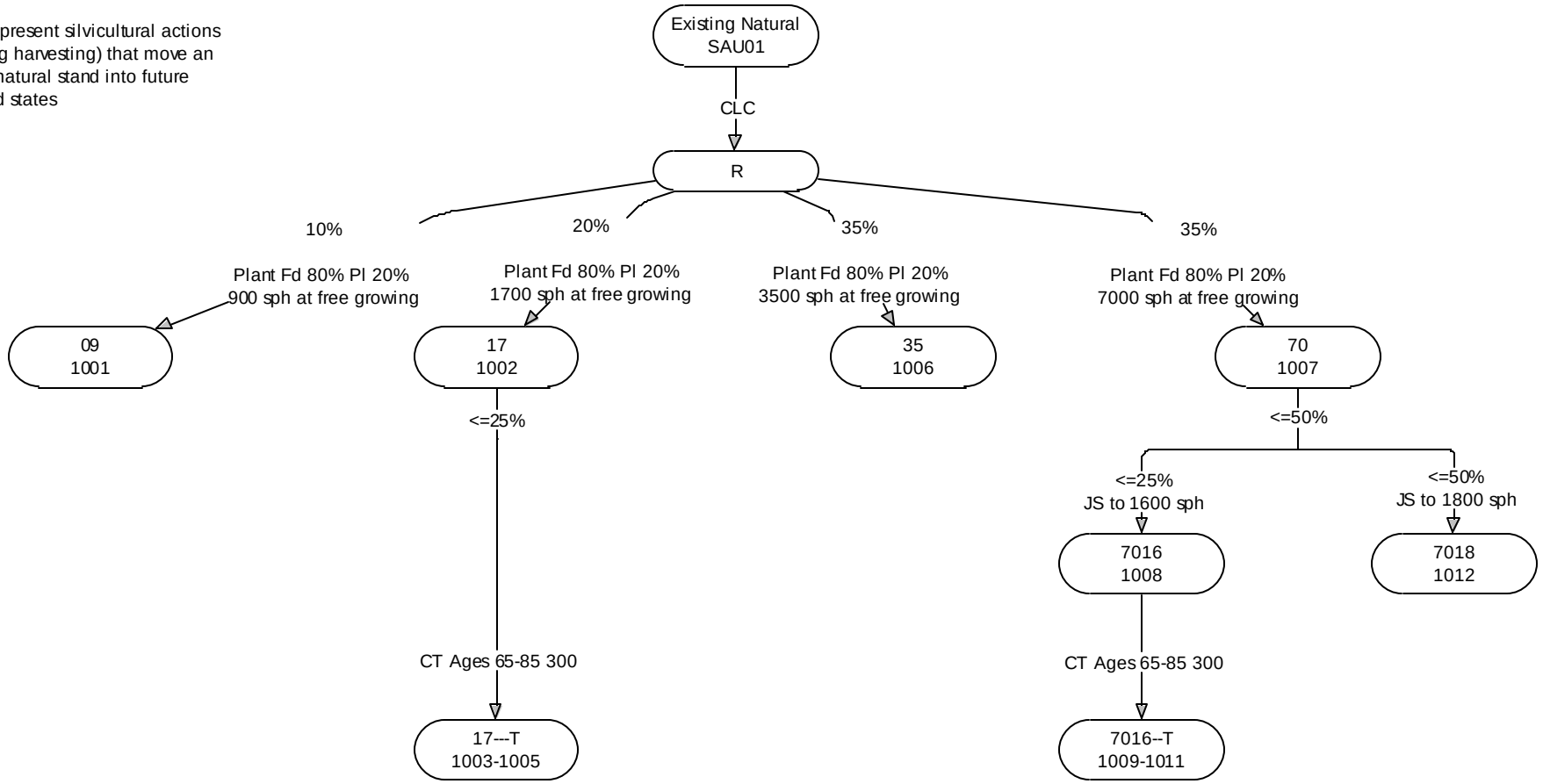
Table B-2. Activity codes

Code	Activity Code
ADD_NSR	Add NSR
CLC_EXIST	Clearcut existing natural
CLC_MANAGED	Clearcut managed
CTHIN	Commercial thin
PLNTSAU	Planting and ingrowth to various densities
FERT2xONLY	Ingrowth 900 or 1700, fertilize 2x
FERT3xONLY	Ingrowth 900 or 1700, fertilize 3x
SPACE1400	Ingrowth to 7000 sph, JS to 1400 sph
SPACE1400FERT3x	Ingrowth to 7000 sph, JS to 1400 sph, fertilize 3x
SPACE1500	Ingrowth to 7000 sph, JS to 1500 sph
SPACE1500FERT3x	Ingrowth to 7000 sph, JS to 1500 sph, fertilize 3x
SPACE1600	Ingrowth to 7000 sph, JS to 1600 sph
SPACE1600FERT2x	Ingrowth to 7000 sph, JS to 1600 sph, fertilize 2x
SPACE1800	Ingrowth to 7000 sph, JS to 1800 sph
SPACE1800FERT2x	Ingrowth to 7000 sph, JS to 1800 sph, fertilize 2x
CTFERT	Ingrowth to 7000 sph, JS to 1600 or 1800 sph, CT fertilize

Figure B-1. SAU01 Alternate Development Pathways for Managed Stands

Pope & Talbot Ltd. TFL 23
SAU01 ITG 1-8, 33,34, SI 21+
SAU01 = 7% of the THLB (16348 ha)

Arrows represent silvicultural actions (including harvesting) that move an existing natural stand into future managed states



Managed State Codes

70 - ingrowth to 7000 sph
16 - juvenile spaced to 1600 sph
18 - juvenile spaced to 1600 sph
P - pruned - 100% of stand is pruned
F1 - fertilize once
F2 - fertilize twice
F3 - fertilize three times
T - commercially thinned
L - late fertilization

Action Codes

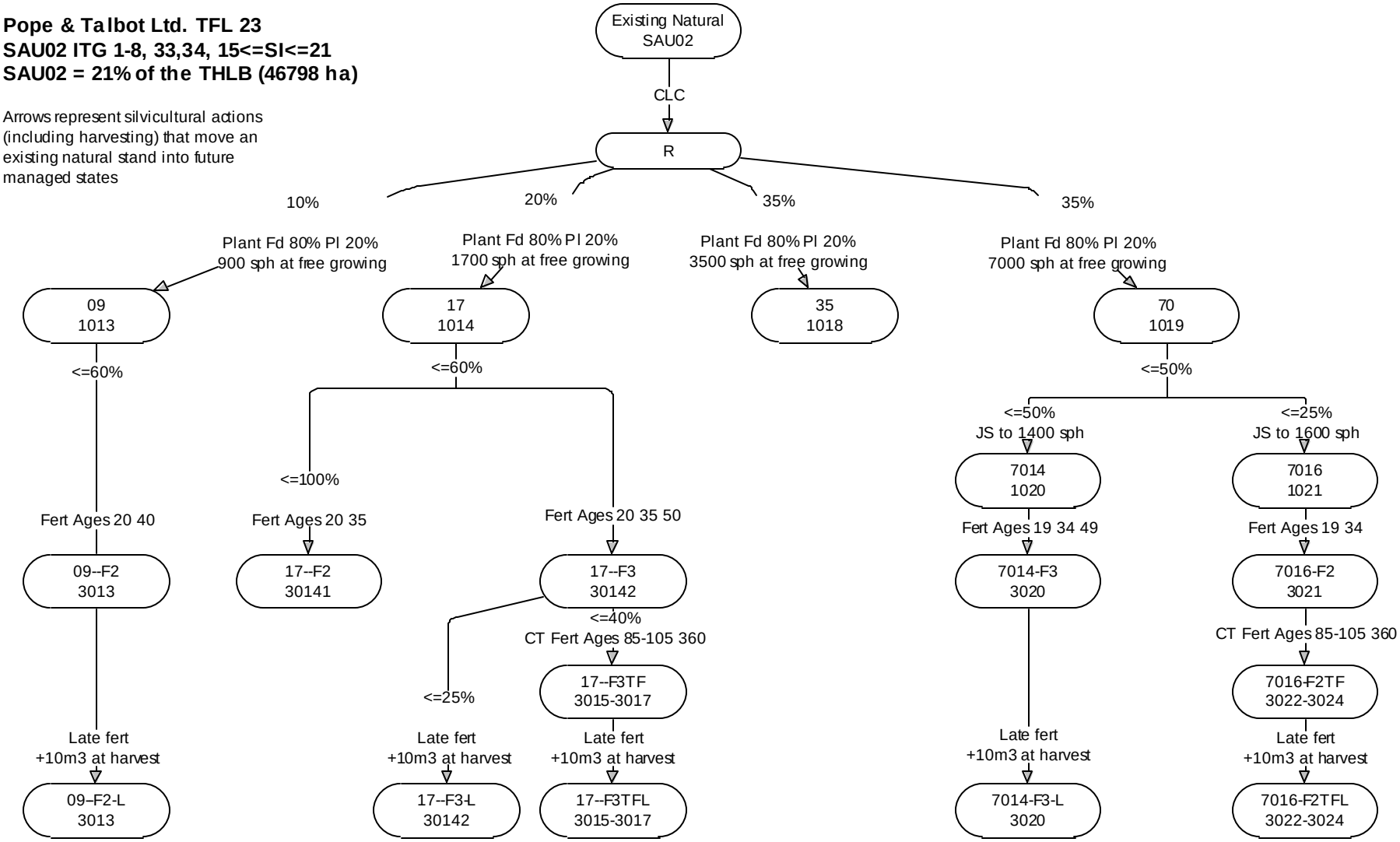
CLC - clearcut
Plant sp1 % sp2 % sp3 % - species mix
JS - juvenile spaced planting density to n sph
Pr - pruning
CT - commerial thinning
Fert - fertilization

CT Opportunity	CT States
17	17---T
7016	7016--T

Figure B-2. SAU02 Alternate Development Pathways for Managed Stands

Pope & Talbot Ltd. TFL 23
SAU02 ITG 1-8, 33,34, 15<=SI<=21
SAU02 = 21% of the THLB (46798 ha)

Arrows represent silvicultural actions (including harvesting) that move an existing natural stand into future managed states



Managed State Codes

70 - plant to 7000 sph
16 - juvenile spaced to 1600 sph
18 - juvenile spaced to 1600 sph
P - pruned - 100% of stand is pruned
F1 - fertilize once
F2 - fertilize twice
F3 - fertilize three times
T - commercially thinned
TF - commercially thinned, fertilized
L - late fertilization

Action Codes

CLC - clearcut
Plant sp1 % sp2 % sp3 % - species mix
JS - juvenile spaced planting density to n sph
Pr - pruning
CT - commerial thinning
Fert - fertilization
Late fert - Fertilize 10 years prior to harvest

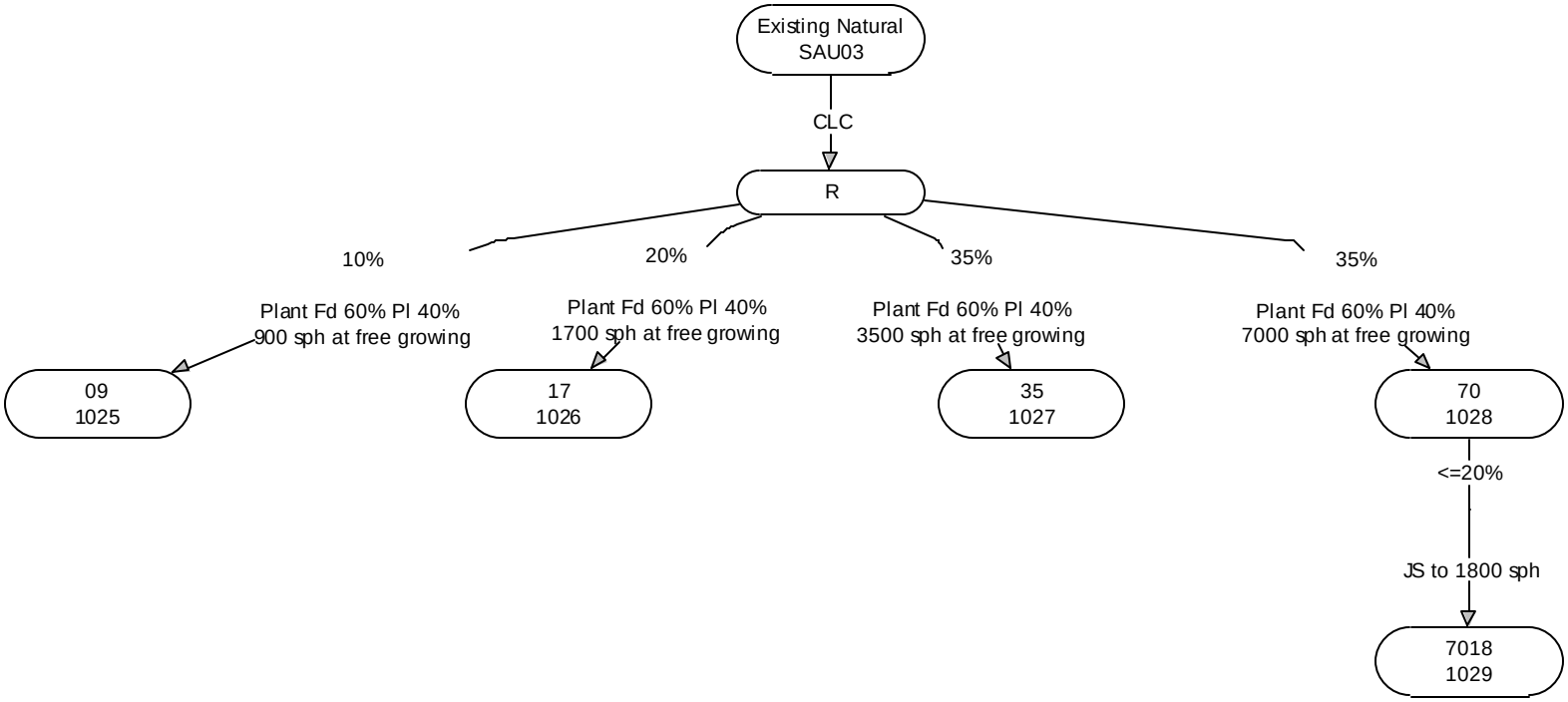
CT Opportunity
17--F3
7016-F2

CT States
17--F3TF
7016-F2TF

Figure B-3. SAU03 Alternate Development Pathways for Managed Stands

Pope & Talbot Ltd. TFL 23
SAU03 ITG 1-8, 33,34, SI<15
SAU03 = 5% of the THLB (11239 ha)

Arrows represent silvicultural actions (including harvesting) that move an existing natural stand into future managed states



Existing Natural and Future Managed Stands

The development of these stands will be modelled (e.g., TIPSY) as planted managed stands.

100% of a stand is pruned.

Managed State Codes

70 - ingrowth to 7000 sph
16 - juvenile spaced to 1600 sph
18 - juvenile spaced to 1600 sph
P - pruned - 100% of stand is pruned
F1 - fertilize once
F2 - fertilize twice
F3 - fertilize three times
T - commercially thinned
L - late fertilization

Action Codes

CLC - clearcut
Plant sp1 % sp2 % sp3 % - species mix
JS - juvenile spaced planting density to n sph
Pr - pruning
CT - commerial thinning
Fert - fertilization

Figure B-4. SAU04 Alternate Development Pathways for Managed Stands

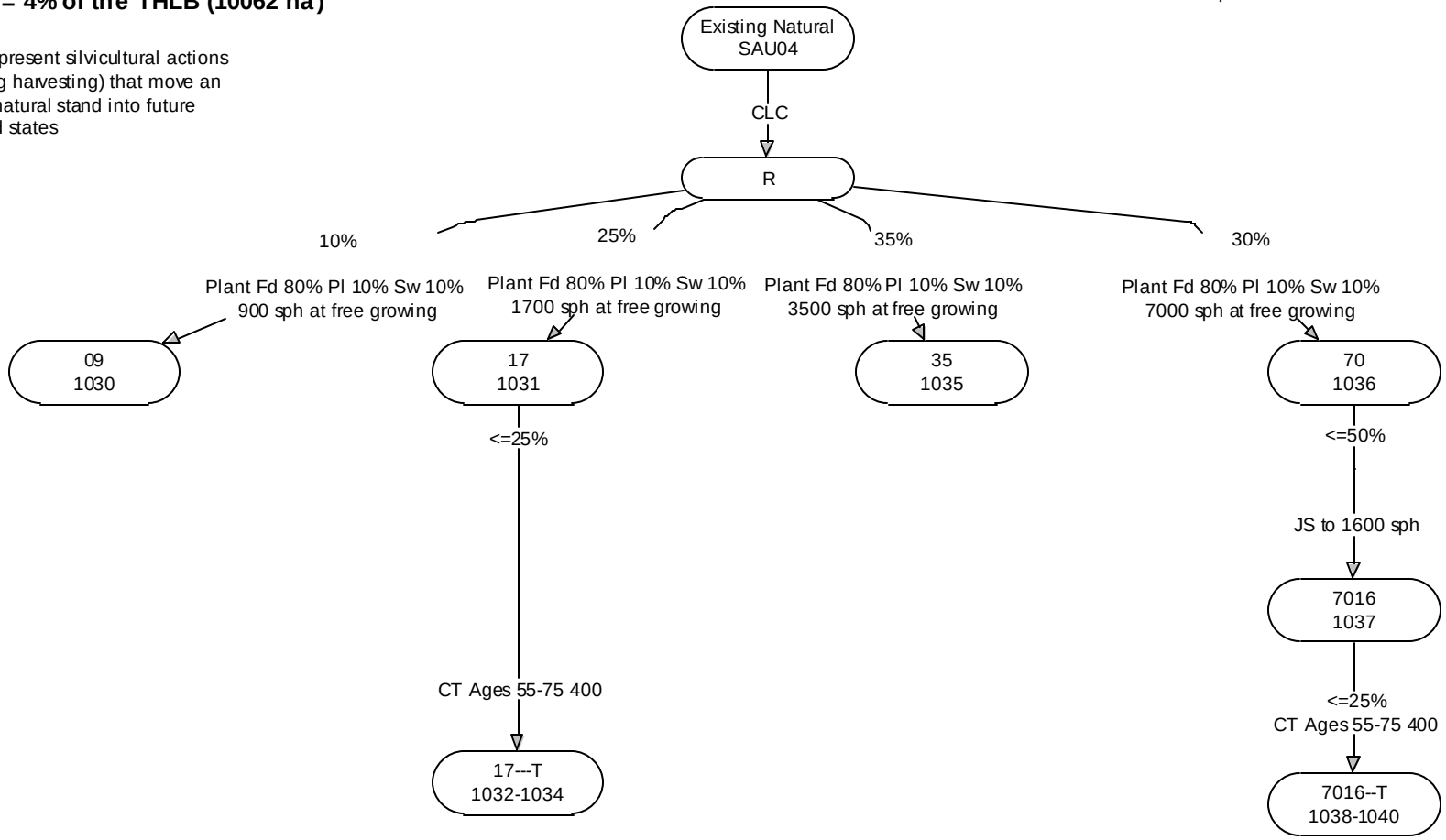
Pope & Talbot Ltd. TFL 23
SAU04 ITG 9-17, SI 19+
SAU04 = 4% of the THLB (10062 ha)

Arrows represent silvicultural actions (including harvesting) that move an existing natural stand into future managed states

Existing Natural and Future Managed Stands

The development of these stands will be modelled (e.g., TIPSY) as planted managed stands.

100% of a stand is pruned.



Managed State Codes

70 - ingrowth to 7000 sph
16 - juvenile spaced to 1600 sph
18 - juvenile spaced to 1600 sph
P - pruned - 100% of stand is pruned
F1 - fertilize once
F2 - fertilize twice
F3 - fertilize three times
T - commercially thinned
L - late fertilization

Action Codes

CLC - clearcut
Plant sp1 % sp2 % sp3 % - species mix
JS - juvenile spaced planting density to n sph
Pr - pruning
CT - commerial thinning
Fert - fertilization

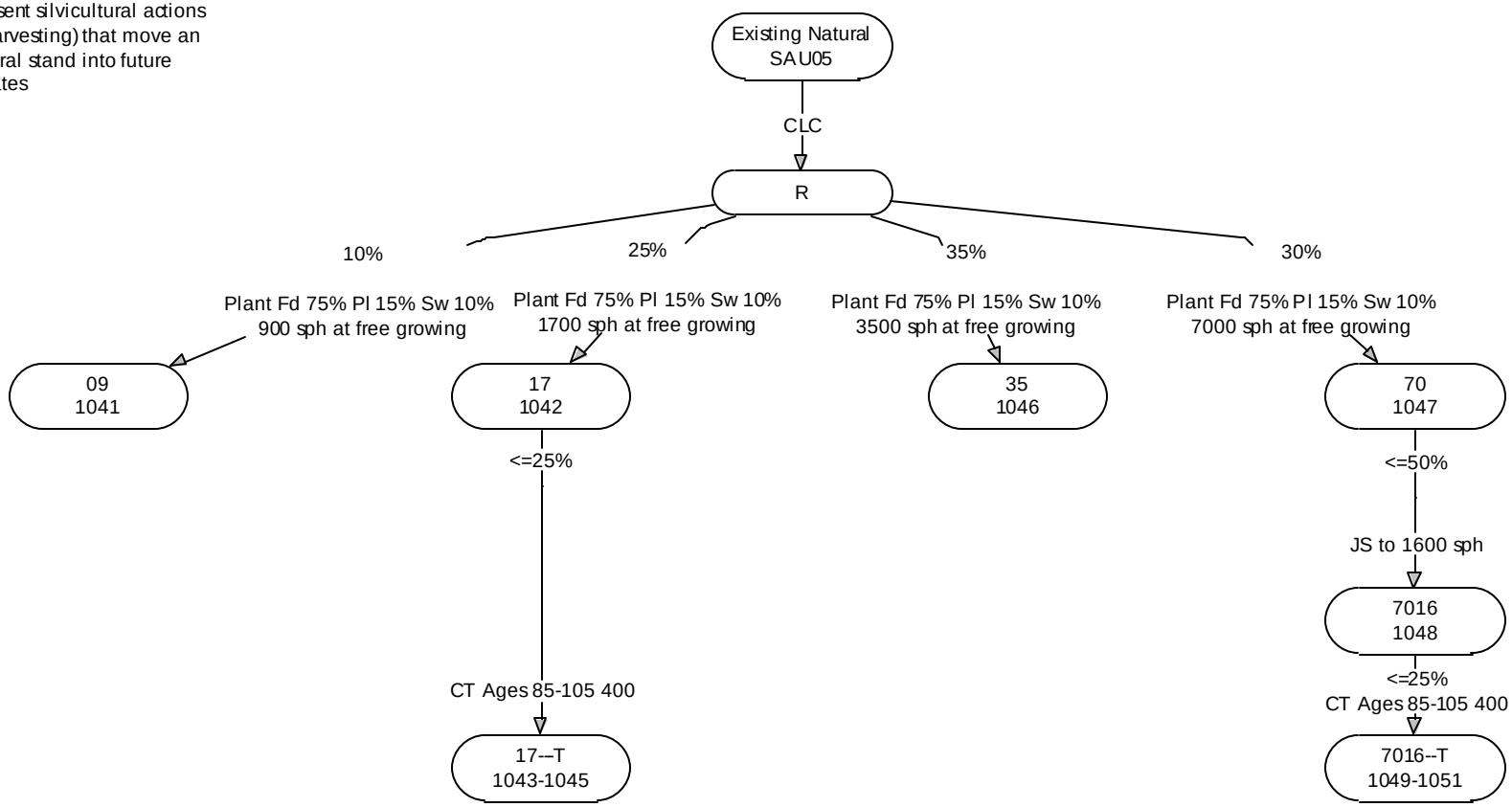
CT Opportunity
7016

CT States
7016--T

Figure B-5. SAU05 Alternate Development Pathways for Managed Stands

Pope & Talbot Ltd. TFL 23
SAU05 ITG 9-17, 16<=SI<=19
SAU05 = 12% of the THLB (27763 ha)

Arrows represent silvicultural actions (including harvesting) that move an existing natural stand into future managed states



Managed State Codes

70 - plant to 7000 sph
16 - juvenile spaced to 1600 sph
18 - juvenile spaced to 1600 sph
P - pruned - 100% of stand is pruned
F1 - fertilize once
F2 - fertilize twice
F3 - fertilize three times
T - commercially thinned
TF - commercially thinned, fertilized
L - late fertilization

Action Codes

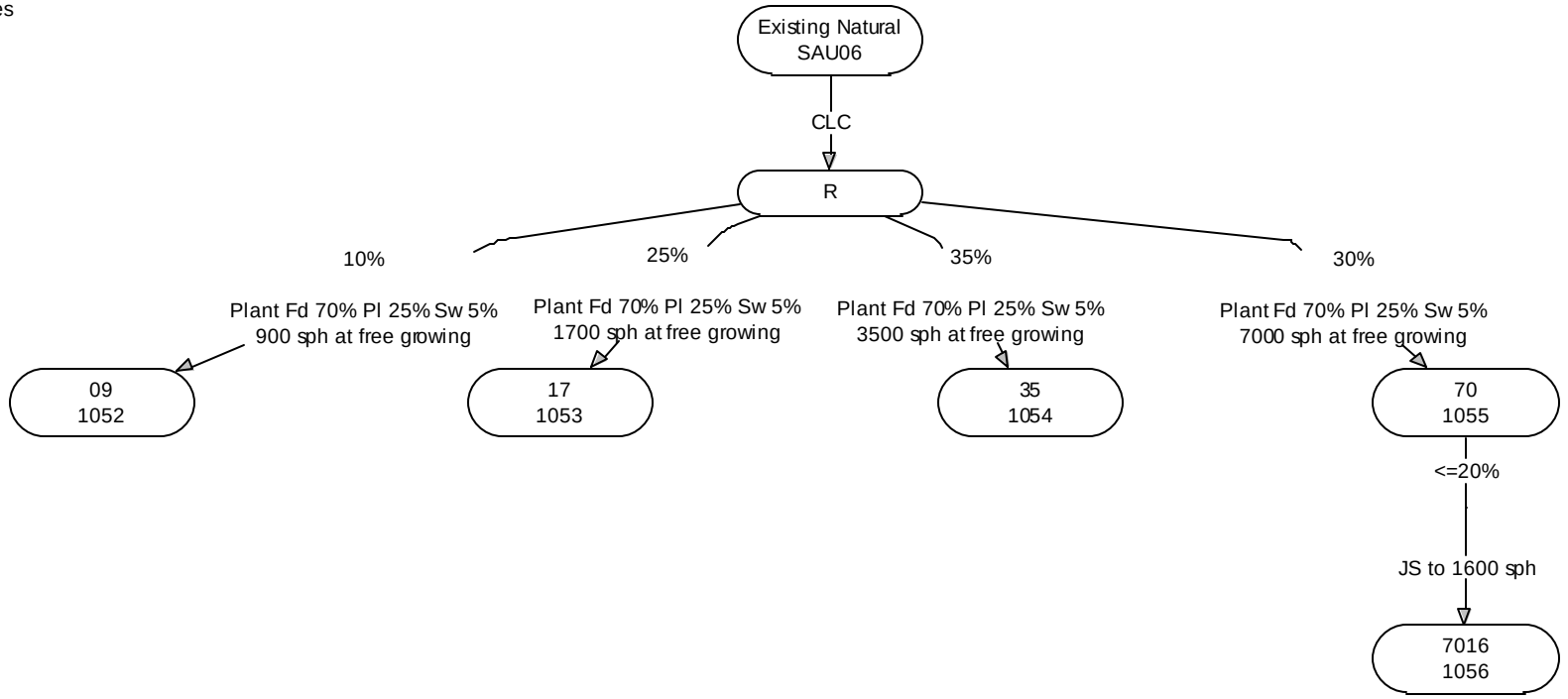
CLC - clearcut
Plant sp1 % sp2 % sp3 % - species mix
JS - juvenile spaced planting density to n sph
Pr - pruning
CT - commerial thinning
Fert - fertilization
Late fert - Fertilize 10 years prior to harvest

CT Opportunity	**CT States**
17--F3	17--F3TF
7016-F2	7016-F2TF

Figure B-6. SAU06 Alternate Development Pathways for Managed Stands

Pope & Talbot Ltd. TFL 23
SAU06 ITG 9-17, SI<16
SAU06 = 12% of the THLB (27781 ha)

Arrows represent silvicultural actions (including harvesting) that move an existing natural stand into future managed states



Managed State Codes

70 - ingrowth to 7000 sph
16 - juvenile spaced to 1600 sph
18 - juvenile spaced to 1600 sph
P - pruned - 100% of stand is pruned
F1 - fertilize once
F2 - fertilize twice
F3 - fertilize three times
T - commercially thinned
L - late fertilization

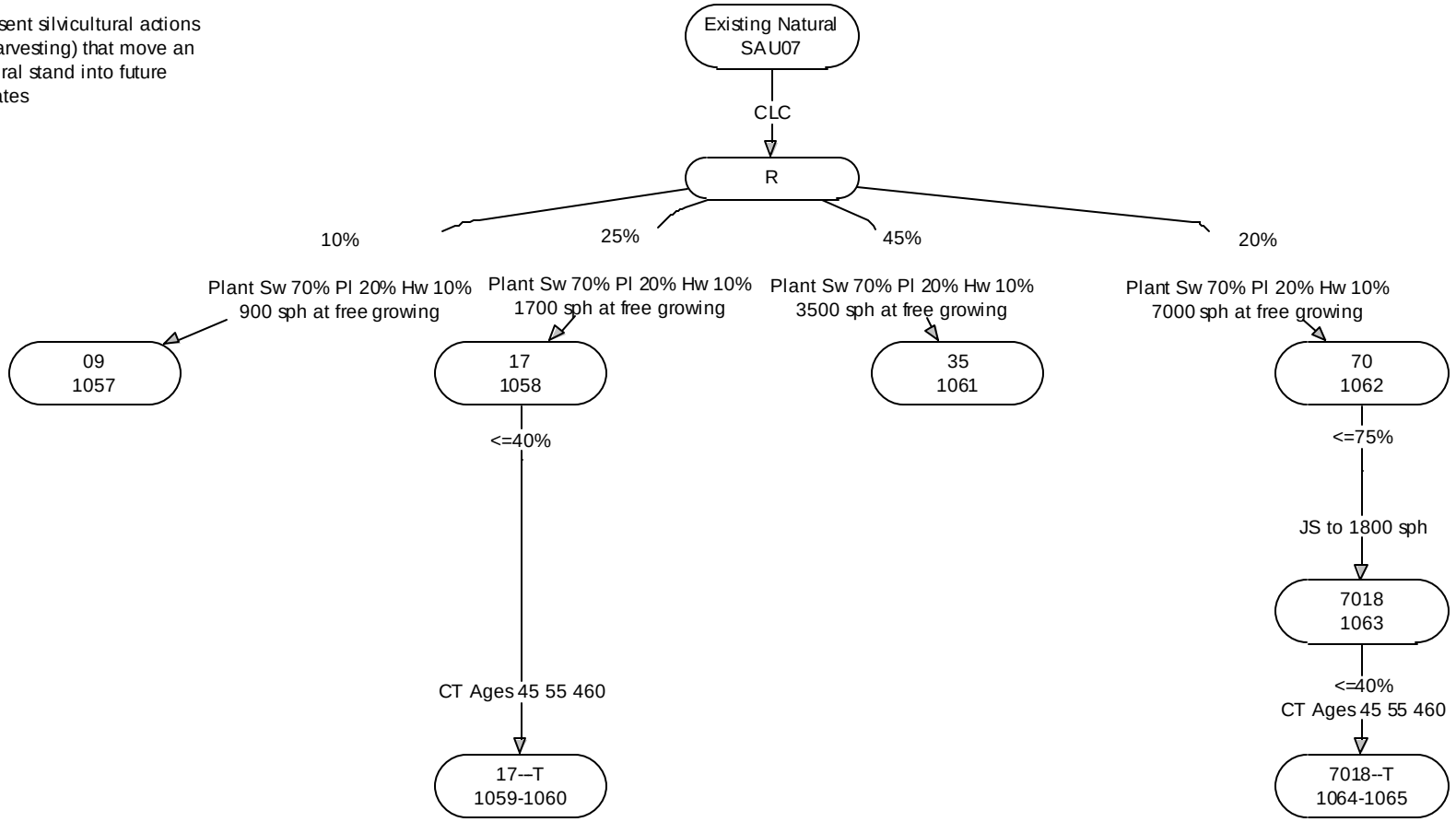
Action Codes

CLC - clearcut
Plant sp1 % sp2 % sp3 % - species mix
JS - juvenile spaced planting density to n sph
Pr - pruning
CT - commerial thinning
Fert - fertilization

Figure B-7. SAU07 Alternate Development Pathways for Managed Stands

Pope & Talbot Ltd. TFL 23
SAU07 ITG 18-26, SI 20+
SAU07 = 3% of the THLB (6778 ha)

Arrows represent silvicultural actions (including harvesting) that move an existing natural stand into future managed states



Managed State Codes

70 - ingrowth to 7000 sph
16 - juvenile spaced to 1600 sph
18 - juvenile spaced to 1600 sph
P - pruned - 100% of stand is pruned
F1 - fertilize once
F2 - fertilize twice
F3 - fertilize three times
T - commercially thinned
L - late fertilization

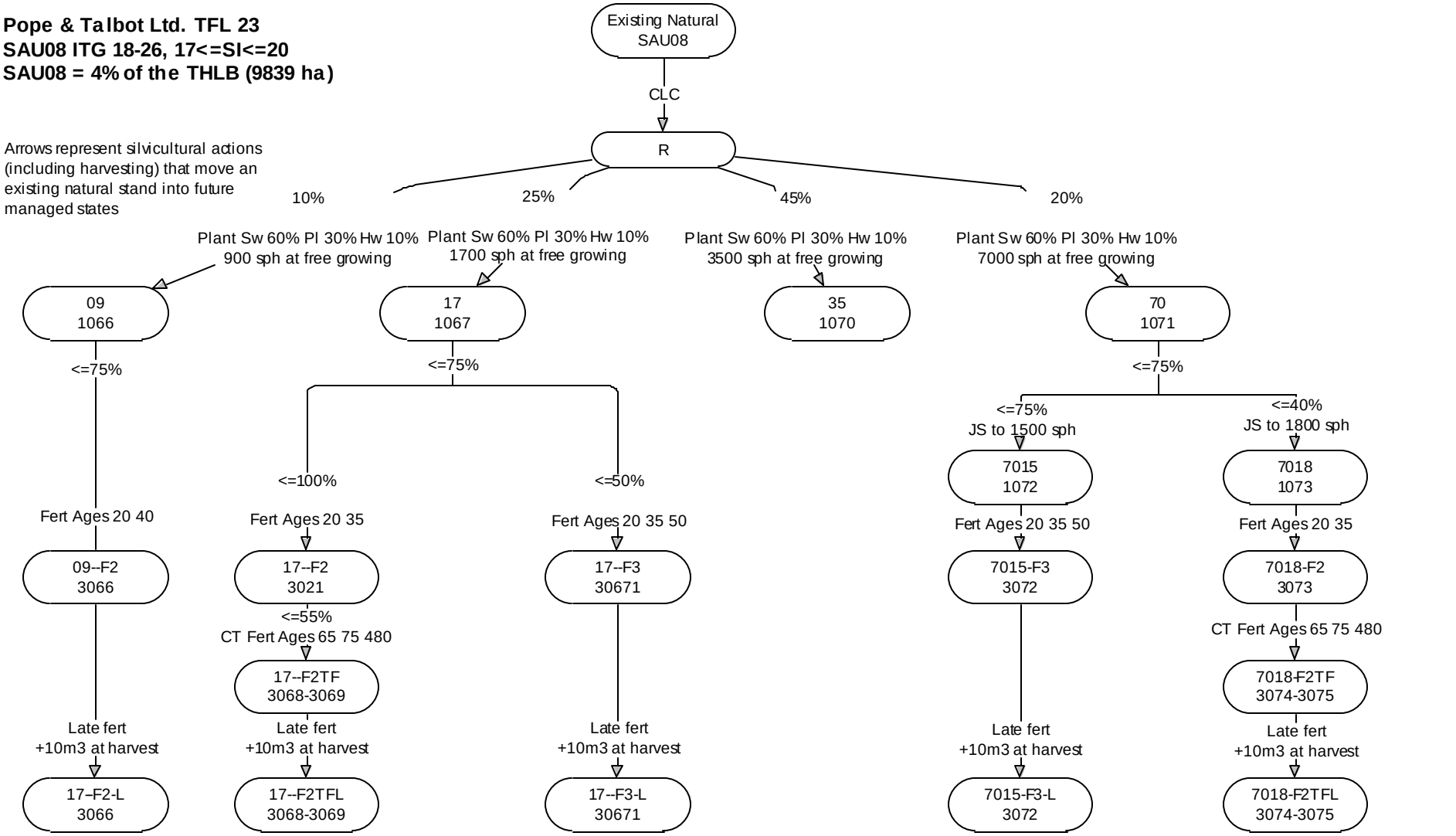
Action Codes

CLC - clearcut
Plant sp1 % sp2 % sp3 % - species mix
JS - juvenile spaced planting density to n sph
Pr - pruning
CT - commerial thinning
Fert - fertilization

CT Opportunity	CT States
17	17---T
7018	7018--T

Figure B-8. SAU08 Alternate Development Pathways for Managed Stands

Pope & Talbot Ltd. TFL 23
SAU08 ITG 18-26, 17<=SI<=20
SAU08 = 4% of the THLB (9839 ha)



Managed State Codes

70 - plant to 7000 sph
16 - juvenile spaced to 1600 sph
18 - juvenile spaced to 1600 sph
P - pruned - 100% of stand is pruned
F1 - fertilize once
F2 - fertilize twice
F3 - fertilize three times
T - commercially thinned
TF - commercially thinned, fertilized
L - late fertilization

Action Codes

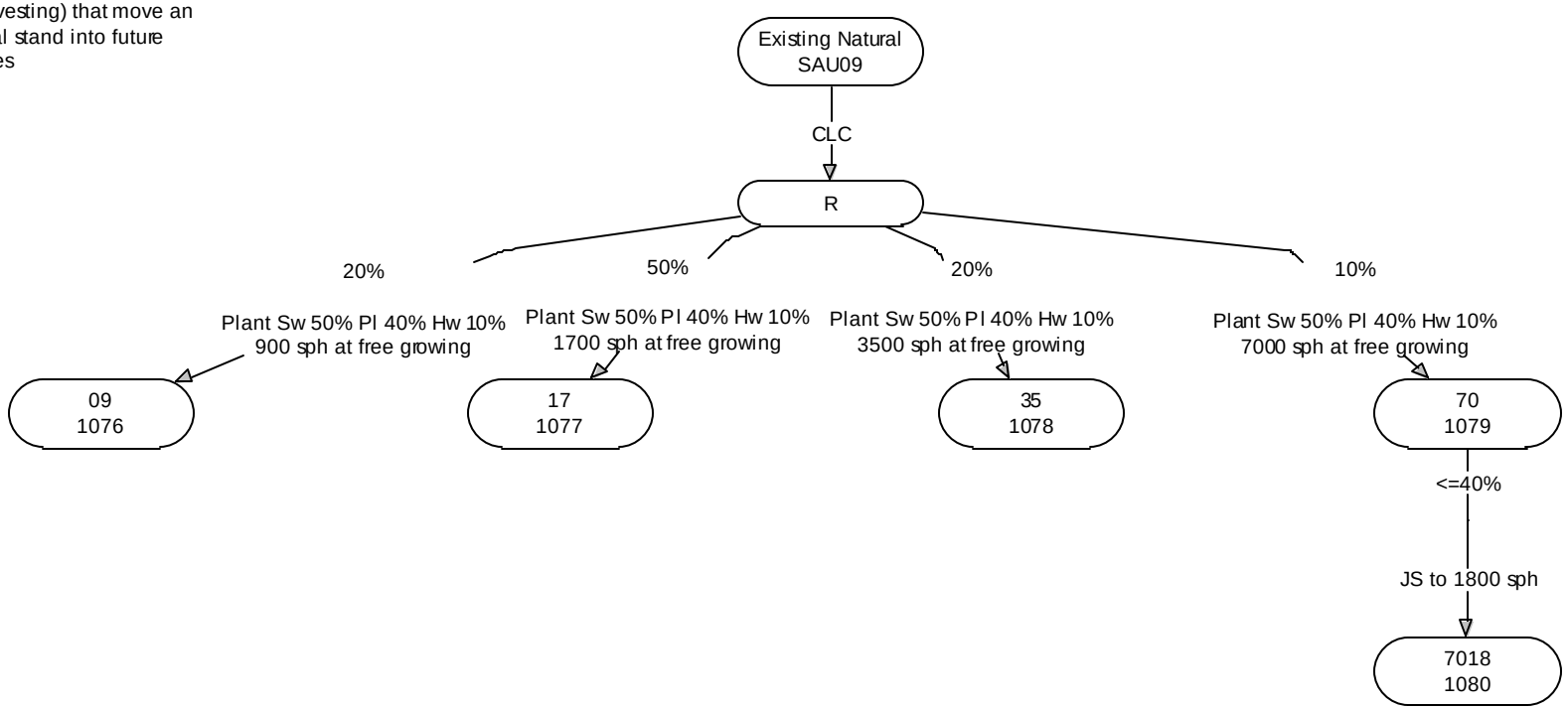
CLC - clearcut
Plant sp1 % sp2 % sp3 % - species mix
JS - juvenile spaced planting density to n sph
Pr - pruning
CT - commerial thinning
Fert - fertilization
Late fert - Fertilize 10 years prior to harvest

CT Opportunity	**CT States**
17--F3	17--F3TF
7018-F2	7018-F2TF

Figure B-9. SAU09 Alternate Development Pathways for Managed Stands

Pope & Talbot Ltd. TFL 23
SAU09 ITG 18-26 SI<17
SAU09 = 19% of the THLB (43127 ha)

Arrows represent silvicultural actions (including harvesting) that move an existing natural stand into future managed states



Managed State Codes

70 - ingrowth to 7000 sph
16 - juvenile spaced to 1600 sph
18 - juvenile spaced to 1600 sph
P - pruned - 100% of stand is pruned
F1 - fertilize once
F2 - fertilize twice
F3 - fertilize three times
T - commercially thinned
L - late fertilization

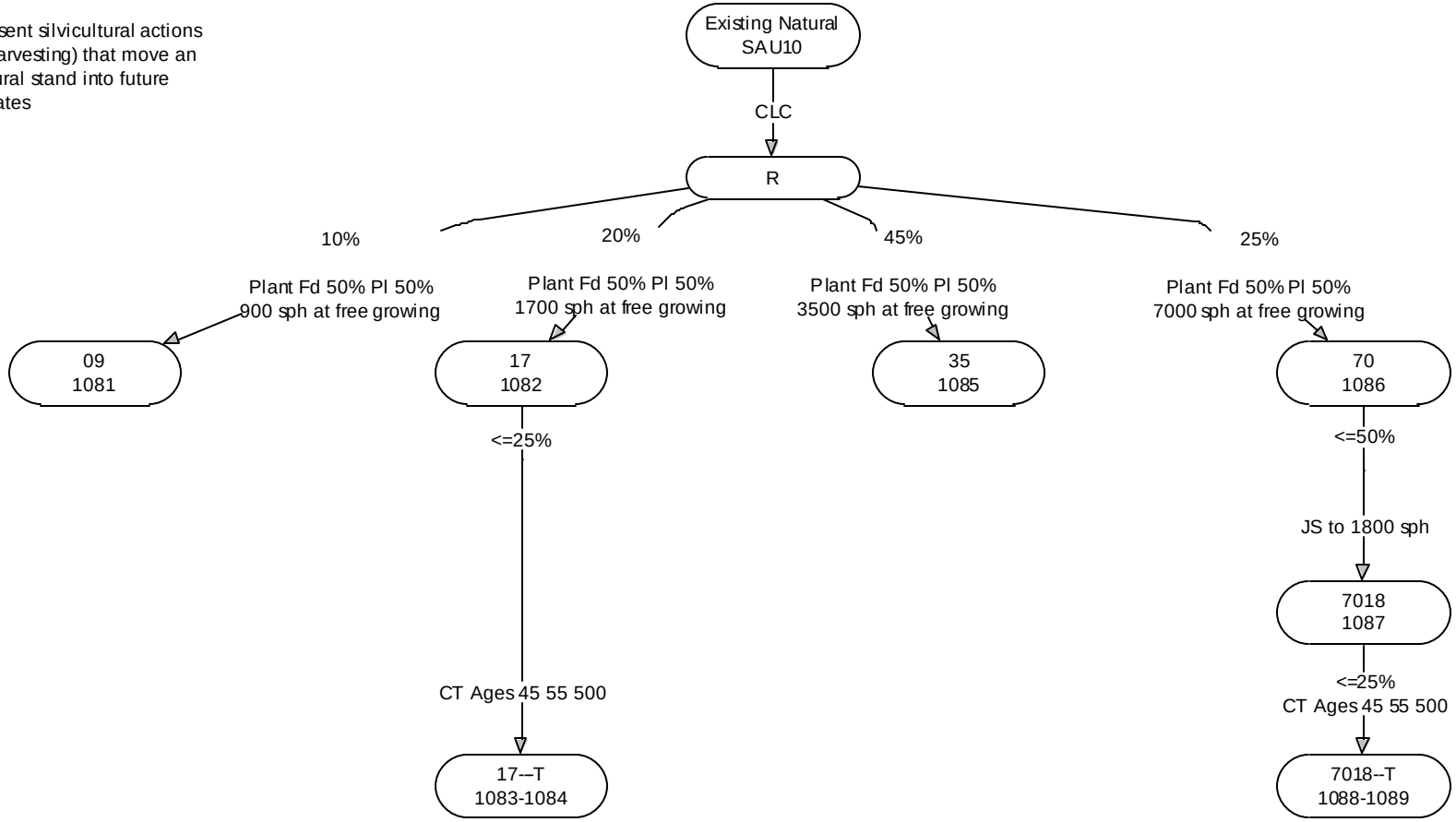
Action Codes

CLC - clearcut
Plant sp1 % sp2 % sp3 % - species mix
JS - juvenile spaced planting density to n sph
Pr - pruning
CT - commerial thinning
Fert - fertilization

Figure B-10 SAU10 Alternate Development Pathways for Managed Stands

Pope & Talbot Ltd. TFL 23
SAU10 ITG 27-32, SI 20+
SAU10 = 4% of the THLB (9717 ha)

Arrows represent silvicultural actions (including harvesting) that move an existing natural stand into future managed states



Managed State Codes

70 - ingrowth to 7000 sph
16 - juvenile spaced to 1600 sph
18 - juvenile spaced to 1600 sph
P - pruned - 100% of stand is pruned
F1 - fertilize once
F2 - fertilize twice
F3 - fertilize three times
T - commercially thinned
L - late fertilization

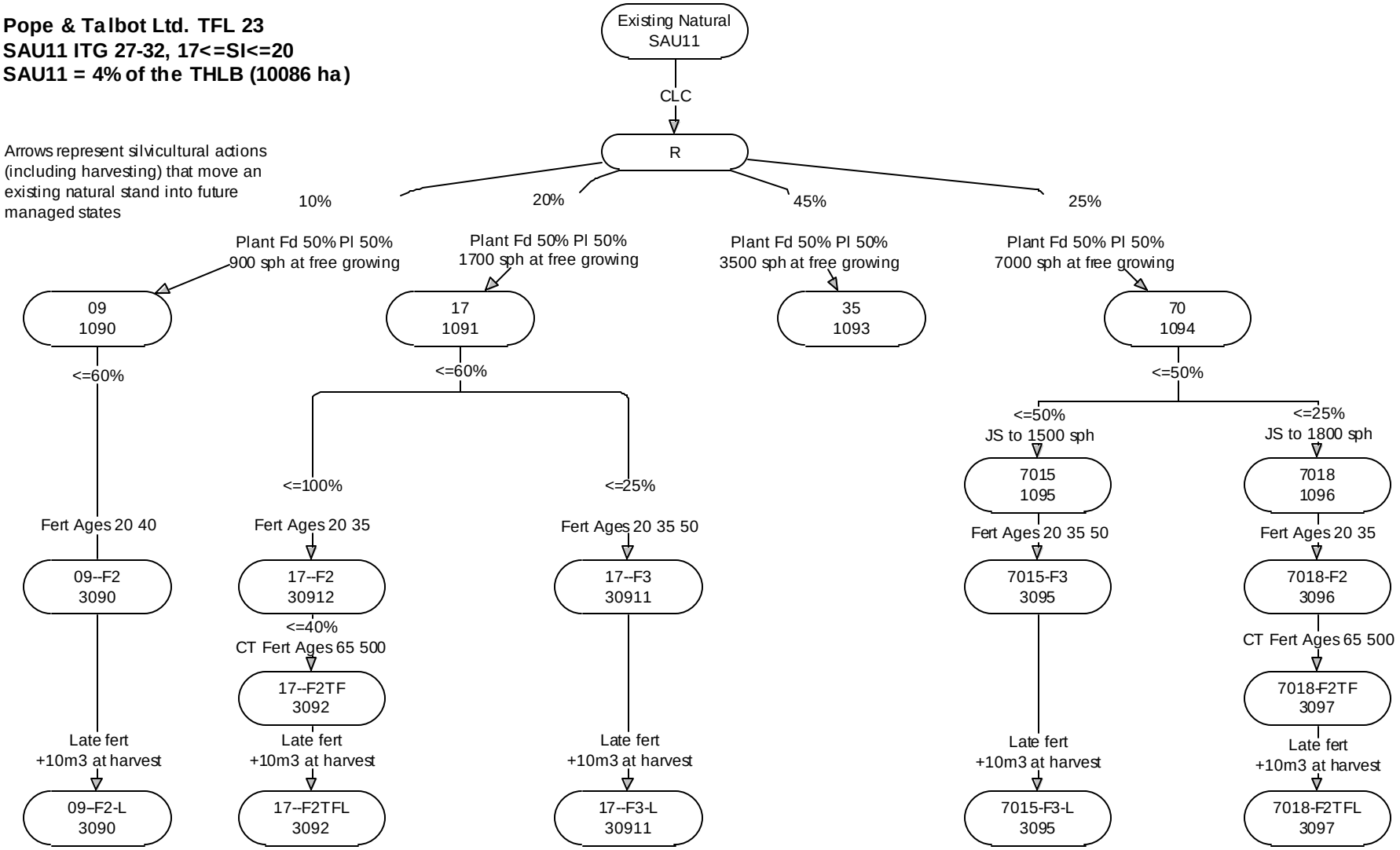
Action Codes

CLC - clearcut
Plant sp1 % sp2 % sp3 % - species mix
JS - juvenile spaced planting density to n sph
Pr - pruning
CT - commerial thinning
Fert - fertilization

CT Opportunity	**CT States**
17	17--T
7018	7018--T

Figure B-11. SAU11 Alternate Development Pathways for Managed Stands

Pope & Talbot Ltd. TFL 23
SAU11 ITG 27-32, 17<=SI<=20
SAU11 = 4% of the THLB (10086 ha)



Managed State Codes

70 - plant to 7000 sph
16 - juvenile spaced to 1600 sph
18 - juvenile spaced to 1600 sph
P - pruned - 100% of stand is pruned
F1 - fertilize once
F2 - fertilize twice
F3 - fertilize three times
T - commercially thinned
TF - commercially thinned, fertilized
L - late fertilization

Action Codes

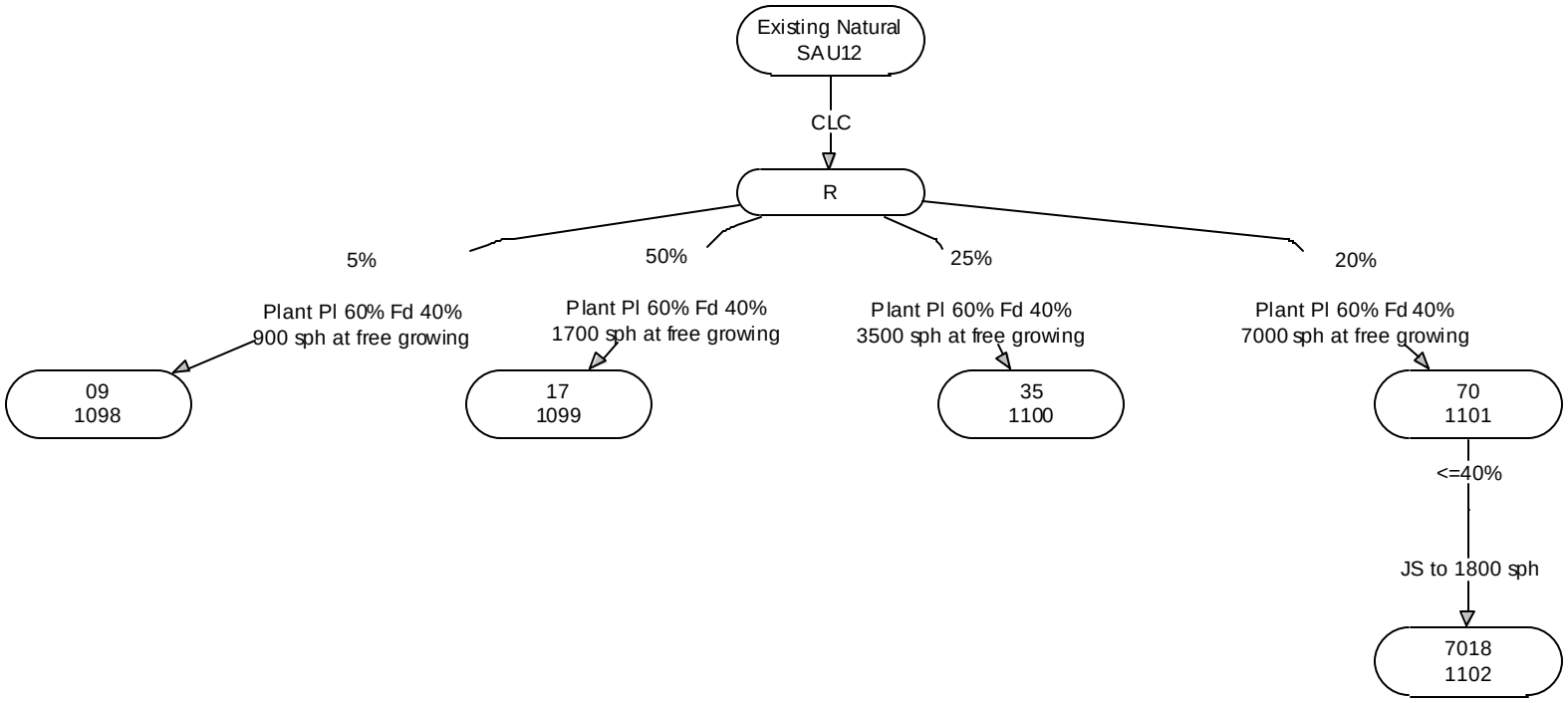
CLC - clearcut
Plant sp1 % sp2 % sp3 % - species mix
JS - juvenile spaced planting density to n sph
Pr - pruning
CT - commerial thinning
Fert - fertilization
Late fert - Fertilize 10 years prior to harvest

CT Opportunity	**CT States**
17--F3	17--F3TF
7018-F2	7018-F2TF

Figure B-12. SAU12 Alternate Development Pathways for Managed Stands

Pope & Talbot Ltd. TFL 23
SAU12 ITG 27-32, SI<17
SAU12 = 3% of the THLB (7113 ha)

Arrows represent silvicultural actions (including harvesting) that move an existing natural stand into future managed states



Managed State Codes

70 - ingrowth to 7000 sph
16 - juvenile spaced to 1600 sph
18 - juvenile spaced to 1600 sph
P - pruned - 100% of stand is pruned
F1 - fertilize once
F2 - fertilize twice
F3 - fertilize three times
T - commercially thinned
L - late fertilization

Action Codes

CLC - clearcut
Plant sp1 % sp2 % sp3 % - species mix
JS - juvenile spaced planting density to n sph
Pr - pruning
CT - commerial thinning
Fert - fertilization

TASS Yield Table Specifications

Table B-3 includes the specifications for the TASS managed stand yield tables developed from the regime diagrams. The associated management assumptions and the fertilization schedule are listed in Tables B-4 and B-5, respectively.

Table B-3. TASS run specifications - TFL 23

SAU	Managed Regime #	Height Adjustment	State Label	Plant species	site index range	Weighted average site index	Regen Lag	Plant tph	natural ingress species	natural ingress tph	Density after ingrowth	Pct Age	PCT leave tph	CT age	CT remove volume	1st Fertilization	2nd Fertilization	3rd Fertilization	4th Fertilization
1	1001	yes	09	Fd80Pl20	SI>21	23.5	2	1600	FdPl	-700	900	0	0	0	0	0	0	0	0
1	1002	yes	17	Fd80Pl20	SI>21	23.5	2	1600	FdPl	100	1700	0	0	0	0	0	0	0	0
1	1003	yes	17---T	Fd80Pl20	SI>21	23.5	2	1600	FdPl	100	1700	0	0	65	0.33	0	0	0	0
1	1004	yes	17---T	Fd80Pl20	SI>21	23.5	2	1600	FdPl	100	1700	0	0	75	0.33	0	0	0	0
1	1005	yes	17---T	Fd80Pl20	SI>21	23.5	2	1600	FdPl	100	1700	0	0	85	0.33	0	0	0	0
1	1006	yes	35	Fd80Pl20	SI>21	23.5	2	1600	FdPl	1400	3000	0	0	0	0	0	0	0	0
1	1007	yes	70	Fd80Pl20	SI>21	23.5	2	1600	FdPl	5400	7000	0	0	0	0	0	0	0	0
1	1008	yes	7016	Fd80Pl20	SI>21	23.5	2	1600	FdPl	5400	7000	16	1600	0	0	0	0	0	0
1	1009	yes	7016--T	Fd80Pl20	SI>21	23.5	2	1600	FdPl	5400	7000	16	1600	65	0.33	0	0	0	0
1	1010	yes	7016--T	Fd80Pl20	SI>21	23.5	2	1600	FdPl	5400	7000	16	1600	75	0.33	0	0	0	0
1	1011	yes	7016--T	Fd80Pl20	SI>21	23.5	2	1600	FdPl	5400	7000	16	1600	85	0.33	0	0	0	0
1	1012	yes	7018	Fd80Pl20	SI>21	23.5	2	1600	FdPl	5400	7000	16	1800	0	0	0	0	0	0
2	1013	yes	09	Fd80Pl20	15-21	18.2	2	1600	FdPl	-700	900	0	0	0	0	0	0	0	0
2	1014	yes	17	Fd80Pl20	15-21	18.2	2	1600	FdPl	100	1700	0	0	0	0	0	0	0	0
2	1015	yes	17---T	Fd80Pl20	15-21	18.2	2	1600	FdPl	100	1700	0	0	85	0.33	0	0	0	0
2	1016	yes	17---T	Fd80Pl20	15-21	18.2	2	1600	FdPl	100	1700	0	0	95	0.33	0	0	0	0
2	1017	yes	17---T	Fd80Pl20	15-21	18.2	2	1600	FdPl	100	1700	0	0	105	0.33	0	0	0	0
2	1018	yes	35	Fd80Pl20	15-21	18.2	2	1600	FdPl	1400	3000	0	0	0	0	0	0	0	0
2	1019	yes	70	Fd80Pl20	15-21	18.2	2	1600	FdPl	5400	7000	0	0	0	0	0	0	0	0
2	1020	yes	7014	Fd80Pl20	15-21	18.2	2	1600	FdPl	5400	7000	19	1400	0	0	0	0	0	0
2	1021	yes	7016	Fd80Pl20	15-21	18.2	2	1600	FdPl	5400	7000	19	1600	0	0	0	0	0	0
2	1022	yes	7016--T	Fd80Pl20	15-21	18.2	2	1600	FdPl	5400	7000	19	1600	85	0.33	0	0	0	0
2	1023	yes	7016--T	Fd80Pl20	15-21	18.2	2	1600	FdPl	5400	7000	19	1600	95	0.33	0	0	0	0
2	1024	yes	7016--T	Fd80Pl20	15-21	18.2	2	1600	FdPl	5400	7000	19	1600	105	0.33	0	0	0	0
3	1025	yes	09	Fd60Pl40	SI<15	13	2	1600	FdPl	-700	900	0	0	0	0	0	0	0	0
3	1026	yes	17	Fd60Pl40	SI<15	13	2	1600	FdPl	100	1700	0	0	0	0	0	0	0	0
3	1027	yes	35	Fd60Pl40	SI<15	13	2	1600	FdPl	1400	3000	0	0	0	0	0	0	0	0
3	1028	yes	70	Fd60Pl40	SI<15	13	2	1600	FdPl	5400	7000	0	0	0	0	0	0	0	0
3	1029	yes	7018	Fd60Pl40	SI<15	13	2	1600	FdPl	5400	7000	26	1800	0	0	0	0	0	0
4	1030	yes	09	Fd80Pl10Sw10	SI>19	21.4	2	1600	FdPlSw	-700	900	0	0	0	0	0	0	0	0
4	1031	yes	17	Fd80Pl10Sw10	SI>19	21.4	2	1600	FdPlSw	100	1700	0	0	0	0	0	0	0	0
4	1032	yes	17---T	Fd80Pl10Sw10	SI>19	21.4	2	1600	FdPlSw	100	1700	0	0	55	0.33	0	0	0	0
4	1033	yes	17---T	Fd80Pl10Sw10	SI>19	21.4	2	1600	FdPlSw	100	1700	0	0	65	0.33	0	0	0	0
4	1034	yes	17---T	Fd80Pl10Sw10	SI>19	21.4	2	1600	FdPlSw	100	1700	0	0	75	0.33	0	0	0	0
4	1035	yes	35	Fd80Pl10Sw10	SI>19	21.4	2	1600	FdPlSw	1400	3000	0	0	0	0	0	0	0	0
4	1036	yes	70	Fd80Pl10Sw10	SI>19	21.4	2	1600	FdPlSw	5400	7000	0	0	0	0	0	0	0	0
4	1037	yes	7016	Fd80Pl10Sw10	SI>19	21.4	2	1600	FdPlSw	5400	7000	17	1600	0	0	0	0	0	0
4	1038	yes	7016--T	Fd80Pl10Sw10	SI>19	21.4	2	1600	FdPlSw	5400	7000	17	1600	55	0.33	0	0	0	0
4	1039	yes	7016--T	Fd80Pl10Sw10	SI>19	21.4	2	1600	FdPlSw	5400	7000	17	1600	65	0.33	0	0	0	0
4	1040	yes	7016--T	Fd80Pl10Sw10	SI>19	21.4	2	1600	FdPlSw	5400	7000	17	1600	75	0.33	0	0	0	0
5	1041	yes	09	Fd75Sw15Pl10	16-19	17.9	2	1600	FdSwPl	-700	900	0	0	0	0	0	0	0	0
5	1042	yes	17	Fd75Sw15Pl10	16-19	17.9	2	1600	FdSwPl	100	1700	0	0	0	0	0	0	0	0
5	1043	yes	17---T	Fd75Sw15Pl10	16-19	17.9	2	1600	FdSwPl	100	1700	0	0	65	0.33	0	0	0	0
5	1044	yes	17---T	Fd75Sw15Pl10	16-19	17.9	2	1600	FdSwPl	100	1700	0	0	75	0.33	0	0	0	0
5	1045	yes	17---T	Fd75Sw15Pl10	16-19	17.9	2	1600	FdSwPl	100	1700	0	0	85	0.33	0	0	0	0
5	1046	yes	35	Fd75Sw15Pl10	16-19	17.9	2	1600	FdSwPl	1400	3000	0	0	0	0	0	0	0	0
5	1047	yes	70	Fd75Sw15Pl10	16-19	17.9	2	1600	FdSwPl	5400	7000	0	0	0	0	0	0	0	0
5	1048	yes	7016	Fd75Sw15Pl10	16-19	17.9	2	1600	FdSwPl	5400	7000	20	1600	0	0	0	0	0	0
5	1049	yes	7016--T	Fd75Sw15Pl10	16-19	17.9	2	1600	FdSwPl	5400	7000	20	1600	65	0.33	0	0	0	0
5	1050	yes	7016--T	Fd75Sw15Pl10	16-19	17.9	2	1600	FdSwPl	5400	7000	20	1600	75	0.33	0	0	0	0
5	1051	yes	7016--T	Fd75Sw15Pl10	16-19	17.9	2	1600	FdSwPl	5400	7000	20	1600	85	0.33	0	0	0	0

SAU	Managed Regime #	Height Adjustment	State Label	Plant species	site index range	Weighted average site index	Regen Lag	Plant tph	natural ingress species	natural ingress tph	Density after ingrowth	Pct Age	PCT leave tph	CT age	CT remove volume	1st Fertilization	2nd Fertilization	3rd Fertilization	4th Fertilization
6	1052	yes	09	Fd70Pl25Sw5	SI<16	14.4	2	1600	FdPlSw	-700	900	0	0	0	0	0	0	0	0
6	1053	yes	17	Fd70Pl25Sw5	SI<16	14.4	2	1600	FdPlSw	100	1700	0	0	0	0	0	0	0	0
6	1054	yes	35	Fd70Pl25Sw5	SI<16	14.4	2	1600	FdPlSw	1400	3000	0	0	0	0	0	0	0	0
6	1055	yes	70	Fd70Pl25Sw5	SI<16	14.4	2	1600	FdPlSw	5400	7000	0	0	0	0	0	0	0	0
6	1056	yes	7016	Fd70Pl25Sw5	SI<16	14.4	2	1600	FdPlSw	5400	7000	24	1600	0	0	0	0	0	0
7	1057	yes	09	Sw70Pl20Hw10	SI>20	23.3	2	1600	SwPlHw	-700	900	0	0	0	0	0	0	0	0
7	1058	yes	17	Sw70Pl20Hw10	SI>19	23.3	2	1600	SwPlHw	100	1700	0	0	0	0	0	0	0	0
7	1059	yes	17---T	Sw70Pl20Hw10	SI>19	23.3	2	1600	SwPlHw	100	1700	0	0	45	0.33	0	0	0	0
7	1060	yes	17---T	Sw70Pl20Hw10	SI>19	23.3	2	1600	SwPlHw	100	1700	0	0	55	0.33	0	0	0	0
7	1061	yes	35	Sw70Pl20Hw10	SI>19	23.3	2	1600	SwPlHw	1400	3000	0	0	0	0	0	0	0	0
7	1062	yes	70	Sw70Pl20Hw10	SI>19	23.3	2	1600	SwPlHw	5400	7000	0	0	0	0	0	0	0	0
7	1063	yes	7018	Sw70Pl20Hw10	SI>19	23.3	2	1600	SwPlHw	5400	7000	23	1800	0	0	0	0	0	0
7	1064	yes	7018--T	Sw70Pl20Hw10	SI>19	23.3	2	1600	SwPlHw	5400	7000	23	1800	45	0.33	0	0	0	0
7	1065	yes	7018--T	Sw70Pl20Hw10	SI>19	23.3	2	1600	SwPlHw	5400	7000	23	1800	55	0.33	0	0	0	0
8	1066	yes	09	Sw60Pl30Hw10	17-20	18.4	2	1600	SwPlHw	-700	900	0	0	0	0	0	0	0	0
8	1067	yes	17	Sw60Pl30Hw10	17-20	18.4	2	1600	SwPlHw	100	1700	0	0	0	0	0	0	0	0
8	1068	yes	17---T	Sw60Pl30Hw10	17-20	18.4	2	1600	SwPlHw	100	1700	0	0	65	0.33	0	0	0	0
8	1069	yes	17---T	Sw60Pl30Hw10	17-20	18.4	2	1600	SwPlHw	100	1700	0	0	75	0.33	0	0	0	0
8	1070	yes	35	Sw60Pl30Hw10	17-20	18.4	2	1600	SwPlHw	1400	3000	0	0	0	0	0	0	0	0
8	1071	yes	70	Sw60Pl30Hw10	17-20	18.4	2	1600	SwPlHw	5400	7000	0	0	0	0	0	0	0	0
8	1072	yes	7015	Sw60Pl30Hw10	17-20	18.4	2	1600	SwPlHw	5400	7000	27	1500	0	0	0	0	0	0
8	1073	yes	7018	Sw60Pl30Hw10	17-20	18.4	2	1600	SwPlHw	5400	7000	27	1800	0	0	0	0	0	0
8	1074	yes	7018--T	Sw60Pl30Hw10	17-20	18.4	2	1600	SwPlHw	5400	7000	27	1800	65	0.33	0	0	0	0
8	1075	yes	7018--T	Sw60Pl30Hw10	17-20	18.4	2	1600	SwPlHw	5400	7000	27	1800	75	0.33	0	0	0	0
9	1076	yes	09	Sw50Pl40Hw10	SI<17	12.8	2	1600	SwPlHw	-700	900	0	0	0	0	0	0	0	0
9	1077	yes	17	Sw50Pl40Hw10	SI<17	12.8	2	1600	SwPlHw	100	1700	0	0	0	0	0	0	0	0
9	1078	yes	35	Sw50Pl40Hw10	SI<17	12.8	2	1600	SwPlHw	1400	3000	0	0	0	0	0	0	0	0
9	1079	yes	70	Sw50Pl40Hw10	SI<17	12.8	2	1600	SwPlHw	5400	7000	0	0	0	0	0	0	0	0
9	1080	yes	7018	Sw50Pl40Hw10	SI<17	12.8	2	1600	SwPlHw	5400	7000	36	1800	0	0	0	0	0	0
10	1081	yes	09	Fd50Pl50	SI>20	22.7	2	1600	FdPl	-700	900	0	0	0	0	0	0	0	0
10	1082	yes	17	Fd50Pl50	SI>20	22.7	2	1600	FdPl	100	1700	0	0	0	0	0	0	0	0
10	1083	yes	17---T	Fd50Pl50	SI>20	22.7	2	1600	FdPl	100	1700	0	0	45	0.33	0	0	0	0
10	1084	yes	17---T	Fd50Pl50	SI>20	22.7	2	1600	FdPl	100	1700	0	0	55	0.33	0	0	0	0
10	1085	yes	35	Fd50Pl50	SI>20	22.7	2	1600	FdPl	1400	3000	0	0	0	0	0	0	0	0
10	1086	yes	70	Fd50Pl50	SI>20	22.7	2	1600	FdPl	5400	7000	0	0	0	0	0	0	0	0
10	1087	yes	7018	Fd50Pl50	SI>20	22.7	2	1600	FdPl	5400	7000	16	1800	0	0	0	0	0	0
10	1088	yes	7018--T	Fd50Pl50	SI>20	22.7	2	1600	FdPl	5400	7000	16	1800	45	0.33	0	0	0	0
10	1089	yes	7018--T	Fd50Pl50	SI>20	22.7	2	1600	FdPl	5400	7000	16	1800	55	0.33	0	0	0	0
11	1090	yes	09	Fd50Pl50	17-20	18.5	2	1600	FdPl	-700	900	0	0	0	0	0	0	0	0
11	1091	yes	17	Fd50Pl50	17-20	18.5	2	1600	FdPl	100	1700	0	0	0	0	0	0	0	0
11	1092	yes	17---T	Fd50Pl50	17-20	18.5	2	1600	FdPl	100	1700	0	0	65	0.33	0	0	0	0
11	1093	yes	35	Fd50Pl50	17-20	18.5	2	1600	FdPl	1400	3000	0	0	0	0	0	0	0	0
11	1094	yes	70	Fd50Pl50	17-20	18.5	2	1600	FdPl	5400	7000	0	0	0	0	0	0	0	0
11	1095	yes	7015	Fd50Pl50	17-20	18.5	2	1600	FdPl	5400	7000	19	1500	0	0	0	0	0	0
11	1096	yes	7018	Fd50Pl50	17-20	18.5	2	1600	FdPl	5400	7000	19	1800	0	0	0	0	0	0
11	1097	yes	7018--T	Fd50Pl50	17-20	18.5	2	1600	FdPl	5400	7000	19	1800	65	0.33	0	0	0	0
12	1098	yes	09	Pl60Fd40	SI<17	14.9	2	1600	PlFd	-700	900	0	0	0	0	0	0	0	0
12	1099	yes	17	Pl60Fd40	SI<17	14.9	2	1600	PlFd	100	1700	0	0	0	0	0	0	0	0
12	1100	yes	35	Pl60Fd40	SI<17	14.9	2	1600	PlFd	1400	3000	0	0	0	0	0	0	0	0
12	1101	yes	70	Pl60Fd40	SI<17	14.9	2	1600	PlFd	5400	7000	0	0	0	0	0	0	0	0
12	1102	yes	7018	Pl60Fd40	SI<17	14.9	2	1600	PlFd	5400	7000	20	1800	0	0	0	0	0	0

SAU	Managed Regime #	Height Adjustment	State Label	Plant species	site index range	Weighted average site index	Regen Lag	Plant tph	natural ingress species	natural ingress tph	Density after ingrowth	Pct Age	PCT leave tph	CT age	CT remove volume	1st Fertilization	2nd Fertilization	3rd Fertilization	4th Fertilization
No height adjustment, not fertilized																			
2	2013	no	09	Fd80Pl20	SI>21	18.2	2	1600	FdPl	-700	900	0	0	0	0	0	0	0	0
2	2014	no	17	Fd80Pl20	SI>21	18.2	2	1600	FdPl	100	1700	0	0	0	0	0	0	0	0
2	2015	no	17---T	Fd80Pl20	SI>21	18.2	2	1600	FdPl	100	1700	0	0	85	0.33	0	0	0	0
2	2016	no	17---T	Fd80Pl20	SI>21	18.2	2	1600	FdPl	100	1700	0	0	95	0.33	0	0	0	0
2	2017	no	17---T	Fd80Pl20	SI>21	18.2	2	1600	FdPl	100	1700	0	0	105	0.33	0	0	0	0
2	2020	no	7014	Fd80Pl20	SI>21	18.2	2	1600	FdPl	5400	7000	19	1400	0	0	0	0	0	0
2	2021	no	7016	Fd80Pl20	SI>21	18.2	2	1600	FdPl	5400	7000	19	1600	0	0	0	0	0	0
2	2022	no	7016--T	Fd80Pl20	SI>21	18.2	2	1600	FdPl	5400	7000	19	1600	85	0.33	0	0	0	0
2	2023	no	7016--T	Fd80Pl20	SI>21	18.2	2	1600	FdPl	5400	7000	19	1600	95	0.33	0	0	0	0
2	2024	no	7016--T	Fd80Pl20	SI>21	18.2	2	1600	FdPl	5400	7000	19	1600	105	0.33	0	0	0	0
8	2066	no	09	Sw60Pl30Hw10	17-20	18.4	2	1600	SwPlHw	-700	900	0	0	0	0	0	0	0	0
8	2067	no	17	Sw60Pl30Hw10	17-20	18.4	2	1600	SwPlHw	100	1700	0	0	0	0	0	0	0	0
8	2068	no	17---T	Sw60Pl30Hw10	17-20	18.4	2	1600	SwPlHw	100	1700	0	0	65	0.33	0	0	0	0
8	2069	no	17---T	Sw60Pl30Hw10	17-20	18.4	2	1600	SwPlHw	100	1700	0	0	75	0.33	0	0	0	0
8	2072	no	7015	Sw60Pl30Hw10	17-20	18.4	2	1600	SwPlHw	5400	7000	27	1500	0	0	0	0	0	0
8	2073	no	7018	Sw60Pl30Hw10	17-20	18.4	2	1600	SwPlHw	5400	7000	27	1800	0	0	0	0	0	0
8	2074	no	7018--T	Sw60Pl30Hw10	17-20	18.4	2	1600	SwPlHw	5400	7000	27	1800	65	0.33	0	0	0	0
8	2075	no	7018--T	Sw60Pl30Hw10	17-20	18.4	2	1600	SwPlHw	5400	7000	27	1800	75	0.33	0	0	0	0
11	2090	no	09	Fd50Pl50	17-20	18.5	2	1600	FdPl	-700	900	0	0	0	0	0	0	0	0
11	2091	no	17	Fd50Pl50	17-20	18.5	2	1600	FdPl	100	1700	0	0	0	0	0	0	0	0
11	2092	no	17---T	Fd50Pl50	17-20	18.5	2	1600	FdPl	100	1700	0	0	65	0.33	0	0	0	0
11	2095	no	7015	Fd50Pl50	17-20	18.5	2	1600	FdPl	5400	7000	19	1500	0	0	0	0	0	0
11	2096	no	7018	Fd50Pl50	17-20	18.5	2	1600	FdPl	5400	7000	19	1800	0	0	0	0	0	0
11	2097	no	7018--T	Fd50Pl50	17-20	18.5	2	1600	FdPl	5400	7000	19	1800	65	0.33	0	0	0	0
No height adjustment, fertilized																			
2	3013	no	09--F2	Fd80Pl20	SI>21	18.2	2	1600	FdPl	-700	900	0	0	0	0	20	40	0	0
2	30141	no	17--F2	Fd80Pl20	SI>21	18.2	2	1600	FdPl	100	1700	0	0	0	0	20	35	0	0
2	30142	no	17--F3	Fd80Pl20	SI>21	18.2	2	1600	FdPl	100	1700	0	0	0	0	20	35	50	0
2	3015	no	17--F3TF	Fd80Pl20	SI>21	18.2	2	1600	FdPl	100	1700	0	0	85	0.33	20	35	50	85
2	3016	no	17--F3TF	Fd80Pl20	SI>21	18.2	2	1600	FdPl	100	1700	0	0	95	0.33	20	35	50	95
2	3017	no	17--F3TF	Fd80Pl20	SI>21	18.2	2	1600	FdPl	100	1700	0	0	105	0.33	20	35	50	105
2	3020	no	7014-F3	Fd80Pl20	SI>21	18.2	2	1600	FdPl	5400	7000	19	1400	0	0	19	34	49	0
2	3021	no	7016-F2	Fd80Pl20	SI>21	18.2	2	1600	FdPl	5400	7000	19	1600	0	0	19	34	0	0
2	3022	no	7016-F2TF	Fd80Pl20	SI>21	18.2	2	1600	FdPl	5400	7000	19	1600	85	0.33	19	34	85	0
2	3023	no	7016-F2TF	Fd80Pl20	SI>21	18.2	2	1600	FdPl	5400	7000	19	1600	95	0.33	19	34	95	0
2	3024	no	7016-F2TF	Fd80Pl20	SI>21	18.2	2	1600	FdPl	5400	7000	19	1600	105	0.33	19	34	105	0
8	3066	no	09--F2	Sw60Pl30Hw10	17-20	18.4	2	1600	SwPlHw	-700	900	0	0	0	0	20	40	0	0
8	30671	no	17--F3	Sw60Pl30Hw10	17-20	18.4	2	1600	SwPlHw	100	1700	0	0	0	0	20	35	50	0
8	30672	no	17--F2	Sw60Pl30Hw10	17-20	18.4	2	1600	SwPlHw	100	1700	0	0	0	0	20	35	0	0
8	3068	no	17--F2TF	Sw60Pl30Hw10	17-20	18.4	2	1600	SwPlHw	100	1700	0	0	65	0.33	20	35	65	0
8	3069	no	17--F2TF	Sw60Pl30Hw10	17-20	18.4	2	1600	SwPlHw	100	1700	0	0	75	0.33	20	35	75	0
8	3072	no	7015-F3	Sw60Pl30Hw10	17-20	18.4	2	1600	SwPlHw	5400	7000	27	1500	0	0	27	42	57	0
8	3073	no	7018-F2	Sw60Pl30Hw10	17-20	18.4	2	1600	SwPlHw	5400	7000	27	1800	0	0	27	42	0	0
8	3074	no	7018-F2TF	Sw60Pl30Hw10	17-20	18.4	2	1600	SwPlHw	5400	7000	27	1800	65	0.33	27	42	65	0
8	3075	no	7018-F2TF	Sw60Pl30Hw10	17-20	18.4	2	1600	SwPlHw	5400	7000	27	1800	75	0.33	27	42	75	0
11	3090	no	09--F2	Fd50Pl50	17-20	18.5	2	1600	FdPl	-700	900	0	0	0	0	20	40	0	0
11	30911	no	17--F3	Fd50Pl50	17-20	18.5	2	1600	FdPl	100	1700	0	0	0	0	20	35	50	0
11	30912	no	17--F2	Fd50Pl50	17-20	18.5	2	1600	FdPl	100	1700	0	0	0	0	20	35	0	0
11	3092	no	17--F2TF	Fd50Pl50	17-20	18.5	2	1600	FdPl	100	1700	0	0	65	0.33	20	35	65	0
11	3095	no	7015-F3	Fd50Pl50	17-20	18.5	2	1600	FdPl	5400	7000	19	1500	0	0	19	34	49	0
11	3096	no	7018-F2	Fd50Pl50	17-20	18.5	2	1600	FdPl	5400	7000	19	1800	0	0	19	34	0	0
11	3097	no	7018-F2TF	Fd50Pl50	17-20	18.5	2	1600	FdPl	5400	7000	19	1800	65	0.33	19	35	65	0

Table B-4. Management assumptions for generation of TASS yield curves - TFL 23

1 Utilization levels

	min dbh	max stump	min top dib
all types	12.5	30	10

Note: all figures in centimetres.

2 Operational adjustment factors

OAF 1	15
OAF 2	5

3 Juvenile spacing

- leave well-spaced trees, favouring tallest

4 Commercial thinning

- thin from below: removing shortest, and leaving well-spaced trees, favouring fattest
- pre-commercial thinning stand volume must be > 240 m3 in order to be elligible for commercial thinning

Table B-5. Fertilization schedule- TFL 23

Managed Regime #	State Label	SAU	Sp	SI	Fertilize at age:
3013	09--F2	2	FdPl	18.2	20,40
30141	17--F2	2	FdPl	18.2	20,35
30142	17--F3	2	FdPl	18.2	20,35,50
3015	17--F3TF	2	FdPl	18.2	20,35,50,85
3016	17--F3TF	2	FdPl	18.2	20,35,50,95
3017	17--F3TF	2	FdPl	18.2	20,35,50,105
3020	7014-F3	2	FdPl	18.2	19,34,49
3021	7016-F2	2	FdPl	18.2	19,34
3022	7016-F2TF	2	FdPl	18.2	19,34,85
3023	7016-F2TF	2	FdPl	18.2	19,34,95
3024	7016-F2TF	2	FdPl	18.2	19,34,105
3066	09--F2	8	SwPlHw	18.4	20,40
30671	17--F3	8	SwPlHw	18.4	20,35,50
30672	17--F2	8	SwPlHw	18.4	20,35
3068	17--F2TF	8	SwPlHw	18.4	20,35,65
3069	17--F2TF	8	SwPlHw	18.4	20,35,75
3072	7015-F3	8	SwPlHw	18.4	27,42,57
3073	7018-F2	8	SwPlHw	18.4	27,42
2074	7018-F2TF	8	SwPlHw	18.4	27,42,65
3075	7018-F2TF	8	SwPlHw	18.4	27,42,75
3090	09--F2	11	FdPl	18.5	20,40
30911	17--F3	11	FdPl	18.5	20,35,50
30912	17--F2	11	FdPl	18.5	20,35
3092	17--F2TF	11	FdPl	18.5	20,35,65
3095	7015-F3	11	FdPl	18.5	19,34,50
3096	7018-F2	11	FdPl	18.5	19,34
3097	7018-F2TF	11	FdPl	18.5	19,34,65

Appendix C — Genetic Gain

The seed zones and elevation breaks (Table C-1) and the forecast gain in volume from improved seed (Table C-2) for TFL 23 were obtained from the Forest Genetics Council. The gain forecast for 2007–2008 was assumed to be applicable out to the planning horizon of this study (25 decades) and was prorated over the planting mixes identified by the TFL staff and the proportion of the TSA in each elevation Table C-3.

Table C-1. Elevation breaks for the TFL 23 THLB

Elevation	Area	Area weighted percent
0 - 599 m	14,442.0	5%
600 - 999	88,849.4	31%
1000 - 1299	64,465.8	23%
1300 - 1399	21,924.1	8%
>= 1400	93,042.7	33%
	282,724.0	**100%**

Table C-2. Species genetic gain for TFL 23

Species	Species SPU elevation breaks	Area	Area weighted percent	Seed Zone	Genetic Gain	Area weighted genetic gain for species
Fdi	< 1000m	103,291.4	37%	NE	25%	9%
	>1000m	179,432.6	63%	NE	22%	14%
						23%
Pli	< 1400m	189,681.3	67%	NE	14%	9%
	> 1400m	93,042.7	33%	NE	9%	3%
						12%
Sx	< 1000m	103,291.4	37%	NE	0%	0%
	< 1400m	86,389.9	31%	NE	8%	2%
	>= 1400m	93,042.7	33%	NE	7%	2%
						5%
Hw			NO DATA			**0%**

Note: Genetic gain data is from FGC Business Plan 2002/2003

Table C-1. Adjusted SAU genetic gain

SAU	State	Planted	Ingress	Total stems/ha	Ingress adjustment (percent planted)	Species 1	Species 1 PCT	Species 2	Species 2 PCT	Species 3	Species 3 PCT	Species 1 genetic gain	Species 2 genetic gain	Species 3 genetic gain	Adjusted state genetic gain	Percent state planted	Adjusted percent state planted	Adjusted SAU genetic gain
1	09	900	0	900	100	Fdi	80	Pli	20			23	12		20.8	10	10	2.1
1	17	1600	100	1700	94	Fdi	80	Pli	20			23	12		20.8	20	19	3.9
1	35	1600	1900	3500	46	Fdi	80	Pli	20			23	12		20.8	35	16	3.3
1	70	1600	5400	7000	23	Fdi	80	Pli	20			23	12		20.8	35	8	1.7
																		11.0
2	09	900	0	900	100	Fdi	80	Pli	20			23	12		20.8	10	10	2.1
2	17	1600	100	1700	94	Fdi	80	Pli	20			23	12		20.8	20	19	3.9
2	35	1600	1900	3500	46	Fdi	80	Pli	20			23	12		20.8	35	16	3.3
2	70	1600	5400	7000	23	Fdi	80	Pli	20			23	12		20.8	35	8	1.7
																		11.0
3	09	900	0	900	100	Fdi	60	Pli	40			23	12		18.6	10	10	1.9
3	17	1600	100	1700	94	Fdi	60	Pli	40			23	12		18.6	20	19	3.5
3	35	1600	1900	3500	46	Fdi	60	Pli	40			23	12		18.6	35	16	3.0
3	70	1600	5400	7000	23	Fdi	60	Pli	40			23	12		18.6	35	8	1.5
																		9.8
4	09	900	0	900	100	Fdi	80	Pli	10	Sw	10	23	12	5	20.1	10	10	2.0
4	17	1600	100	1700	94	Fdi	80	Pli	10	Sw	10	23	12	5	20.1	25	24	4.7
4	35	1600	1900	3500	46	Fdi	80	Pli	10	Sw	10	23	12	5	20.1	35	16	3.2
4	70	1600	5400	7000	23	Fdi	80	Pli	10	Sw	10	23	12	5	20.1	30	7	1.4
																		11.3
5	09	900	0	900	100	Fdi	75	Sw	15	Pli	10	23	5	12	19.2	10	10	1.9
5	17	1600	100	1700	94	Fdi	75	Sw	15	Pli	10	23	5	12	19.2	25	24	4.5
5	35	1600	1900	3500	46	Fdi	75	Sw	15	Pli	10	23	5	12	19.2	35	16	3.1
5	70	1600	5400	7000	23	Fdi	75	Sw	15	Pli	10	23	5	12	19.2	30	7	1.3
																		10.8
6	09	900	0	900	100	Fdi	70	Pli	25	Sw	5	23	12	5	19.4	10	10	1.9
6	17	1600	100	1700	94	Fdi	70	Pli	25	Sw	5	23	12	5	19.4	25	24	4.6
6	35	1600	1900	3500	46	Fdi	70	Pli	25	Sw	5	23	12	5	19.4	35	16	3.1
6	70	1600	5400	7000	23	Fdi	70	Pli	25	Sw	5	23	12	5	19.4	30	7	1.3
																		10.9
7	09	900	0	900	100	Sw	70	Pli	20	Hw	10	5	12	0	5.9	10	10	0.6
7	17	1600	100	1700	94	Sw	70	Pli	20	Hw	10	5	12	0	5.9	25	24	1.4
7	35	1600	1900	3500	46	Sw	70	Pli	20	Hw	10	5	12	0	5.9	45	21	1.2
7	70	1600	5400	7000	23	Sw	70	Pli	20	Hw	10	5	12	0	5.9	20	5	0.3
																		3.5
8	09	900	0	900	100	Sw	60	Pli	30	Hw	10	5	12	0	6.6	10	10	0.7
8	17	1600	100	1700	94	Sw	60	Pli	30	Hw	10	5	12	0	6.6	25	24	1.6
8	35	1600	1900	3500	46	Sw	60	Pli	30	Hw	10	5	12	0	6.6	45	21	1.4
8	70	1600	5400	7000	23	Sw	60	Pli	30	Hw	10	5	12	0	6.6	20	5	0.3
																		3.9
9	09	900	0	900	100	Sw	50	Pli	40	Hw	10	5	12	0	7.3	20	20	1.5
9	17	1600	100	1700	94	Sw	50	Pli	40	Hw	10	5	12	0	7.3	50	47	3.4
9	35	1600	1900	3500	46	Sw	50	Pli	40	Hw	10	5	12	0	7.3	20	9	0.7
9	70	1600	5400	7000	23	Sw	50	Pli	40	Hw	10	5	12	0	7.3	10	2	0.2
																		5.7
10	09	900	0	900	100	Fdi	50	Pli	50			23	12		17.5	10	10	1.8
10	17	1600	100	1700	94	Fdi	50	Pli	50			23	12		17.5	20	19	3.3
10	35	1600	1900	3500	46	Fdi	50	Pli	50			23	12		17.5	45	21	3.6
10	70	1600	5400	7000	23	Fdi	50	Pli	50			23	12		17.5	25	6	1.0
																		9.6
11	09	900	0	900	100	Fdi	50	Pli	50			23	12		17.5	10	10	1.8
11	17	1600	100	1700	94	Fdi	50	Pli	50			23	12		17.5	20	19	3.3
11	35	1600	1900	3500	46	Fdi	50	Pli	50			23	12		17.5	45	21	3.6
11	70	1600	5400	7000	23	Fdi	50	Pli	50			23	12		17.5	25	6	1.0
																		9.6
12	09	900	0	900	100	Pli	60	Fdi	40			23	12		18.6	5	5	0.9
12	17	1600	100	1700	94	Pli	60	Fdi	40			23	12		18.6	50	47	8.8
12	35	1600	1900	3500	46	Pli	60	Fdi	40			23	12		18.6	25	11	2.1
12	70	1600	5400	7000	23	Pli	60	Fdi	40			23	12		18.6	20	5	0.9
																		12.7

Notes: Adjusted state genetic gain = species 1 PCT*(species 1 genetic gain/100)
+species 2 PCT*(species 2 genetic gain/100)
+species 3 PCT*(species 3 genetic gain/100)

Adjusted percent state planted = ingress adjustment (percent planted) * percent state plantec

Adjusted SAU genetic gain = SUM(adjusted state genetic gain * adjusted percent state planted)