Development of a Perth and Peel Urban Forest Spatial Mapping Layer

Version: 18/06/2026

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1. Executive Summary

1.1 Background

Local governments across Western Australia are responsible for, and over recent decades have increasingly undertaken, the direct management of most trees within their boundaries. As urban areas experience population growth and building infill, maintaining green streetscapes has become a critical priority for local communities.

A typical local government now maintains registers of between 10,000 to 100,000+ tree records, along with associated monitoring, watering programs, and pruning schedules. Local governments also plant between approximately 100 and 10,000 new trees every year, both to replace damaged or unsafe trees and to expand urban canopy coverage.

"WALGA is working with the Local Government sector to develop a tree asset spatial mapping layer for the Perth and Peel Regions. The mapping layer will collate individual Local Government tree inventory data into a single dataset. Benefits include baseline information on the number and distribution of tree assets managed by the sector, evaluation of the outcomes of grant funded planting programs, ability to support an efficient response to biosecurity incursions, and analyses of urban forest composition (diversity, age, and health) to inform management needs and investment priorities."

A pilot was commenced in 2024 to combine tree inventories provided by the Cites of Melville, Perth, and Vincent.

1.2 Current Objectives

The current project expands on the 2024 pilot from three local governments to a target of 16 local governments.

The core objective is to demonstrate the viability of a single tree database covering all metropolitan Local Governments, while also providing a template that could adopted more broadly across Western Australia.

Additional objectives include:

- Standardisation of attribute data
- Analysis of trends
- Evaluation of the effectiveness of grant funding
- Provision of feedback to local governments.

Definet also proposed an additional objective, demonstrating automated extraction of date from Local Government Enterprise GIS. We believe this is critical for long term viability of any centralised database.

1.3 Methodology

WALGA contacted 33 Local Governments requesting permission to access the following tree register information:

- Data coordinates from GDA2020 in WGS84 Lat/Long
- Botanical genus and species
- Commercial cultivar name (e.g. Agonis flexuosa 'Burgundy')
- Maturity
- Tree height (m)
- Canopy width (m)
- Trunk diameter (cm)
- Health
- Data currency (date of data collection)

Local Governments that agreed to the license terms, were then referred to Definet, who worked individually with each organisation to extract the required data from their GIS systems.

Definet used FME (Feature Manipulation Engine) software to automate data extraction via web services where possible. Where automation was not available, manual extracts supplied by each organisation were processed, including CSV, Excel, Shapefile, and Geopackage formats.

Definet then analysed the data to produce standardised attributes listing before transforming all input dataset into a single unified output. This process was designed to be easily repeatable and scalable as additional local governments joined the program.

1.4 Outcomes

Between WALGA and Definet's efforts, approval and data were successfully secured from 16 local governments across the Perth and Peel regions. Unfortunately, one local government was unable to supply data due to IT limitations, resulting in a final total of 15 datasets.

Definet successfully demonstrate automated data extraction across nine unique GIS software platforms, and data formats.

A merged dataset was subsequently produced containing a total of 470,086 tree records.

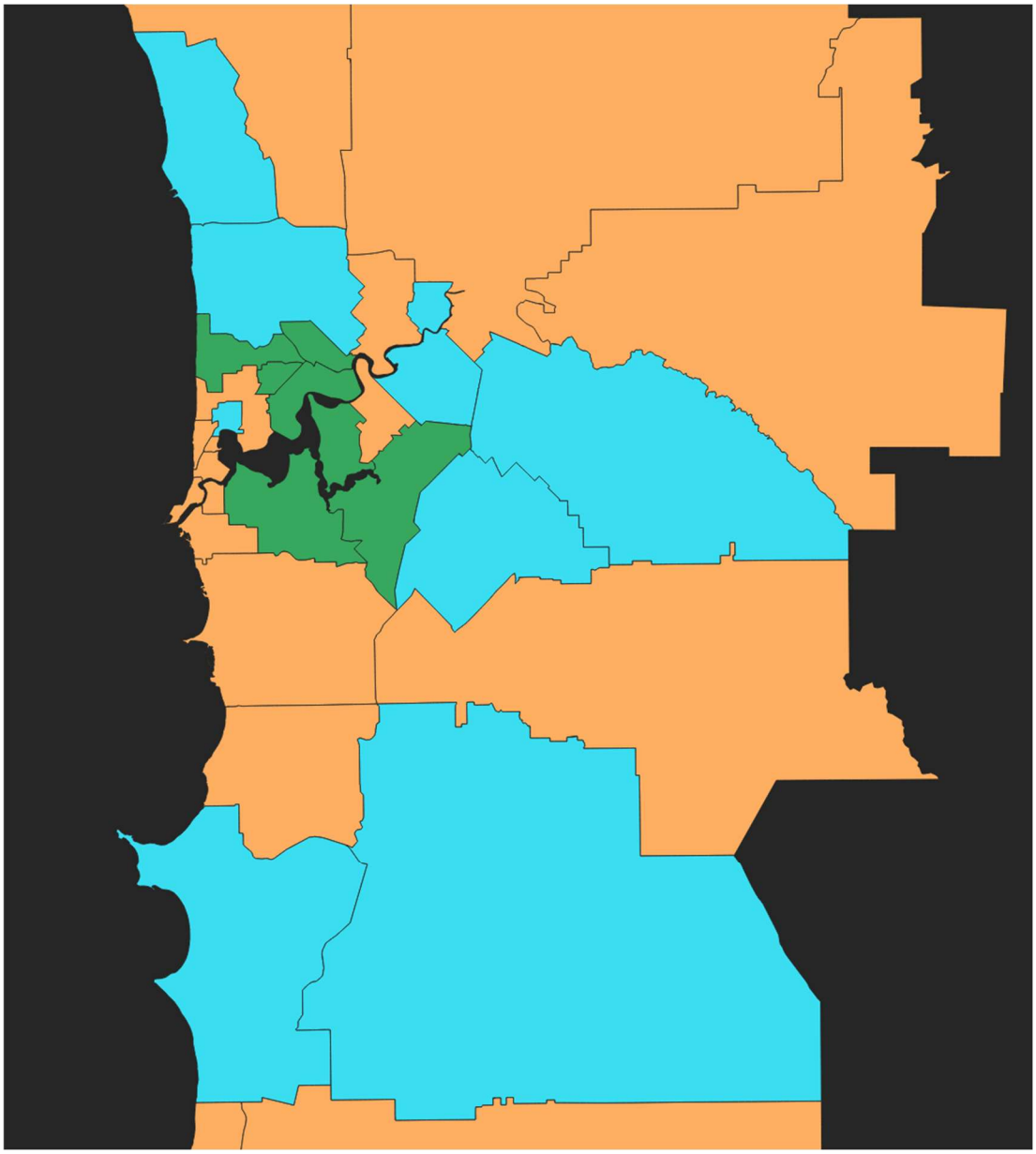
Finally, Definet undertook preliminary analysis and presented the results to working groups on three occasions, providing feedback to approximately 50 stakeholder organisations across Western Australia, including local governments, State Government departments, working groups and committees.

2. Local Government Participation

2.1 Summary of data collection

A total of 16 local governments agreed to participate in the study. The map below highlights in green those local governments who participated and had complete datasets covering their entire local government area, while local governments shown in light blue provided partial datasets, typically focused on street trees and excluding reserve trees.

- Total area of Perth and Peel: 8818km²
- Estimated area excluding rural/forested land not managed by local governments: 3290km²
- Toal area covered by collected datasets: 2051km² (23%)
- Estimated data collection area excluding rural and forest land inside local government boundaries: 1044km² (32%).



The table below highlights participating local governments and the status of their datasets as of early 2026:

- **Complete** data coverage indicates that the local governments has captured its entire area in detail, including both street and reserve trees.
- **Street** coverage indicates that a significant portion of the local government area has been captured, primarily street trees, with little to no reserve tree data included.
- **Partial** coverage indicates that the local government is still in the process of capturing its tree datasets, with only a minority portion of the area currently recorded.

Perth and Peel LGA	Data Coverage	Extraction Method
Bassendean	Street	Automated
Belmont	Street	Manual
Cambridge	Complete	Manual
Canning	Complete	Automated
Claremont	Street	Manual
Gosnells	Partial	Manual
Joondalup	Partial	Manual
Kalamunda	Street	Automated
Melville	Complete	Manual
Perth	Complete	Automated
Serpentine Jarrahdale	Partial	Manual
Rockingham	Could not provide data	Manual
South Perth	Complete	Automated
Stirling	Street	Manual
Subiaco	Complete	Automated
Vincent	Complete	Automated

2.2 Software used by participating LGAs

A challenge for the project was the diverse range of software used by responding local governments.
The table below provides a summary of the software identified in responses.

Enterprise GIS	Field Mapping	Asset Management
12x IntraMaps	4x Forestree	4x Forestree
2x ESRI	2x ESRI	3x TechOne EAM
1x Pozi	2x IntraMaps Roam	1x ESRI
	1x Tree Plotter	1x IntraMaps
	1x Field Maps	

Note: not all participating local governments specified the software used internally, therefore this should not be considered a definitive list. Many local governments also outsource their field mapping and tree inspections to external contractors.

2.3 Data formats supplied by participating LGAs

Definet selected FME for use in this project as it provides streamlined methods of integrating data from the diverse range of software outlined in Section 2.2.

Where possible, FME was used to download, process, combined, and analyse data in a single workbench environment, including the formats listed in the following table:

Live data sources (webservices)	Manual data sources
ESRI (Portal)	CSV
Forestree (REST API)	Excel
IntraMaps (WFS)	Geopackage
TechOne EAM (REST API)	Shapefile
Pozi (WFS)	

3. Output Dataset Analysis

A total of 470,086 trees were successfully extracted and combined into a single dataset. The table below provides a summary of requested data, along with commentary on quality of information returned by local governments (LGAs).

Attribute Requested	Definet Comment
Data coordinates in GDA2020 WGS84 Lat/Long	While most LGAs supplied GIS coordinates, there were a mix of datasets in WGS84 Lat/Long, GDA2020 MGA Zone 50, and GDA94 MGA Zone 50. All datasets were transformed into EPSG 7850; GDA2020 MGA Zone 50 for supply back to WALGA.
Botanical genus and species	This was the most complete attribute set supplied, with all participating LGAs returning data
Commercial cultivar name (common name)	This was well populated, with all but one participating LGA supplying common names.
Maturity	Decently populated, with 10 of the 16 LGAs supplying data; however, the scales and attributes definitions varied significantly. Definet needed to develop a standardised lookup table to merge this data (see associated document 'Perth and Peel LGs Tree Mapping.xlsx' Maturity worksheet)
Tree height (m)	Well populated with approximately 70% of supplied records contained tree height data. However, the accuracy of this data is uncertain, as most trees have not been recently inspected, and many heights estimates are visually assessed rather than measured using laser rangefinders. This data should therefore be treated as a general guide only.
Canopy width (m)	Most LGAs were not able to supply this data, and those that did had only limited records. We suggest that aerial and satellite imagery would provide a far more accurate and useful representations of canopy coverage.
Trunk Diameter (cm)	Few LGAs were able to supply this data; it was therefore excluded from the merged dataset as no meaningful analysis could be undertaken. It may still be present in some of the raw datasets provided alongside this report.
Health	Decently populated, with 11 of the 16 LGAs returning this data; however, the scales and attribute definitions varied significantly. Definet developed a single standardised lookup table to merge this data (see associated document 'Perth and Peel LGs Tree Mapping.xlsx' Health worksheet)
Data Currency	Many LGAs returned either 'date planted' or 'inspection date' field; however, these were sparsely populated. During data collection, this field was discussed with several local government officers, who advised that it was largely unreliable, as systemic tracking of this information had only recently commenced. As a result, this field was excluded from the merged dataset. Some records may still be present in the input data folder; however, it is recommended that these not be used for analysis.

3.1 Shot-Hole Borer Risk Index

Polyphagous Shot-Hole Borer (PSHB) has been identified as the most significant risk to urban forests across Perth and Peel, as such it was included as a key analysis component of this project.

The Department of Primary Industries and Regional Development has published detailed host lists and susceptibility ratings. The latest version is available at:

https://www.dpird.wa.gov.au/siteassets/documents/biosecurity/incidents/pshb/pshb-wa-host-list.pdf

A copy of this PDF has been retained for project records as 'pshb-wa-host-list.pdf'.

The list provided in the report matches botanical names to risk ratings on a scale from 'Extreme' to 'Negligible'. To map and analyse this data, a numerical scoring system was developed to weight risk levels for spatial visualisation and comparison

Numerical scores were assigned to each classification as outlined in the related worksheet 'Perth and Peel LGs Tree Mapping.xlsx'. The table below provides an example of how this can be used to assess local governments risk exposure. A heatmap derived from this data is also supplied.

Local Government	Total Records	Susceptibility Index	Percent Match	Percent of Total Medium+	Percent of Matched Trees Medium+
Shire of Serpentine-Jarrahdale	6558	12.44	65	51	78
City of Canning	76091	7.22	48	30	63
City of Perth	16920	5.97	42	25	59
City of Gosnells	15079	5.91	39	26	67
City of South Perth	36870	5.07	49	20	40
Town of Bassendean	10638	5.07	39	22	56
City of Joondalup	9956	4.77	54	17	32
City of Kalamunda	13578	4.53	30	18	61
City of Subiaco	18257	4.31	41	18	44
City of Melville	63126	4.24	45	18	39
City of Stirling	114495	3.97	42	16	39
City of Belmont	22230	3.95	41	17	41
City of Vincent	23054	3.33	41	14	33
City of Claremont	6568	2.89	39	13	33
Town of Cambridge	36666	2.77	43	12	28

Column descriptions for the table in section 3.1

Total Records – Count of trees captured in a councils register. See table in section 2.1 for 'Coverage', roughly half are complete datasets with the other half being only partial.

Susceptibility Index – Average score of trees as defined in the excel sheet 'Perth and Peel LGs Tree Mapping.xlsx''

Individual trees were allocated as such:
Extreme (50)
Very High (30)
High (25)
Medium (20)
Low (1)
Negligible (0)

All trees which matched a record on this list had their index score summed, which was divided by the total record count.

Percent Match - How many trees in the councils register matched the spreadsheet provided by DPIRD (pshb-wa-host-list.pdf)

Percent of Total Medium+ - Percentage of the total councils register which were rated as medium risk or higher.

Percent of Matched Trees Medium+ - Percentage of trees which matched a record on the DPIRD list and were rated as medium risk or higher.

For a worked example, if a council had 100 trees, 70 of which were found on the DPIRD register, and 55 were rated medium risk or higher:

Percent of Total Medium+ would be 55%.
Percent of Matched Trees Medium+ would be 78.6%.

3.2 Shot-Hole Borer Water Sources

It was noted when we generated heatmaps for the PSHB index in Section 3.1 that results appeared to cluster around rivers and waterbodies. It was therefore suggested that analysis be re-run to specifically assess this phenomenon.

The table below demonstrates how the calculated susceptibility index changes when filtering trees to those within 100m or 200m of a water source.

The results indicate a positive correlation between proximity to water and increased susceptibility.

It should be noted that this demonstrates only a correlation and certainly not causation, since we are not assessing the infected trees but rather than botanical species of trees at risk.

Note that this analysis accounts for all trees near water, not just those matched with the 'at risk' register. A higher index score suggests that there are more trees **at risk** as a indexed percentage of the trees near waterbodies.

Local Government	Total Trees	Trees Within 200m Major Water source	Trees Within 100m Major Water source	Susceptibility Index	Susceptibility 200m Major Water source	Susceptibility 100m Major Water source
Shire of Serpentine-Jarrahdale	6558	688	291	12.44	14.57	18.24
City of Canning	76091	21135	12785	7.22	9.88	11.81
City of Perth	16920	8680	6186	5.97	7.67	8.4
City of Gosnells	15079	2374	1069	5.91	6.18	5.09
Town of Bassendean	10638	1246	366	5.07	7.93	10.77
City of South Perth	36870	10854	5765	5.07	10.93	13.06
City of Joondalup	9956	322	117	4.77	2.21	4.7
City of Kalamunda	13578	2013	930	4.53	4.21	4.43
City of Subiaco	18257	2724	1268	4.31	4.57	5.51
City of Melville	63126	8869	3791	4.24	5.36	6.17
City of Stirling	114495	12153	4319	3.97	5.46	6.06
City of Belmont	22230	4377	1820	3.95	4.6	5.67
City of Vincent	23054	3313	1576	3.33	6.21	9.81
City of Claremont	6568	734	111	2.89	2.38	1.75
Town of Cambridge	36666	6188	3173	2.77	5.43	6.18

3.3 Species Diversity

Supplied local government data contained 1779 unique botanical names in the final merged dates.

We noted that a significant number of these are duplicates or typographical errors; however, resolving these inconsistencies would a substantial data-cleaning exercise.

Filtering to only trees with more than 100 record of the same botanically name, produced 341 unique botanical names.

The table below highlights the most common records across 15 local governments that returned data:

Botanical Name	Count	Percent of total dataset
Agonis flexuosa	37474	7.97%
Jacaranda mimosifolia	32451	6.90%
Lophostemon confertus	30896	6.57%
Callistemon viminalis	14752	3.14%
Corymbia calophylla	11723	2.49%
Melaleuca quinquenervia	11562	2.46%
Corymbia maculata	9906	2.11%
Eucalyptus rudis	9873	2.10%
Eucalyptus gomphocephala	9213	1.96%
Corymbia ficifolia	8722	1.86%

3.4 Health Index

Most local governments returned reasonably populated attributes relating to tree health, either within a general condition rating field or through dedicated health assessment fields.

Some local government included multiple attributes capturing specific components of tree health, such as structural risks, stress indicators, and environmental constraints. However, most provided only a single summary field limiting the ability to undertake any meaningful comparative analysis.

Of the 11 local governments returning data, 10 unique scales were identified in the table below.

Local Government	Average Health	Scale
City of Claremont	1.5	Excellent - Good - Acceptable - Fair - Poor - Dead
City of Stirling	1.58	1 to 4
Shire of SJ	2.03	Very Good Condition - Minor Defects Only - Maintenance Required - Requires Renewal
City of Melville	2.11	Excellent - Good - Fair - Poor - Very Poor - Dead
City of Subiaco	2.14	Good - Fair - Poor - Dead
City of Joondalup	2.35	Good - Fair - Poor - Very Poor - Dead
Town of Bassendean	2.52	Very Good - Good - Average - Poor - Very Poor - Dead
City of Kalamunda	2.59	Good - Fair - Poor - Very Poor - Dead
City of Vincent	2.72	Good - Fair - Poor - Very Poor - Has Failed
Town of Cambridge	2.84	2 to 5
City of South Perth		1 to 5

These rating scales were standardised prior merging into a single dataset.

The associated spreadsheet ‘Perth and Peel LGs Tree Mapping.xlsx’ contains a mapping lookup table in the Health tab, which re-rates all data on a scale of 1 – 5 scale.

These standardised indexes were then used to produce the average health score in the table above.

The results varied significantly, and we do not believe it represents the true health of trees in each local government. The extreme variation highlights the need for standardised assessment frameworks, as the local government averages reflected their assessment methodologies more than a realistic score.

3.5 Tree Maturity Index

Most local governments returned reasonable well- populated attributes related to the maturity of their trees.

Of the 10 local governments returning data, 10 unique rating scales were identified, as shown in the table below. However, these scales were generally more consistent compared with the wide variation observed in health assessments methodologies.

Local Government	Average Maturity	Scale
Town of Cambridge	3.23	Young - Semi-Mature - Mature
City of Claremont	3.13	Juvenile - Semi-mature - Mature - Post-mature
City of Joondalup	3.01	Juvenile - Semi mature - Mature - Post mature
City of Vincent	2.97	Juvenile - Semi mature - Mature - Overmature
City of Belmont	2.89	Young - Semi mature - Mature - Post mature - Dead
Shire of Serpentine-Jarrahdale	2.85	Young (Newly Planted) - Semi-mature (>20%) Mature (20%-80%) - Over-mature (>80%)
City of Subiaco	2.8	Juvenile - Young - Semi-Mature - Mature - Post Mature - Senescent
City of Melville	2.75	Juvenile - Young - Semi Mat - Mature - Over mature
City of Stirling	2.62	Young - Semi-Mature - Mature - Senescent
City of Kalamunda	2.48	13 unique categories in every combination

These rating scales were standardised before merging into a single dataset.

The associated spreadsheet ‘Perth and Peel LGs Tree Mapping.xlsx’ contains a mapping lookup table in the Maturity tab, which re-rates data on a of 1 – 5 scale.

These standardised indexes were then used to calculate the average maturity score in the table above.

We note that the scales used by local governments are much consistent compared to health average, and unlike the health scores, the maturity scores appear more reliable. Inner city local governments averaged much taller and more mature trees than local governments further from the Central Business District. This is consistent with newer developments and urban infill or subdivision areas requiring new trees planted.

4. Recommendations and Future Direction

4.1 Data Collection

We were pleased to demonstrate an automated data extraction method covering five unique web services and four manual data formats.

We strongly recommend that any future projects focus on establishing an ongoing agreement enabling automated weekly or monthly data transfers into a centralised data warehouse.

Communicating with and gathering data from the 16 participating local governments consumed the majority of project time, leaving limited capacity for analysis or derivative work.

The FME workbench developed for this project demonstrates that an automated solution is achievable and would likely save hundreds of hours of officer time across local governments, WALGA, and other stakeholders.

We also recommend that local governments be encouraged to publish data on their websites in a GIS friendly format or via web services, as three participating local governments are already doing. Landgate / SLIP could also be utilised where local governments do not have the capacity to publish data via web services.

4.2 Data Standards and Record Keeping

We were aware that local governments maintained tree registers in different ways; however, we did not expect nearly every participating local government to have completely unique conventions and methodologies for attributing tree data.

We strongly recommend that relevant working groups and urban forestry stakeholders collaborate to agree on a single set of standards.

A review of existing literature indicates that appropriate standards for Australian urban forestry management already exist.

We also noted that most local governments maintained limited records relating to removed or disposed tree assets. We consider that capturing and retaining data on dead or removed trees is as important as recording live trees, as this helps enable more robust analysis of program outcomes and survival rates.

We recommend that local governments place greater emphasis on maintaining historical records relating to tree planting, previous inspections, and removals.

4.3 Improved Analysis

Analysis in this project was primarily proof of concept and remained surface level. The scores and indexes (PSHB, Health, and Maturity) were developed quickly without extensive research into the underlaying subject matter.

We recommend that future projects be allocate sufficient time for detailed analysis to develop more accurate and representative indexes, as well as produce more detailed mapping outputs for reporting and local government use.