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Dudley Creek Flood Remediation
Downstream Options Report
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Appendix B

Arboricultural Report

Dudley Creek Flood Remediation Downstream Options Report Tree Survey Summary



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Appendix 1: Tree Inspection Results

1.0 Executive Summary

This report outlines the tree survey methodology and results summary for the Dudley Creek Downstream Options Report. This information is intended to provide input into the project design and consultation by establishing the quantity, size and quality of the existing tree and shrub populations within three potential project areas, and trees and shrubs that may be affected by the works for each option.

All of the three options are expected to result in the removal and replacement of trees and shrubs.

- Option A may result in the removal of 122 trees and shrubs (of 284 surveyed), and includes Banks Avenue;
- Option B may result in the removal of 44 trees and shrubs (of 74 surveyed); and,
- Option C may result in the removal of 70 trees and shrubs (of 108 surveyed), and includes parts of Stapletons Road, south of Warden Street.

A team of landscape architects, surveyors and arborists undertook site visits during March to May 2015. The tree assessment survey was undertaken by Arbor Vitae and Treetech. Both companies provide arboricultural services to Christchurch City Council (CCC), and have a comprehensive understanding of Council's tree survey methods and maintenance requirements, and provide services relating to the protection of natural assets. The locations and dimensions of the trees, shrubs and groups of shrubs were captured by Woods surveyors.

Accurately locating, measuring and assessing the trees and shrubs is intended to inform the design team (Beca/Opus), and assist with determining where trees and shrubs should be retained and where they will require removal for the required alignment and extent of works.

The survey included detailed assessments of trees and shrubs (individuals and groups) along the routes for the three options. A range of elements were assessed, which included the following:

- The asset type (private or CCC, and street, park or special purpose road zone);
- The tree or shrub species;
- Whether they are native or exotic;
- The age class (juvenile/semi-mature/mature/over-mature);
- The height (small:0-6m/medium:6-10m/large:10-15m/very large:>15m);
- The canopy diameter;
- The DBH (diameter at breast height – trunk diameter at 1.4m above ground level);
- The basal diameter (the trunk diameter including basal flare at ground level);
- The condition (very poor/poor/fair/good/very good); and
- The estimated life expectancy of the tree or shrub (short:<10 years/medium:10-20 years/long: >20 years).

The existing vegetation within the three option routes is a mix of native and exotic trees and shrubs, with approximately 60% of all trees/shrubs surveyed being exotic and 40% native. The life expectancy of trees/shrubs was also quite varied, with approximately 30% having a short term life expectancy (less than 10 years), 30% medium term life expectancy (10 to 20 years) and 40% having a long term life expectancy (greater than 20 years).

The life expectancy assessments are estimates only, and were based on conditions at the time of the survey, and may change in some areas as the full consequence of the earthquakes on soil, drainage, tidal and ground water level changes take effect during the next few years.

Trees like all living organisms go through growth and decline cycles. In addition to the normal decline expected of trees towards the end of their life, a number of trees in the project area appeared to have been adversely affected by the changes in ground conditions (e.g. movement, ground levels, water levels and quality, soil composition, etc.) caused by the earthquakes, especially some parts of Banks Avenue and to a lesser degree parts of Stapletons Road.

It is expected that the majority of trees and shrubs assessed as having short and medium term life expectancies would eventually be removed by CCC where required as part of routine maintenance. The Dudley Creek Flood Remediation project will provide an opportunity to remove and replace the trees and shrubs where the works occur.

This report only considers the current tree and shrub populations and the potential removals that relate to each option, and not replacement planting.

The project design has also received input from landscape architects and ecologists, and appropriate replacement planting will also be proposed for the three options to mitigate any required tree and shrub removals. Further detail regarding replacement planting is contained in Section 7.2 of the Dudley Creek Flood Remediation Downstream Options Report.

2.0 Tree Assessment Methodology

The survey was carried out during March to May 2015 by Arbor Vitae and Treotech, and the locations and dimensions of the trees, shrubs and groups of shrubs were captured by Woods surveyors.

Tree inspections were carried out from ground level, and included non-invasive visual tree assessment techniques and CCC tree assessment methods. During the survey the following elements were assessed for trees and shrubs located within the vicinity of routes proposed for the three options.

- The asset type (private or CCC, and street, park or special purpose road zone);
- The tree or shrub species;
- Whether they are native or exotic;
- The age class (juvenile/semi-mature/mature/over-mature);
- The height (small:0-6m/medium:6-10m/large:10-15m/very large:>15m);
- The canopy diameter;
- The DBH (diameter at breast height or trunk diameter at 1.4m above ground level);
- The basal diameter (the trunk diameter including basal flare at ground level);
- The condition (very poor/poor/fair/good/very good); and
- The estimated life expectancy of the tree or shrub (short:<10 years/medium:10-20 years/long: >20 years).

2.1 Definitions

2.1.1 Age Class

Age class relates to the stage of development of the tree or shrub at the time of the survey.

Juvenile: this relates to trees that have been planted in recent years and are becoming established.

Semi-mature: trees that are established and are not yet mature.

Mature: trees that are mature for the species.

Over-mature: this relates to trees that are reaching the end of their lives and are showing signs of age-related decline.

2.1.2 Size

Height: the height measurements of trees and shrubs were provided as ranges, from Small (up to 6.0 metres, Medium (6.0 to 10 metres), Large (10.0 to 15.0 metres), to Very Large (greater than 15.0 metres). These height ranges are consistent with classifications in CCC tree maintenance contracts.

Canopy Diameter: the canopy spread of trees and shrubs were measured, including asymmetrical tree canopies and where there were groups of shrubs.

DBH: this relates to the trunk diameter at breast height (1.4m above ground level). In some situations this measurement was estimated or taken above or below this height, such as where trees or shrubs had multiple stems.

Basal Diameter: the basal diameter of trees and shrubs was also measured to assist with determining estimates of the root protection zone of each tree and shrub (which is calculated by CCC as approximately ten times the basal diameter).

2.1.3 Condition

The condition of the trees and shrubs were rated using the following CCC tree assessment system. The condition of each tree or shrub was rated as Very Good, Good, Fair, Poor or Very Poor. This relates to the Health, Structural Integrity and Shape of a tree or shrub, as outlined below.

Condition	Health	Structure	Shape
Very Good	The tree/shrub is above average for the species, with no more than approximately 5% decline.	The tree/shrub has no structural defects or abnormalities	The tree/shrub has no more than approximately 5% of the overall canopy shape is missing or modified.
Good	The tree/shrub is representative of the species, with no more than approximately 6-20% decline.	Any defects do not affect the structural integrity or continued well-being of the tree/shrub.	There is no more than approximately 6-20% of the canopy shape missing or modified.
Fair	The condition of the tree/shrub is below average for the species, with approximately 21-30% decline.	Defects are present, but can be rectified in order to maintain the structural integrity and continued well-being of the tree/shrub.	Approximately 21-30% of the canopy shape is missing or modified.
Poor	The tree/shrub exhibits approximately 31-70% decline.	Tree maintenance cannot improve the framework or the continued well-being of the tree/shrub, and defects result in a loss of structural integrity that cannot be rectified.	Approximately 31-70% of the canopy shape is missing or modified.
Very Poor	The tree/shrub is in more than approximately 70% state of decline	The tree/shrub has a total loss of structural integrity	There is more than approximately 70% of canopy shape is missing or modified.

2.1.4 Life Expectancy

The life expectancy of each tree and shrub was estimated. This was based upon the condition of the tree or shrub at the time of the survey and the species characteristics.

Short: this applied where trees and shrubs have declined or are likely to significantly decline in health or structural integrity, and require removal within 10 years. A number of existing trees were found to be dead or in an advanced state of decline and others were showing signs of stress and poor health and are likely to die within the next ten years.

Medium: this applied where trees and shrubs may decline in health or structural integrity, and require removal within the next 10 to 20 years.

Long: this applied where trees and shrubs were expected to survive more than 20 years.

Note: The *Shape* of a tree or shrub is often determined by position in relation to surrounding vegetation or structures, and may not relate to the health, structural integrity or the life expectancy of the tree/shrub. Therefore, crown suppression may result in a *Poor* score being allocated but the tree/shrub may still be awarded *Good* or *Fair* for their *Health* or *Structure*. Whereas, a tree/shrub is more likely to have a *Medium* or *Low* life expectancy where there is *Poor* health or structural integrity.

Note that the tree assessments are estimates only, and were based on tree conditions at the time of the survey, and may change as the full consequence of the earthquakes on soil, drainage, tidal and ground water level changes take effect during the next few years.

2.1.5 Asset Type

Asset Type relates to the land ownership and the various land classifications where the trees and shrubs are located, including where the trees/shrubs are on private or CCC land, and whether the land is classified as street, park or special purpose road zone (SPRZ).

Private: this applied where trees and shrubs are on non-Council owned land (including schools).

Street: this applied where trees and shrubs are within the road corridor and are classified by CCC as Street Trees.

Park: this applied where trees and shrubs are located on park land and are classified by CCC as Park Trees.

SPRZ: this applied where trees and shrubs were located within road corridors that are listed in the Christchurch City Plan as Special Purpose Road Zone. Within the three option routes this applies to Banks Avenue, Stapletons Road, North Parade and River Road.

3.0 Survey Areas and Results Summary

The information provided in this report relates to trees and shrubs within the areas that may be affected by each of the three options.

Note that the current design is concept level only, and hence numbers of affected trees may vary as the design develops.

The survey areas include the following:

3.1 Option A

- Warden Street (from Stapletons Road to 98 Warden Street)
- Shirley Intermediate School
- Banks Avenue to River Road

Warden Street

There were ten (10) street trees within the survey area that were in relatively poor condition. These trees may require removal and replacement as part of the works (also identified in Option B).

The street trees in Warden Street were of a relatively low quality, and as part of the project there is an opportunity for street tree renewals within the affected section of the street.

Shirley Intermediate School

There were ten (10) trees on the North Parade frontage of Shirley Intermediate School, opposite Banks Avenue, that were surveyed and found to be in reasonably good condition. Four (4) of these trees may require removal and replacement as part of the works. These trees form part of a row of mature, large growing, exotic deciduous species that were planted along the school frontage, opposite the length between Banks Avenue and Marian College.

Banks Avenue

There were two hundred and sixty-four (264) trees and shrubs surveyed within Banks Avenue (between Dudley Creek and Banks Avenue road carriageway). They were found to be of mixed species, age and size, and the condition ranged from Good to Very-Poor. One hundred and eight (108) of these trees and shrubs would require removal and replacement as part of the works.

Banks Avenue has areas with significant established trees located on or near the creek bank, which contribute greatly to the landscape character of the street. There are also areas with trees and shrubs that provide relatively low amenity value due to the species profile, age, size and condition.

In addition to the normal decline expected of trees towards the end of their lives, a number of trees within Banks Avenue appeared to have been affected by the earthquakes (due to movement and changes in ground levels, water levels and quality, soil composition, etc.) including both dead trees and trees in an advanced state of decline, especially towards River Road.

3.2 Option B

- Warden Street (from Stapletons Road to 98 Warden Street)
- Shirley Intermediate School
- North Parade (outside Marian College)
- Marian College
- Richmond Park
- Residential Red Zone (RRZ) land (route not surveyed), or
- 39 Medway Street to River Road (alternate Option B route to avoid RRZ land)

Warden Street: as per the Option A route noted in Section 3.1, this option includes work on the same stretch of Warden Street where there are 10 trees of low quality that may be replaced as part of the works.

Shirley Intermediate School: (note this is different to the route through Shirley Intermediate School in Option A) there were five (5) trees on the North Parade frontage opposite Marian College that were in reasonably good condition. These trees form a group of mature, exotic deciduous species located opposite Marian College, and may require removal and replacement as part of the works.

North Parade: outside Marian College there were fifteen (15) trees and shrubs of mixed species, age and size, and the condition ranged from Good to Poor. Based upon the proposed alignment and construction method, it is expected that these trees and shrubs can be retained and protected during the works.

Marian College: there were twenty-three (23) trees and shrubs near the southern boundary of the Marian College property that were of mixed species, age and size, and the condition ranged from Good to Poor. Twenty-two (22) of these trees and shrubs may require removal and replacement as part of the works, and one (1) commemorative tree could be transplanted if required.

Richmond Park: there are two possible routes from the north-western corner of Richmond Park; the main Option B route which runs from the south-western boundary of Marian College to the Woodchester Avenue entrance, and then through Residential Red Zone land to the Avon River, and an alternative Option B route which runs from the south-western boundary of Marian College to the walkway at 39 Medway Street, and then along Medway Street to the Avon River at River Road, to avoid the RRZ.

Main Option B: There were five (5) trees surveyed in the north-western corner of Richmond Park, which were in reasonably good condition, and two (2) of these trees may require removal and replacement during the works. Five (5) trees were surveyed near the Woodchester Avenue entrance of the park, and one (1) tree which is in poor condition, may require removal and replacement.

Alternate Option B: As per the Option B route above, two (2) of the five (5) trees surveyed in the north-western corner of Richmond Park may require removal and replacement. Between the north-western corner of Richmond Park and 39 Medway Street there were an additional nine (9) trees surveyed, that were of mixed species, age and size, and the condition ranged from Good to Fair. Three (3) of these trees may require removal and replacement as part of the works. Also, on the corner of Medway Street and River Road there were two (2) trees surveyed and found to be in Fair condition. One (1) of these trees may require removal and replacement as part of the works.

3.3 Option C

- Stapletons Road (from Warden Street, along Dudley Creek and to Petrie Street – some trees on private land not surveyed)
- Petrie Street to Randall Street (trees not affected)
- Randall Street to Medway Street
- Medway Street to River Road

Stapletons Road: from Warden Street to Dudley Street there were seventy-seven (77) trees and shrubs of mixed species, age and size, and the condition ranged from Good to Very-Poor. Fifty (50) of these trees and shrubs may require removal and replacement as part of the works.

Stapletons Road has areas with significant established trees located on or near the creek bank, which contribute greatly to the landscape character of the street. Similarly to Banks Avenue, there are also areas with trees and shrubs that provide relatively low amenity value due to the species profile, age, size and condition.

In addition to the normal decline expected of trees towards the end of their lives, a number of trees within Stapletons Road may have also been affected by the earthquakes (due to movement and changes in ground levels, water levels and quality, soil composition, etc.) and some trees were declining in health.

Stapletons Road to Petrie Street: although not included in the tree survey due to being on private property, it is estimated that there are up to thirteen (13) trees in this section that may be affected by this option, including trees of mixed species, age and size, and the condition ranged from Good to Very-Poor.

Randall Street to Medway Street: on the corner of Randall Street and North Parade there were five (5) street trees surveyed and on the corner of Medway Street and North Parade there were eleven (11) street trees surveyed. The trees were found to be of mixed species, age and size, and the condition ranged from Good to Fair. Six (6) of these street trees may require removal and replacement as part of the works, targeted for areas of poorer quality trees.

Medway Street to River Road: on the corner of Medway Street and River Road there were two (2) trees surveyed and found to be in Fair condition. One (1) of these trees may require removal and replacement as part of the works.

4.0 Conclusions

Based upon current concept designs, the three options are expected to result in the removal and replacement of the following tree and shrub quantities.

- **Option A** may result in the removal of 122 trees and shrubs (of 284 surveyed), and includes Banks Avenue;
- **Option B** may result in the removal of 44 trees and shrubs (of 74 surveyed); and,
- **Option C** may result in the removal of 70 trees and shrubs (of 108 surveyed), and includes parts of Stapletons Road, south of Warden Street.

The life expectancy of existing trees and shrubs varied, with approximately 30% having a short term life expectancy (less than 10 years), 30% medium term life expectancy (10 to 20 years) and 40% having a long term life expectancy (greater than 20 years).

Trees like all living organisms go through growth and decline cycles. In addition to the normal decline expected of trees towards the end of their life, a number of trees in the project area appeared to have been adversely affected by the changes in ground conditions (e.g. movement, ground levels, water levels and quality, soil composition, etc.) caused by the earthquakes, especially some parts of Banks Avenue and to a lesser degree parts of Stapletons Road.

It is expected that the majority of trees and shrubs assessed as having short and medium term life expectancies would eventually be removed by Council as part of routine maintenance. This is currently required in some areas of Banks Avenue and Stapletons Road, and in Warden Street.

The Dudley Creek Flood Remediation project will provide opportunities to remove and replace the trees and shrubs where the works occur, and is expected to improve the overall quality of the tree and shrub populations in those areas through appropriate landscaping and replacement planting.

Further detail regarding replacement planting is contained in Section 7.2 of the Dudley Creek Flood Remediation Downstream Options Report.

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