Technical Note

Project:	Belfast Tidal Flood Alleviation Scheme		
Subject:	Stranmillis Embankment Defence		
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Client signoff

Client	DfI Rivers
Project	Belfast Tidal Flood Alleviation Scheme
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Client signature / date	

1. Introduction

This technical note records the assessment performed on the flood defence alignment during the design development of the scheme from 2018 which included tree survey with the arboriculturalist on the preferred route.

Wider options for the flood defence for Belfast were reviewed earlier at Feasibility Study and Business Case stage which identified the preferred option as flood defence structures. During the design development stage of the project, through consultation with landowners and in consideration of the site constraints and environmental impact, the preferred alignment was identified.

This note also records recent discussion of the defence option and review of any potential alternatives to further minimise impact on trees at the Stranmillis open space since the appointment of the Design & Build Contractor.

The flood defence on the Stranmillis open space upstream of Governors Bridge defends the Lockview Road area and adjacent properties from bank overtopping and flooding from a current day tidal flood event.

2. Alignment Options

The flood defence alignment at Stranmillis Wharf along its boundary with the tow path provides protection to that property and prevents a flood flow path to Lockview Road. The defence is required to continue in the open space area adjacent to Stranmillis Wharf to tie into high ground at Governors Bridge to continue to cut off the flood flow path to Stranmillis Wharf and Lockview Road.

2.1. Design Development Proposals

Two alignment options were considered to continue the flood defence from Stranmillis Wharf boundary through the Stranmillis open space during the design development stage.

These were:

1. Flood wall along right hand side (looking downstream of the river) of the tow path.
2. Flood wall along left hand side (looking downstream of the river) of the tow path.

The options would both need to tie into the higher ground at Governors Bridge.

These options were assessed based on the tree protection zone requirements provided in the arboriculturalist survey report performed during design development stage.

A summary of the impact on the trees in the Stranmillis open space reach based on this assessment is provided below:

Table 2-1 - Summary of Trees Impacted by Route Options

Route Option	Trees to be felled and replaced	Trees to be retained and protected
1	8	6
2	6	8

Route Option 2 (flood wall along left hand side of tow path) was taken forward to contractor tender as the preferred route.

2.2. Contractor Proposals

Once the Contractor was appointed, a review of the defence alignments and construction approach was performed along the defence to consider tree impact along with other constraints such as existing infrastructure and utilities.

In the Stranmillis open space reach, the Contractor's design proposal for Route Option 2 reduced the impact on the trees from the 6 No. estimated to be felled and replaced at tender stage to 4 No. based on their proposed construction methodology.

The team also reviewed another route (following the side boundary of Stranmillis Wharf and along the footpath to Governors Bridge) to confirm if the impact on trees could be further reduced; however, the construction of the defence through this alignment would result in a felling of 6 trees in the Stranmillis open space and an additional tree within the Stranmillis Wharf apartments which is a greater impact than the Route Option 2. This option also poses further risk and constraint by buried utilities in the footpath area compared to Route Option 2.

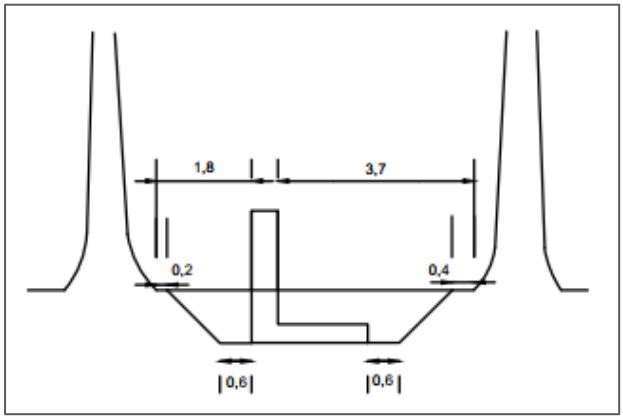
3. Foundation Options

The Contractor assessed foundation design and construction methodology options for the construction of flood walls for the scheme and determined the working areas required for such construction approaches. These are presented in the sections below. The options for the foundation design were considered with respect to impact on trees and other constraints along the route.

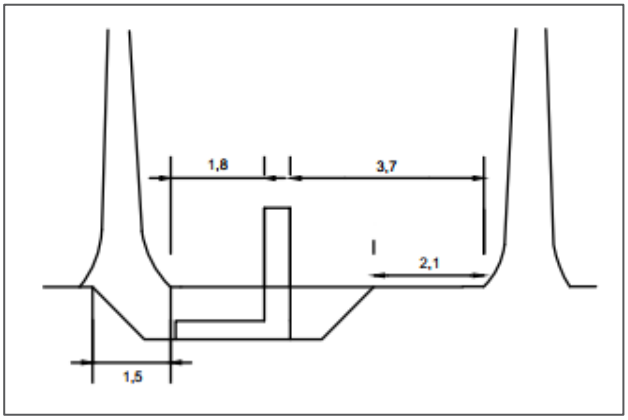
Due to the size of the structure necessary to provide flood defence to Lockview there are similar working area requirements between the construction method options which does not reduce the impact on the trees identified for felling and replacement on the Route Option 2 or any of the alternative routes considered.

The space between the tree 242 and 245 adjacent to the tow path has been used to show foundation and construction options and associated working areas. The space between the next pair, 241 and 244, narrows.

3.1. Cantilever Foundation

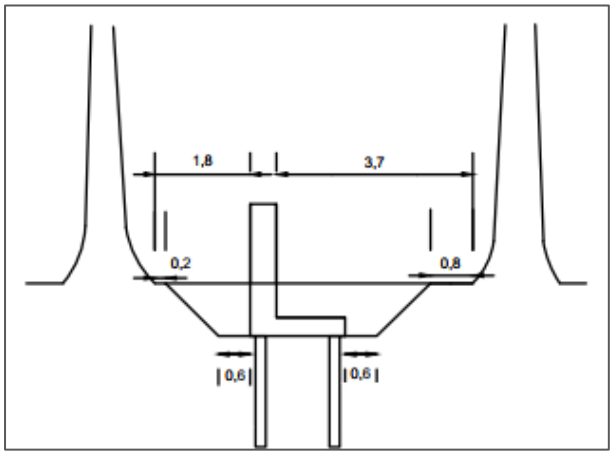


Working area impacts protection zone for both sides

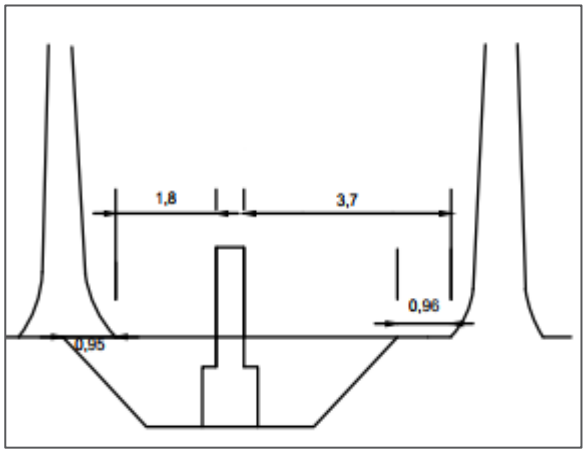


Working area impacts protection zone for one side

3.2. Piled Foundation



Working area impacts protection zone for both sides



Working area impacts protection zone for both sides

4. Liaison with Arboriculturalist

We reengaged with the arboriculturalist involved in the design development tree survey to take a focussed review of the proposed works and subsequent impact on the trees in the Stranmillis open space.

A meeting to discuss the route options and confirm the Arboriculturalist's recommendations regarding the works in the Stranmillis open space was then held on 23/2/22.

The routes and construction methodologies were presented at the meeting and the arboriculturalist provided their recommendation for actions to deliver the lowest impact route in this area. This is provided in Appendix 1.

The arboriculturalist supported the lowest impact route for the defence as Route Option 2.

5. Conclusions

The assessment of the route options and methodology proposals have concluded, with support of the arboriculturalist, that the Route Option 2 presents the lowest impact on the trees in this area.

4 No. trees are impacted by this alignment and require felling and replacement. Compensatory planting on a 4:1 basis (semi-mature, minimum girth 25-30cm with type of tree to be agreed with the Tree Conservation Department in advance) has been agreed with Belfast City Council as part of the licence agreement for works in the Stranmillis open space.

We have been advised that one of the trees impacted by this route is a tree planted under ceremony by Belfast's first female Lord Mayor. We have subsequently notified Belfast City Council of this and it has been agreed that one of the replacement trees to be planted as part of the project will be sited close to the original tree location and dedicated to the former Lord Mayor.

Tree protection measures will be employed as recommended by the arboriculturalist for the remaining trees.

Appendices

Appendix A. Arboriculturalist Recommendation

ARBORICULTURAL IMPACT STATEMENT

FOR

BELFAST TIDAL FLOOD ALEVIATION SCHEME, GOVERNORS BRIDGE

FEBRUARY 2022

COMMISSIONED BY

ATKINS GLOBAL

PB

Dr Philip Blackstock

ARBORICULTURAL IMPACT STATEMENT

On trees growing in the grounds of

Lands at Governors Bridge, Stranmillis

For

Atkins Global

Terms of reference

This statement was commissioned to identify the likely, foreseeable impacts of the proposed re-development of the above site on existing trees.

Proposed site plan referred to in this impact statement

Route Option 2

Produced by

Atkins global

Details available

Site Plan indicating position and Tree Protection Zones of existing trees, as well as the footprints of the existing and proposed buildings. No details on underground services, proposed level changes, elevations or the positions of proposed windows were available.

Statement produced on

23rd February 2022

Impact Statement carried out and report compiled by

Dr Philip Blackstock, 26 Tullynahinnion Road, Portglenone BT44 8EL
Telephone 02825 821202, Fax 02825 821295, Mobile 07767 393075,
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ARBORICULTURAL IMPACT STATEMENT FOR THE PROPOSED BELFAST TIDAL FLOOD ALEVIATION SCHEME, GOVERNORS BRIDGE
February 2022

The trees reported on here are growing in a small 'Pocket Park' close to the Governors Bridge in Stranmillis. These trees are in public ownership and have been carefully maintained. As such, they have some significance in the local landscape.

It is understood that plans are being considered for the erection of a barrier to control potential flooding into adjoining residential housing and roads. It is further understood that a concrete barrier supported by a 2.0m toed foundation is to be constructed along the eastern edge of an existing footpath. It is further understood that the construction of this barrier will necessitate excavations extending about 1.6m on each side of its foundations.

Trees 234, 235, 241 and 242 will be removed and replaced to facilitate these construction works. The removal of these four trees will expose trees 236, 239 and 240. These trees should have exposed side branches shortened by up to 2.0m to ensure that their crowns remain stable. Trees 243 to 246, inclusive will also be exposed. They will also be subject to some construction works within their notional Root Protection Area (if this is shown as a perfect circle). However, as these incursions, if they occur, will only be within an existing paved footpath, it is recommended that these four trees are pruned in a manner developed by Belfast City Council, for managing their street trees.

Finally, to ensure that the construction works reported on here do not adversely affect retained trees the arboricultural method statements reproduced below and relevant to this project should be adopted.

Dr Philip Blackstock

ARBORICULTURAL METHOD STATEMENTS

Protection of trees. A protective barrier, 2.3m high and comprising a vertical and horizontal framework of scaffolding, well braced to resist impacts and securely supporting weldmesh panels, (as illustrated in Figs 2 & 3 of BS5837:2012) shall be erected around the base of all trees to be retained on site. This barrier shall be clearly identified on site by the attachment of all-weather signs of suitable dimension stating: 'CONSTRUCTION EXCLUSION ZONE – NO ACCESS'. The line of this fence shall be at least the distance defined in the attached plan, or as otherwise directed by Dr Philip Blackstock. No construction traffic, materials or debris will be permitted within this zone of protection.

Access facilitation pruning. If it is deemed appropriate to trim back retained trees to provide adequate access to approved construction works, all such tree works should be undertaken by a competent and suitably qualified tree surgeon (will associated support, as defined in the Health and safety section of this report). Such works shall remedy any tree related conflict with proposed structures or access in a way that ensure that not less than 70% of live buds are retained within the tree canopy. The aim of the tree works shall be to retain the general form of the tree by a combination of crown thinning, reduction of end weight (tipping back of outermost branches) and the re-forming of the trees crown to create a pleasing and balanced crown. No branch, limb or trunk greater than 100mm diameter shall be cut in the process of reducing end weight.

Temporary surfaces within zone of protection. Where temporary access is to be established within the 'zone of protection' surrounding retained trees, (for example, during demolition of existing buildings), ground surfaces will be protected by a layer of sharp sand, approx. 50 mm thick, overlaid with a geotextile membrane on which a temporary surface of no fines granular material, at least 150 mm thick, (as detailed by a competent Civil or Structural Engineer) is laid. Where traffic is turning on these surface, stout planks will be laid over the geotextile membrane and below the granular material. The trunks of adjacent trees shall be suitably protected as indicated on site by Dr Philip Blackstock.

Demolition within the zone of protection. If it is deemed necessary to carry out demolition works within a construction exclusion zone surrounding retained trees, (for example, to remove existing paths), or kerbs, only pedestrian operated plant, or low ground pressure plant that is less than 2 tonnes gross weight fully loaded, shall be permitted. Such plant shall only be operated on existing hard surfaces, or where temporary surfaces have been established. In any case, no excavations within the root protection zone of these retained trees shall be permitted, except only, under close supervision, with the use of an 'Air Spade' or by the careful use of hand tools in a way that retains, without damage, all exposed roots with a diameter greater than 25mm.

Scaffolding within zone of protection. Where scaffolding is to be established within the 'zone of protection' surrounding retained trees, the existing undisturbed ground surfaces shall be protected by a layer of sharp sand, approx. 50 mm thick,

overlaid with a geotextile membrane. Stout planks, such as closely side-butted scaffold boards, will be laid over the geotextile membrane and scaffolding will be constructed on these planks with additional stays, as directed by a competent person. Adequate protective fencing, as Illustrated in Figs 2 & 3 of BS5837:2012, will be maintained between scaffolding and adjacent trees.

Construction of hard surfaces close to retained trees. Where permanent surfaces are to be constructed close to retained trees, within the zone of protection as defined by BS5837: 2012, carefully remove accumulated organic material and loose soil, leaving existing topsoil in situ. Protect root zone with a layer of sharp sand and, on this, establish a firm sub-base of no-fines granular material supported on a geotextile membrane and a three-dimensional cell product (as defined by a competent Civil or Structural Engineer). Construct the paved area on this sub-base using established design guidelines (and no-fines granular material) with a porous surface finish such as pavers or porous bitmac.

Alterations of levels on lands adjoining construction exclusion zones. Where it is deemed appropriate to lower ground levels on land adjoining a root protection zone established around a retained tree, all excavations and the subsequent construction of supporting structures shall be managed in a way that excludes access by construction traffic to the construction exclusion zone. Where such alterations result in the lowering of existing surfaces, the existing ground water environment within the root protection zone shall be maintained by the insertion of a root barrier behind proposed supporting structures. This shall consist of a non-porous barrier carefully inserted in a way that maintains the existing soil moisture regime surrounding the retained tree. Where alterations result in the raising of levels, these shall be designed and detailed by a competent Civil or Structural Engineer to ensure no alterations to ground conditions within the root protection zones.

Landscaping within the root protection zone. If it is deemed necessary to carry out landscaping, planting or re-instatement works within a construction exclusion zone surrounding retained trees, only pedestrian operated plant, or low ground pressure plant that is less than 2 tonnes gross weight fully loaded, shall be permitted. Such works should be supervised by competent Horticulturalists and be timed and designed to ensure that no soil compaction occurs. In any case, no excavations within the root protection zone of these retained trees shall be permitted, except only, under close supervision, with the use of an 'Air Spade' or by the careful use of hand tools in a way that retains, without damage, all exposed roots with a diameter greater than 25mm.

HEALTH AND SAFETY

Working with trees is a hazardous occupation. It is important that competent tree surgery contractors are employed to carry out tree works. These contractors should carry all relevant insurance cover and should comply with the recommendations outlined below.

Notwithstanding the following recommendations, all tree surgeons and accompanying staff should comply with all the requirements contained in the Health and Safety at Work (NI) Order 1978 and all subsequent legislation made thereunder.

Staff qualifications, experience and training

Only skilled operatives should be employed for tree work identified as appropriate in the attached tree condition report sheets. These skilled operatives should have a proven expertise and experience in the areas of work specified and should hold all relevant certificates of competence.

Operatives using chain saws to fell trees must have National Proficiency Test Council certificate of competence Units CS 30, 31*, 32*, 33* (* whichever is appropriate for the size of tree being felled) if they are working from the ground and, in addition, Units CS 38, 39, 40 & 41 if they are climbing.

All operatives undertaking work near underground or over head electric cables must have attended a Northern Ireland Electricity Safety Awareness course. They must comply with the guidelines laid down in AFAG Safety Guide 804: Electricity at work; Forestry and Arboriculture. Where there is a risk of a climber, equipment or parts of a tree touching or coming close to overhead cables, the advice of Northern Ireland Electricity must be sought, and adhered to, before work commences.

Work wear

All operatives should wear the appropriate safety clothing for the task being performed as specified in the relevant safety codes. Where operatives are employed on tree work near public roads, or when the available lighting is poor, they should wear high visibility 'florescent' jackets or waistcoats

Tools and Equipment

Tree surgeons should use such tools and equipment deemed suitable to complete the specified task. All bladed tools should be sharp and in a serviceable condition. All plant and machinery operated by the tree surgeon should be tested and certified to comply with all current legislation. All vehicles should be taxed and roadworthy. Machinery and vehicles should carry operational fire extinguishing equipment to the standards required by insurers.

All machinery should be used in accordance with the manufacturers' instructions. These machines should carry warning notices as specified by the relevant AFAG safety guide.

Climbing equipment for tree work is subject to the Provision and Use of Work equipment regulations (NI) 1998 (PUWER), the Lifting Operations and Lifting Equipment Regulations (NI) 1998 (LOLER) and is also subject to the Personal Protective Equipment at Work regulations (NI) 1992 (PPE Regs). Operatives using climbing equipment should be familiar with, and comply with, these and all other relevant regulations.

First aid
All chain saw operatives should have a current First Aid Certificate. No chain saw operative should be left working on site without an additional first aider present. These operatives should be familiar with AFAG Safety Guide 802: Emergency Planning and First Aid.

All operatives should have immediate access to a first aid kit conforming to SI 1981 No 917 and FSC 34, and, in addition, carry a personal first aid kit which includes a large sterile wound dressing.

Site organisation
Tree surgeons should ensure that a team of at least three people carry out all tree climbing, pruning and tree felling operations. When undertaking tree climbing work, one of the grounds staff must be competent to perform aerial rescue and be conversant with AFAG Safety Guide 401: Aerial Tree Rescue. In addition, one of the ground staff must be made responsible for ensuring that there is no trespass into the working zone when tree pruning or felling operations are taking place. Adequate staff should be available during tree work operations to ensure that no un-authorised persons or livestock enter the working area.

Tree surgeons should provide and constantly maintain all necessary warning and direction notices, cones and barriers when carrying out tree works that are adjacent to a road or footpath used by the public. These should conform to the recommendations and directions given in;

- Chapter 8 of the Traffic Signs Manual 1993, published by DRD
- Section 174 of the NI orders of the Highways Act
- Section 65 & 142 of the New Roads and Street Works Act
- Safety at Street Works and Road Works code of practice 1993
- Any other relevant legislation

Where tree works are to be carried out over or adjacent to, public roads, the contractor should arrange the work to avoid traffic congestion and public inconvenience. They should make arrangements with the Police Service of Northern Ireland and the Department for Regional Development Roads Service as may be found necessary.

Where tree works are to be carried out over, or adjacent to, railway lines, the contractor shall liaise with Translink, informing them of the tree works to be carried out and complying with any requests made by Translink or its agents in relation to timing of operations, safety, staffing levels and competence or any other reasonable request.

Statement of truth

I Dr Philip Blackstock confirm that I have made clear which facts and matters referred to in this report are within my own knowledge and which are not. Those that are within my own knowledge I confirm to be true. The opinions I have expressed represent my true and complete professional opinions on the matters to which they refer.

Signed:

Date:
23rd February 2022

QUALIFICATIONS
National Diploma of Horticulture (R.H.S) Inter.
Diploma in Industrial Management
M.Sc. in Environmental Management (A Field Survey of Unmanaged Roadside Cuttings in South Antrim)
D.Phil in Forestry (Broad-Leaved Tree and Shrub Invasion of Conifer Plantations in Ireland)

Professional member of the Arboricultural Association
Registered Forestry Consultant with the Irish Forest Service

EMPLOYMENT
1996 to present
Arboricultural and Woodland Consultant
Duties include carrying out tree and vegetation surveys and providing tree and woodland management plans, completing reports and liaising with clients, providing court appearances etc. for public and private clients.

ARBORICULTURAL AND FORESTRY EXPERIENCE AND EXPERTISE
I have carried out surveys and produced reports on the health, condition, amenity value and landscape value of more than 250,000 trees since 1983. Since 1996 I have been fully employed as an Arboricultural and Forestry Consultant. Clients have now included most of the Local Authorities, Health Trusts and Government Departments within Northern Ireland. Private clients have included Solicitors, Architects and Developers. I have also lectured, to foundation degree level, on arboriculture and forestry.

I have provided expert opinion (including Court appearances) for a large number of clients involved in litigation or in planning appeals since 1996. Topics covered by these opinions have included the predictability of failure in trees, amenity and financial evaluation of damage to trees, evidence of subsidence caused by trees, evidence of unsafe tree surgery practices leading to injury, and tree related evidence in boundary and planning disputes.

I have maintained a research interest in the effects of environmental influences on tree and shrub regeneration in Ireland and on the development of woody biodiversity in recently planted woods. I have also a research interest in the distribution of and environmental influences on deciduous tree diseases, tree stability and in the incidence of dangerous roadside trees.

Dr Philip Blackstock

Tree Impact Report Sheet

Site: Belfast Tidal Flood Alleviation Scheme Governors Bridge

Client: Atkins Global

Tree No.	Type	Species	Age	Condition	Height (m)	N	E	S	W	DBH (cm)	Crown Form	Defect	Obstacle	Action recommended for Works
234	Tree	Silver maple	Mature	Fair	14	5	6	4	5	48	2 stems from 3.0m, Spreading crown	Basal damage	Lamp, Path	Fell and replace to facilitate development
235	Tree	Silver maple	Mature	Fair	18	7	7	5	5	63	2 stems from 3.0m, Spreading crown	None	Lamp	Fell and replace to facilitate development
236	Tree	Silver maple	Mature	Fair	17	5	4	5	6	51	3 stems from 3.0m	None	None	Reduce end weight in exposed branches by up to 2.0m
237	Tree	Norway maple	Mature	Fair	18	5	6	6	7	55	3 stems from 2.0m	Narrow fork, Basal damage	None	Crown clean, Reduce end weight by 3.0m
238	Tree	Norway maple	Mature	Fair	18	3	7	7	5	45	Single main stem with heavy side branches	None	Buildings	Clear back from building
239	Tree	Norway maple	Mature	Fair	17	3	6	6	2	38	Multi stem from 2.0m	None	None	Reduce end weight in exposed branches by up to 2.0m
240	Tree	Norway maple	Mature	Fair	15	4	4	5	4	31	Single main stem with heavy side branches	None	None	Reduce end weight in exposed branches by up to 2.0m
241	Tree	Norway maple	Mature	Fair	15	5	5	5	3	40	3 stems from 3.0m	None	None	Fell and replace to facilitate development
242	Tree	Norway maple	Mature	Fair	15	3	3	5	3	33	2 stems from 3.0m	None	None	Fell and replace to facilitate development
243	Tree	Sycamore	Young mature	Fair	13	4	4	2	2	24	2 stems from 4.0m	None	None	Prune as per Belfast street tree, to facilitate development
244	Tree	Sycamore	Early mature	Fair	14	2	4	3	2	30	Single stem	None	None	Prune as per Belfast street tree, to facilitate development

245	Tree	Sycamore	Early mature	Fair	15	3	5	2	3	27	Single stem	None	None	Prune as per Belfast street tree, to facilitate development
246	Tree	Sycamore	Early mature	Fair	15	2	5	5	4	33	Single stem	None	None	Prune as per Belfast street tree, to facilitate development