Grangemouth Flood Protection Scheme

Technical Note - Impact of Construction Works on Port of Grangemouth

B2386100-JEC-S4-C03-ZZZ-TN-C-0004 | P02

01 June 2023

Falkirk Council

B2386100

Document history and status

Revision	Date	Description	Author	Checked	Reviewed	Approved
P01	24/10/2023	For issue to Forth Ports	SF	RM	SS	AM
P02	12/12/2025	Issued for local hearing	SF	RM	SS	AM

Distribution of copies

Revision	Issue approved	Date issued	Issued to	Comments
P01	24/10/2023	24/10/2023	Forth Ports	For comment
P02	12/12/2025	15/12/2025	Local hearing	Issued for local hearing

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Project No:	B2386100
Document Title:	Impact of Construction Works on Port of Grangemouth
Document No.:	B2386100-JEC-S4-C03-ZZZ-TN-C-0004
Revision:	P02
Document Status:	Final Draft
Date:	02 October 2023
Client Name:	Falkirk Council
Client No:	B2386100
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File Name:	B2386100-JEC-S4-C03-ZZZ-TN-C-0004_Construction impact _Port

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1. Introduction

The purpose of this technical note is to outline the typical activities associated with constructing flood defences in the Port of Grangemouth. This technical note has been requested by Forth Ports to assist their understanding of how the proposed construction activities could impact on port operations.

The details included in this technical note give a general indication of the different activities likely to be carried out during the construction phase. It is not possible at this stage of the project to determine or prescribe exactly which methods of construction the appointed contractor will select, or the sequence in which the works will be constructed. During the detailed design phase more information on the construction methods and programme will become available and dialogue with Forth Ports will continue.

This technical note, covers the following construction related activities:

- Advanced works.
- Traffic management.
- Working areas.
- Site compounds.
- Construction access.
- Construction works.

2. Advanced Works

Advanced works or enabling works may be carried out in advance of the main works contract. This type of preparatory work reduces the risk of delay to the main construction works and allows greater certainty of programme and costs. This work is typically carried out by specialist contractors.

2.1 De-Vegetation/ Site Clearance

Depending on the timing of the main construction works, the de-vegetation may be carried out as advanced works. Work is typically carried out to clear vegetation and fell trees to prepare and give access to the areas where the flood defences will be constructed. Elements of this work can be time dependant, and it is generally undertaken out-with the bird nesting season therefore during the winter period (September to March).

In addition to the removal of vegetation, it will be necessary to carry out site clearance along access routes and the main working areas. This will involve the removal of debris, waste, fences and any other obstructions that would interfere with construction works. It may be possible to re-use some materials e.g. fencing. Where this is possible the materials will be carefully removed and stored for re-use.

During this activity, temporary fencing would normally be erected to delineate the construction working areas.

Figure 1 - Hawick Flood Protection Scheme Site Clearance Underway

2.2 Service/Utility Diversions

Some service and utility diversions will need to be carried out prior to construction of the flood defences this aims to significantly reduce a major risk of delay to the main construction works. An example of this is that a 100m length of 11kv electrical cable will need to be diverted on North Shore Road to allow the flood wall to be constructed adjacent to the existing carriageway.

Figure 2 - Hawick Flood Protection Scheme Utility Diversions in Progress

2.3 Temporary Roads, Hardstanding and Accommodation Works

If there is a need to construct temporary roads or make changes to existing roads/ junctions/ hardstanding to facilitate the main construction works, it is likely that these would be carried out as advanced works to minimise any delays on the construction phase.

Similarly, any accommodation works requested by Forth Ports may be carried out in advance if their nature and scale made this required or suitable.

3. Traffic Management

To facilitate a safe working area, it is highly likely that a rolling, temporary, single lane closure will be required along North Shore and South Shore Roads to provide a suitable working area to enable the flood wall to be constructed. Any temporary lane closure within the Port, will be carried out with agreement from Forth Ports and will be over short, localised sections of approximately100-300m lengths. This will reduce the impact on port traffic and will be supported with signage, barriers and fencing as required. Traffic management works will comply with the provisions of the Traffic Signs Manual Chapter 8: Traffic Safety Measures and Signs for Road Works and Temporary Situations. Traffic signs will comply with the Traffic Signs Regulations and General Directions 2002, as amended. The traffic management for the temporary lane closure would be relocated along the road as the flood wall construction is progressed.

Figure 3 - Hawick Flood Protection Scheme Traffic Management – single lane closure

4. Working Areas

At this stage of the project, it is difficult to define exactly how many working areas will be active at any one time. Working areas are areas where construction works are being undertaken e.g. if an area of North Shore Road had temporary traffic management installed to allow the flood defences to be constructed, this would be classed as one working area.

In order to reduce the overall construction period within the port we would assume that 2 or 3 working areas could be active simultaneously along North Shore and South Shore Road this is excluding any work associated with replacing the lock gates. The overall number of active working areas would be subject to further discussion with Forth Ports to minimise any disruption to their operations within the port.

The size of the working areas will depend on the type of works being carried out and need to be sufficient to allow the works to be carried out safely taking into account the equipment to be used and any mitigation required to reduce risks associated with the interface between equipment and people, temporary works e.g. excavation supports etc.

5. Site Compounds

Site compounds are necessary for the contractor to accommodate the facilities and store the plant and materials needed to construct the flood defences. Ideally, a main site compound would be located in a central location, in close proximity to the works and comprise of offices, welfare facilities. parking and material storage areas. Locating a main site compound within the port boundary would significantly reduce the frequency of construction traffic entering and leaving the port daily and the associated burden that would place on the port security teams. A satellite compound is similar to the main compound, but smaller in size and may contain an office, welfare facilities and material/plant storage.

In addition to the compounds, it would be advantageous to have laydown areas within the port, where construction plant and materials could also be stored. The laydown areas would serve the more remote construction areas, minimising the frequency of construction traffic being required to use North Shore Road and South Shore Road.

There are a few unoccupied areas within the port at present which could be suitable for compounds or laydown areas, we are aware however that these areas may be occupied, or developed in the future in advance of construction works commencing. Figures 4 and 5 highlight potential locations for site compound and laydown areas.

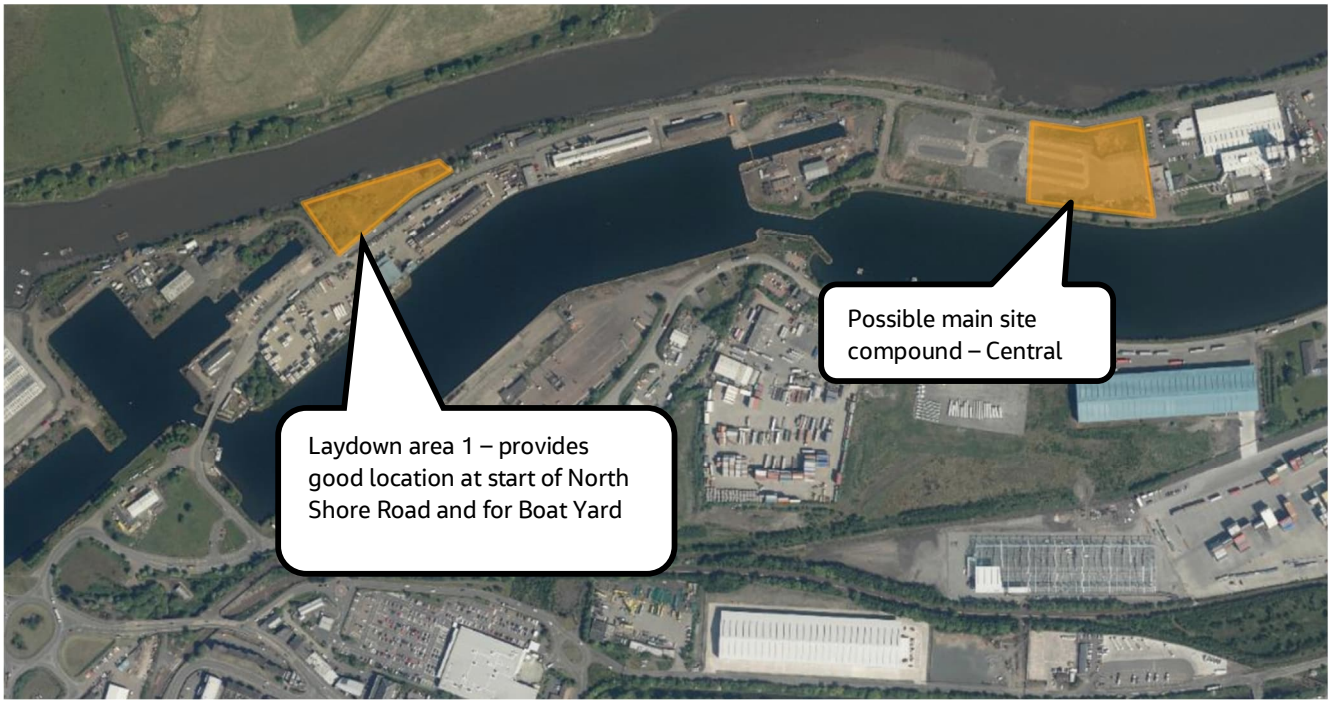

Figure 4 – Possible locations for site compound and laydown areas.

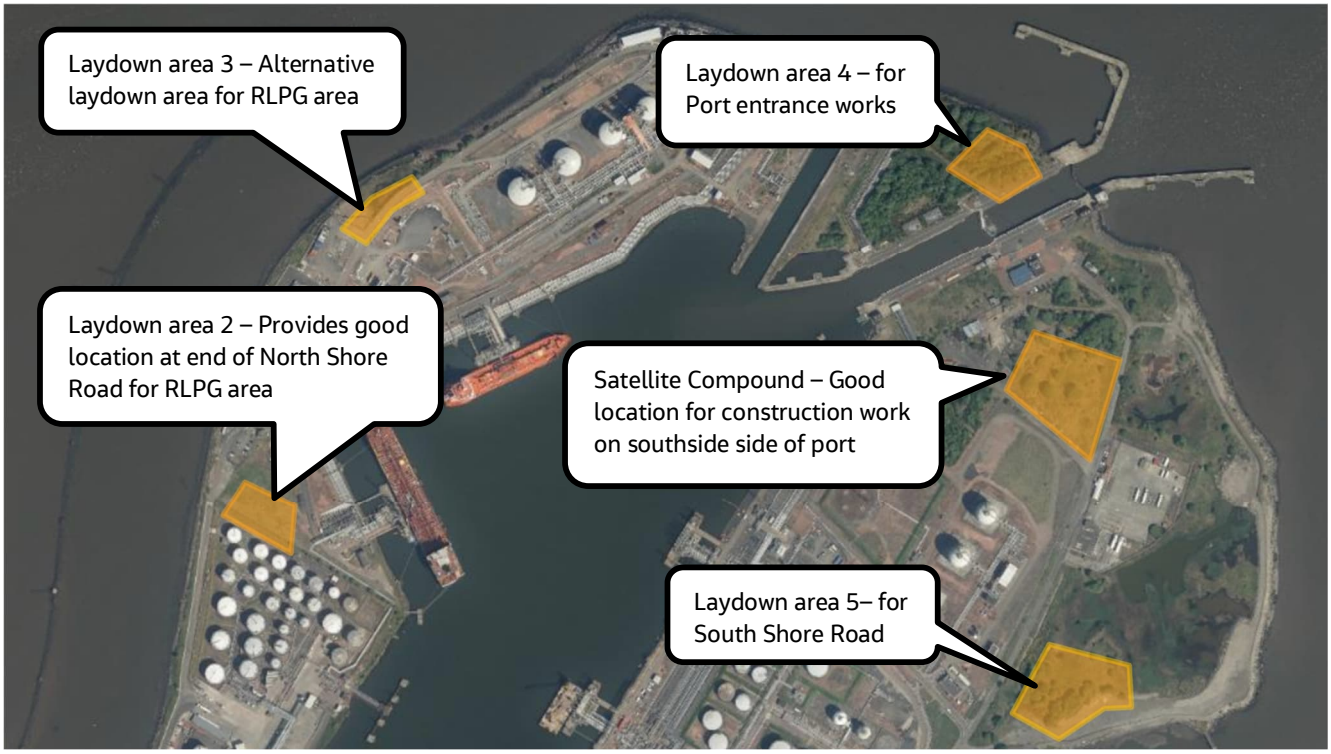

Figure 5 – Possible location for site compound / laydown areas.

The exact location of the site compounds will not be confirmed until the detailed design stage. In the coming years further, engagement will take place with Forth Ports to identify suitable sites within the port.

If no suitable sites are found within the port, the site compounds (example shown in Figure 6) will need be located outside the port which will result in the contractor having to transport materials, plant and welfare units into the port daily which is highly likely to slow the construction of flood defences and increase congestion at the security gates/entrance to the port.

If the site compounds are located within the port, there is likely to be less need for the contractor to enter the port multiple times a day, which would reduce congestion at the entrance to the port. It will be possible to stipulate days and times that contractors are allowed to enter the port to deliver construction materials or plant. The contractors' site workers would need to access the port daily, but it is envisaged they would be given Forth Port passes and could electronically sign-in.

Due to the long duration of the construction programme for the project, it is acknowledged that the security requirements for entering the port may change from the current measures that are in place.

Figure 6 - White Cart Water FPS Phase 3 Site Compound

6. Construction Access

Traffic can access the port via two secure gate location as shown in Figure 7:

- Access 1 (Central Dock Road) - provides access to works within the boat yard area, along North Shore Road, the RLPG site and to the west of the port entrance.
- Access 2 (Powdrake Road) - provides access to works along South Shore Road, the Flo-Gas site, the Port operations facilities and the Port entrance.

As stated in Section 5, reducing the frequency of construction traffic entering and leaving the port can be achieved by locating site compounds and laydown areas within the port.

Figure 7 – Construction works access locations

7. Construction Work

In general, throughout the port the proposed flood defences will take the form of a bare sheet pile wall with capping plate. Following the establishment of the site working area, vegetation clearance and the diversion/ protection of any existing utilities, the construction of the flood defences would commence. The following section will outline some of the main construction work (not every individual operation) associated with the proposed flood defence, not all construction works are noted in this section.

7.1 Sheet Pile Flood Defence Construction

Steel piles would be moved in batches from the site compound/ storage areas to the working areas using suitable road vehicles where they would be off loaded and stacked along the length of the flood defences. Installation of the piles would be undertaken using a suitable pile driving rig, likely to be either a Movax type vibratory hammer rig (similar to a tracked excavator) or a telescopic leader rig (tracked machine with mast and vibratory hammer/ hydraulic press). Depending on ground conditions and risk of encountering an obstruction it may be necessary to pre-auger the pile line (to loosen and break up obstructions) before the installation of piles is undertaken.

Given the piles will remain exposed, it is essential that they are driven to an accurate line and level. This would normally be achieved by using a piling guide to hold the piles in position as they are driven into the ground. On completion of the pile installation a steel capping plate will be welded to the top of the piles and thereafter reinstatement works would commence.

The figures below (figures 8, 9 and10) show various stages of construction.

Figure 8 – Hawick FPS – Pre-augering ahead of pile installation

Figure 9 - White Cart Water FPS Phase 3 - Sheet piles being installed adjacent to road with Movax rig

Figure 10 - Perth FPS – Steel Capping Plate/ Exposed Sheet Pile Flood Defence

7.2 Demountable Defences and Flood Gates

Where demountable defences or a flood gate is proposed, the ground will be excavated down to a level where a reinforced concrete beam can be cast. Typically, this excavation is likely to<1.0m deep from the existing ground levels and no more than 1m wide, a ground beam has been cast (with a sill if required). The flood defences (walls or pillar) either side of the gate will be constructed using reinforced concrete. If necessary, a pillar may be needed to fix the flood gate hinges onto. Once all the concrete work is completed, the new flood gate/demountable flood defence will be installed. For some demountable defences, a recess in the ground beam may be required, to allow an intermediate support post to be installed. The surrounding ground will be reinstated and any local changes to topography undertaken, Figures 11,12 and 13 show a range of demountable barriers and flood gates.

Figure 11 - Exeter FPS – Erection of Demountable Flood Defences

Figure 12 - Demountable Defence Across Rail Track

Figure 13 - Ipswich FPS – Flood Gate Across Rail Track

7.3 In-situ Reinforced Concrete Defences

This section has been split into concrete walls with:

- an in-situ base, and
- casting the wall from an existing concrete/rock surface.

7.3.1 In-situ base

For an in-situ base an area around the base of the wall would be excavated to allow sufficient space for workers to construct the reinforced base. The width of the wall base is likely to be determined by the height of the wall and ground conditions. The reinforcement would be positioned and formwork for the wall base erected in preparation for the concrete pour, see Figure 14. The wall base will be cast before the wall stem is constructed. The wall stem would be cast in a similar manner to the base. This type of wall construction requires multiple concrete pours, and sufficient space around the reinforcement (particularly the base) for workers to erect formwork.

Figure 14 - Hawick FPS – In-situ Reinforced Concrete Wall Showing Base Reinforcement within Sheet Pile Cofferdam

7.3.2 On existing concrete /rock surface

Holes would be drilling into the concrete /rock surface and metal dowls installed. The wall reinforcement will be connected to the dowls, and the formwork erected around the reinforcement. The concrete would be poured, and the formwork removed. This method of construction involves minimal excavation of the existing ground and requires less concrete. If the above method is not possible, then an area of the quay apron will be cut (broken) out and a reinforced concrete wall base cast with a wall stem, similar the method outlined above in section 7.3.1.

7.4 Coastal Revetment

Where required the existing bank will be removed, with large pieces of concrete/rock broken down or removed. A geotextile will be installed on the excavated bank, with the geotextile anchored into the toe of the bank. Bedding rock will be installed on top of the geotextile and armour stone placed on top, See Figure 15. At present, all construction plant will be located on the bank or on North Shore Road.

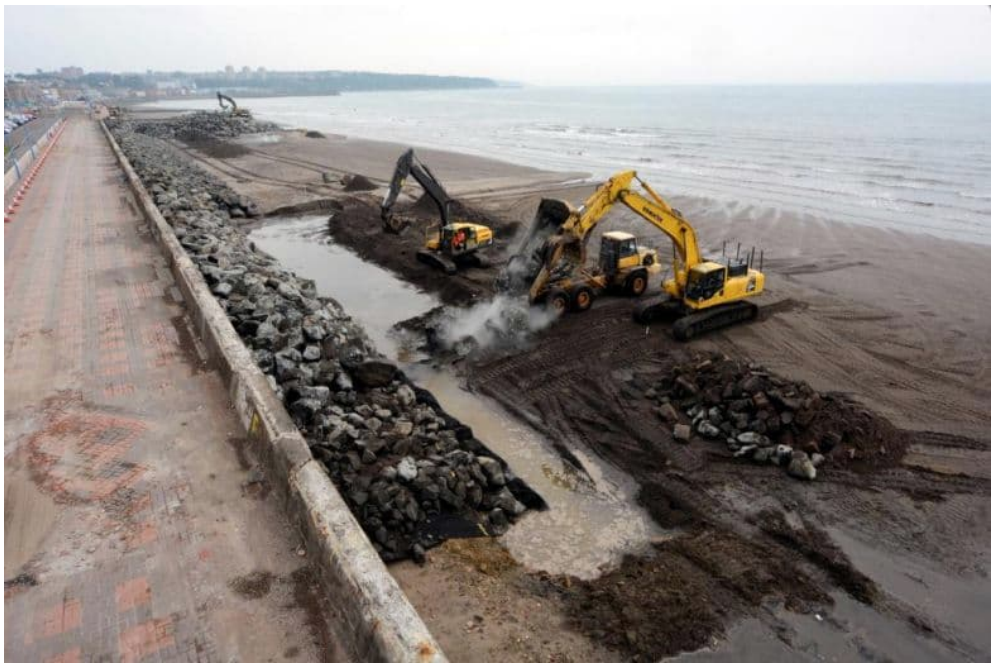

Figure 15 – Kirkcaldy Sea Wall – Rock Revetment Construction. Photo Courtesy VolerWessels UK

7.5 Secondary Drainage

A trench will be dug directly next to the wall and drainage pipes installed. Where required inspection/manhole chambers and outfalls will also be installed. Where possible pre-cast headwalls and chambers will be used to reduce the excavation extent and time taken to install. The trench will be back filled with granular stone and the edges of the trench reinstated, see Figure 16.

Figure 16 – White Cart Water FPS Phase 3 – Secondary Drainage Installation

7.6 Reinstatement

General reinstatement of soft landscaped areas will involve an excavator spreading earth. If required reinstatement of the carriageway will be undertaken with an area planed out and resurfaced. Traffic management measures will be implemented where necessary.

8. Construction Programme/ Constraints

It is not possible at this stage to provide any degree of certainty on the construction programme for the project, particularly. The project does not currently have the statutory consents that are required to allow construction works to commence and the requirement, or not, to hold a public local inquiry will significantly affect when construction works could commence. However, even if there was no public inquiry, the construction phase of the project is still many years away. There are multiple factors which have yet to be agreed or decided will have an impact on the phasing of construction works.

Construction work within the port will be phased/sequenced to minimise potential impacts on port operations. Construction work is likely to take place at 2 or 3 locations simultaneously within the port. The appointed contractor will be responsible for determining the programme and construction sequence for the works in accordance with their contractual obligations including taking into account any constraints identified by Forth Ports and/ or their tenants.

Constraints may be imposed on the contractor, relating to how the works are sequenced or the type of plant which can be used etc. If the constraints are overly onerous this could increase the construction work duration, cost, and complexity of the works.

Examples of constraints that could be incorporated in the construction contract within the port area are listed below:

- Construction work in certain locations may be scheduled for nights or out-with peak times for traffic within the port etc.
- Where a work section will require traffic management along North Shore/South Shore Roads, the contractor may be restricted to a maximum length of lane closure, thereby limiting the extent of the traffic management. Also, any constraints on the number of active working areas under traffic management on the same road, or minimum separation distances if more than one section of traffic management is active.
- Prior to felling trees, out with the breeding bird season, supplementary surveys for breeding birds, bats etc will be required to demonstrate the absence of such species and is a legal requirement depending on species.
- Maximum number of working areas that will be active at one time. All working areas to be agreed with Forth Ports.
- Construction works not allowed between certain dates if this was likely to clash with other significant works or operations being undertaken in the port.