

Welsh Government
M4 Corridor around Newport
Environmental Statement Volume 1
Chapter 3: Scheme Construction

M4CaN-DJV-EGN-ZG_GEN-RP-EN-0026

At Issue | March 2016

Contents

	Page	
3	Scheme Construction	3-1
3.1	Introduction	3-1
3.2	Overall Programme	3-1
3.3	New Section of Motorway	3-2
3.4	Complementary Measures	3-22
3.5	Pre-Construction Environmental Management Plan	3-22

3 Scheme Construction

3.1 Introduction

3.1.1 This chapter provides key information on the construction of the Scheme and provides an overview of the approach to construction and details of the proposed construction methodology. Further information can be found in the Buildability Report (Appendix 3.1) and the Pre-Construction Environmental Management Plan (CEMP) (Appendix 3.2).

3.1.2 The effects of the Scheme have been described throughout the ES based on what is likely (i.e. the likely eventuality) taking into account the requirements of the EIA Directive 2011/92/EU, as amended. Construction information is presented as the 'likely case'. A number of environmental measures are proposed to be implemented to manage environmental effects during construction. Details of these measures are provided in this chapter and in the Pre-Construction Environmental Management Plan (Appendix 3.2) and are set out in each topic chapter. During construction, an Environmental Management System would be implemented. Details of the Environmental Management System are described in the Pre-Construction Environmental Management Plan (Appendix 3.2).

3.1.3 Chapters 2 and 3 of this Environmental Statement (ES), together with the subsequent topic chapters, provide the data required to identify and assess the main and likely significant effects of the Scheme in accordance with Annex IV of the EIA Directive.

3.1.4 A Sustainable Development Report has been prepared for the Scheme which sets out how the Scheme meets the principles of sustainable development.

3.2 Overall Programme

3.2.1 Subject to the successful completion of the statutory procedures, it is anticipated that the main construction activities would begin in early 2018 following a short mobilisation period.

3.2.2 It is anticipated that the construction of the new section of motorway would be completed within approximately four years with a completion date of autumn 2021. Following on from the construction phase, there would be a five-year landscape aftercare period through to autumn 2026.

3.2.3 Work associated with the Complementary Measures (including the reclassification of the existing M4 between Castleton and Magor) would commence on completion of the new section of motorway under a separate construction contract. These works are expected to be completed within two years. However, programmed dates and construction periods may be subject to change depending on factors such as the actual start date, weather conditions and engineering conditions experienced on site. Table 3.1 provides an overview of the construction programme.

Table 3.1: Overall Construction Programme

Activity	Month							
	0 - 6	7-12	13-18	19-24	25-30	31-36	37-44	
Protection of utilities								
Enabling works								
Major earthworks								
Structures								
Embankment construction								
Settlement								
Removal of surcharge material ¹								
Roadworks (including pavement)								

3.3 Proposed New Section of Motorway

Approach to Construction

3.3.1 The general sequence of works during construction of the proposed new section of motorway would depend on the location and engineering needs. However, the general activities would typically include the following.

- Enabling works, including pre-construction ecological mitigation, pre-construction archaeological investigation, provision of access points, temporary fencing and fencing to protect sensitive sites.
- Site clearance and water management works.
- Demolition works.
- Temporary highway diversions and traffic management.
- Diversion/protection of utilities.
- Earthworks.
- Construction of structures, pavement, road works and surfacing.
- Street furniture, including lighting columns, road signs and safety barrier.
- Accommodation works.
- Landscaping.

3.3.2 In addition to the above, the construction methodology includes activities that would occur at specific locations along the route of the new section of motorway, such as at the Gwent Levels, the River Usk Crossing and the Castleton and Magor Interchanges. These activities are set out below.

The Gwent Levels

3.3.3 Activities in this location would include the following.

- Early re-en protection works.
- Ground treatment.

¹ The process of 'surcharging' is explained in the 'Ground Treatment' section of this chapter. Surcharging is where a period of temporary preloading is undertaken using a volume of material in excess of the permanent fill, in order to create settlement within a shorter timeframe..

- Major earthworks and embankment construction (including addition of surcharge material - refer to Ground Treatment section of this chapter below).
- Settlement period.
- Removal of surcharge material.
- Drainage and ree management.
- Construction of reens, culverts and retaining walls.

Castleton and Magor Interchanges

3.3.4 Activities at the Castleton and Magor Interchanges would include the following.

- Topsoil strip.
- Demolition works (including use of blasting during demolition of the existing Pound Hill Overbridge).
- Water management works.
- Major earthworks (including blasting).
- Construction of junctions and tie in with the existing M4.

3.3.5 Details of the new structures, reens, culverts and retaining walls are provided in Chapter 2 of this ES: Scheme Description. The proposed construction techniques to be implemented and the plant to be used are described in the Buildability Report (Appendix 3.1).

River Usk Crossing

3.3.6 Construction of the River Usk Crossing would consist of three main elements: a west approach viaduct, a cable-stayed bridge (of the same type as the Second Severn Crossing) and an east approach viaduct. These structures would be constructed concurrently. The sequence of activities is listed below.

Approach Viaducts East and West

- Installation of bored piles.
- Construction of foundations.
- Construction of the abutments, piers and pier heads.
- Installation of steelwork.
- Installation of concrete precast slabs and construction of the stiches and upstands.

Cable Stayed Bridge

- Demolition of existing buildings.
- Piling works for east and west pylons.
- Construction of foundations for the back span piers and pylons.
- Construction of piers (east and west sides would be constructed concurrently).
- Construction of the pylons.

- Launching of the steelwork for the back spans and construction of the upper pylon.
- Construction of the bridge deck.

Phasing

- 3.3.7** The phasing of the key construction activities for the new section of motorway is set out in Table 3.2 below. These activities are described in more detail in the Buildability Report (Appendix 3.1). Environmental measures relating to these activities are described in the Pre-Construction Environmental Management Plan (Appendix 3.2).

Key Construction Activities

- 3.3.8** The key construction activities from the construction methodology are described below. Further detail is provided in the Buildability Report (Appendix 3.1).

Demolition

- 3.3.9** The construction of the new section of motorway would require the demolition of several existing buildings and structures, which are identified in Chapter 2: Scheme Description and Appendix 3.1 (Buildability Report). Demolition works would be undertaken by a specialist demolition contractor in accordance with method statements approved by the regulator and the local planning authority. Pre-demolition surveys would be undertaken as required. Demolition audits would be undertaken to identify any materials that could be recovered for re-use or recycling.

- 3.3.10** Materials from the demolished buildings and structures would be segregated and processed close to the demolition works. Where possible, materials would be reused within the construction of the new section of motorway. Materials are discussed in more detail in Chapter 12 (Materials).

- 3.3.11** Dust and noise impacts associated with the demolition of buildings and structures and the proposed environmental control measures are described in Chapter 7: Air Quality and Chapter 13: Noise and Vibration and in the Pre-Construction Environmental Management Plan (Appendix 3.2). The measures would include the following.

- Water spraying of structures/use of water as a dust suppressant prior and during demolition.
- Use enclosed chutes and covered skips.
- Protection measures for the Gwent Levels Sites of Special Scientific Interest.

Table 3.2: Construction Phasing

Duration	Activities	Location
Diversion/Protection of Utilities/ Traffic Management		
Q1 to Q3 year 2018 (Usk) Q1 to Q2 year 2018 (Ebbw)	Construct all statutory diversions and temporary access (and haul road and demolition works for River Usk Crossing) from both sides of the River Ebbw and River Usk bridges before piling can commence.	River Ebbw Underbridge. River Usk Crossing.
Q1 to Q2 year 2018	Build access from the Southern Distributor Road (SDR) to the Docks Way Link Road to allow ground treatment to commence and to form the working platforms for the precast piles (east embankment of River Ebbw to west embankment of the River Usk Crossing).	Docks Way Link Road. East embankment of River Ebbw to west embankment of the River Usk Crossing.
Enabling Work		
Q1 to Q4 year 2018	Enabling work including re-en protection (temporary re-en crossings), advanced service diversion/protection measures, site clearance and fencing etc., create access routes (Magor Interchange). More detail on these works are described in the Ecology and Nature Conservation Chapter (Chapter 10) of the Environmental Statement and Appendix 3.2 (Pre-CEMP).	Castleton Interchange, Wentlooge/Caldicot Levels, Magor Interchange.
Q2 to Q4 year 2018	Construct temporary bailey bridge over South Wales to London Mainline (Llandeenny) and/or gain approval to use existing A4810 rail bridge to facilitate bulk earthworks operations.	Magor Interchange.
Major Earthworks		
Q1 year 2018 to Q2 year 2019	Build west embankment to install the launching platform at the west side of the western abutment – enables the structural steelwork to be launched.	River Usk Crossing.
Q1 year 2018 to Q2 year 2019	Build east embankment to install the launching platform at the east side of the eastern abutment – enables the structural steelwork to be launched.	River Usk Crossing.
Q2 year 2018 to Q4 year 2019	Bulk excavation of new eastbound M4 link and Pound Hill Borrow Pit.	Castleton Interchange.
Structures		
Q3 year 2018 to Q4 year 2019	Construct new Magor East B4245 structures, embankments, gyratory and open to traffic.	Magor Interchange
Major Earthworks		
Q4 year 2018 to Q4 year 2020	Build embankment in reinforced earth once precast piles are sufficiently advanced.	East embankment of River Ebbw to west embankment of the River Usk Crossing
Enabling Works		
Q2 year 2018 to Q4	Construct temporary bailey bridge over South Wales to London Mainline (Duffryn).	Wentlooge/Gwent Levels.

Duration	Activities	Location
year 2018		
Embankment Construction		
Q3 year 2018 to Q1 year 2019	Construct working platform band drains and surcharged stage 1 bulk fill to embankments between Church Lane and South Wales to London Mainline (Duffryn).	Wentlooge/Gwent Levels.
Q3 year 2018 to Q3 year 2019	Construct working platform band drains and surcharged stage 1 bulk fill to embankment between Usk East and Glan Llyn Junction.	Caldicot/Gwent Levels.
Structures		
Q4 year 2018 to Q1 year 2020	Construct permanent bridge over South Wales to London Mainline (Duffryn Underbridge).	Wentlooge/Gwent Levels.
Q4 year 2018 to Q4 year 2019	Construct permanent bridge over South Wales to London Mainline (Llandevenny Underbridge).	Magor Interchange
Major Earthworks		
Q4 year 2018 to Q1 year 2019	Bulk excavation of new link road north of existing M4/M48 and deposit along the Caldicot Levels.	Magor Interchange
Embankment Construction		
Q4 year 2018 to Q4 year 2019	Construct working platforms band drains and surcharged stage 1 bulk fill to embankments between Glan Llyn Junction and South Wales to London Mainline (Llandevenny).	Caldicot/Gwent Levels
Q4 year 2018 to Q4 year 2019	Construct working platforms and install pre-cast concrete piles throughout.	Wentlooge/Gwent Levels
Structures		
Q4 year 2018 (North Slip Road). Q4 year 2019 (Motorway mainline). Q1 year 2020 (South Slip Road)	Install the launching platform at the east side of the River Ebbw Underbridge – requires the east embankment to be sufficiently built. This would be undertaken in three stages: - North Slip Road – stage 1. - Motorway Mainline – stage 2; - South Slip Road, stage 3.	River Ebbw Underbridge
Settlement		
Q1 year 2019 to Q1 year 2020	Settlement period – Church Lane to South Wales to London Mainline (Duffryn).	Wentlooge/Gwent Levels
Roadworks		
Q4 year 2019 to Q2 year 2020	Construct eastbound M4 Link Road.	Castleton Interchange
Embankment Construction		
Q4 year 2018 to Q2 year 2019	Construct working platforms band drains and surcharged stage 1 bulk fill to embankments between South Wales to London Mainline (Duffryn) and River Ebbw.	Wentlooge/Gwent Levels
Major Earthworks		

Duration	Activities	Location
Q2 year 2019 to Q3 year 2019	Bulk excavate embankment north of Llandeenny railway to St Brides underpass and deposit along the Caldicot Levels.	Magor Interchange
Structures		
Q4 year 2018 to Q3 year 2019	Construct new B4245 side road and bridge.	Magor Interchange
Q2 year 2019 to Q3 year 2020	Extend existing structures along existing M4/M48 in advance of work to the reclassified M4.	
Q2 to Q4 year 2020	Once the launching of the structural steelwork is complete on the west side of the River Usk Crossing, the reinforced earth walls (near the River Usk) and the Docks Way Link Road roundabout can be completed.	West embankment of the River Usk Crossing
Q2 year 2019 to Q1 year 2021	Construct the pylon to install the stay cables.	River Usk Crossing
Q3 to Q4 year 2018	Construct E7 pier head in order to install a launching platform between E7 to E8.	River Usk Crossing
Q3 year 2018 to Q3 year 2020	Construct new M4 westbound flyover and embankment slip road.	Magor Interchange
Settlement		
Q3 year 2018 to Q4 year 2019	Settlement period.	Docks Link Road
Q3 year 2019 to Q3 year 2020	Settlement period – Usk to Glan Llyn Junction.	Caldicot/Gwent Levels
Roadworks		
Q2 year 2019 to Q2 year 2021	Construct key side roads at Church Lane, Lighthouse Road, Nash Road, Glan Llyn and North Row. (Bridge piers after 12 month settlement).	Wentlooge/Gwent Levels; Caldicot/Gwent Levels
Structures		
Q2 to Q4 year 2020	Construction of the reinforced earth walls (near the River Ebbw) and the Docks Way Junction structures once the launching of the structure steelwork on the east side of the River Ebbw Underbridge is completed.	East embankment of River Ebbw
Q4 year 2019 to Q3 year 2020	Construct the transverse beam on both pylons and launch western and eastern structural steelwork (back spans).	River Usk Crossing
Q1 year 2020 to Q1 year 2021	Construct new Overbridge Link A and eastbound A48M to M4 link.	Castleton Interchange
Settlement		
Q2 year 2019 to Q2 year 2020	Settlement period – South Wales to London Mainline (Duffryn) to Ebbw Bridge.	Wentlooge/Gwent Levels
Q1 to Q4 year 2020	Settlement period – Glan Llyn Junction and South Wales to London Mainline (Llandeenny).	Caldicot/Gwent Levels
Major Earthworks		

Duration	Activities	Location
Q4 year 2019 to Q1 year 2020	Bulk fill to new westbound embankments.	Castleton Interchange
Roadworks		
Q4 year 2019 to Q4 year 2020	Carriageway refurbishment to existing M4 between Junction 23A to tie-in past Junction 23.	Magor Interchange
Q3 year 2020 to Q2 year 2021	Construct road pavement on completion of the embankments and the Docks Way Junction structure.	Docks Link Road
Structures		
Q1 to Q3 year 2020	Complete western and eastern structural steelwork (back spans) to allow installation of structural steelwork for the cable stayed bridge main span. .	River Usk Crossing
Roadworks		
Q1 to Q3 year 2020	Construct westbound M4 link and westbound link to A48M roads.	Castleton Interchange
Removal of Surcharge Material		
Q1 to Q4 year 2020	Excavate surcharge material, road box material and fill to piled embankment east of South Wales to London Mainline (Duffryn) and Ebbw Bridge West, and west of South Wales to London Mainline (Llandeenny).	Wentlooge/Gwent Levels Caldicot/Gwent Levels
Roadworks		
Q2 year 2020 to Q1 year 2021	Motorway mainline road construction.	Wentlooge/Gwent Levels
Traffic Management		
Q3 year 2020	Main Traffic Management switch running new eastbound and westbound.	Castleton Interchange
Major Earthworks		
Q3 year 2020 to Q3 year 2021	Bulk excavation of existing M4 and construct new section of motorway tie-in.	Castleton Interchange
Removal of Surcharge Material		
Q3 year 2020 to Q1 year 2021	Bulk excavation of surcharged material from Caldicot Levels and fill piled embankments and South Wales to London Mainline (Llandeenny).	Magor Interchange
Q1 year 2021	Excavate surcharge and fill reclassified M4 link and Magor East Junction embankments.	Caldicot/Gwent Levels
Roadworks		
Q3 year 2020 to Q3 year 2021	Main line road construction.	Caldicot/Gwent Levels
Q2 to Q3 year 2021	Roadworks to new Magor East Gyratory though link and tie-in existing M4 to new section of motorway.	Magor Interchange

Utilities Works

3.3.12 A number of statutory undertaker utility diversions and private diversions would be required to accommodate the construction of the new section of motorway. Proposed mitigation would range from small localised re-routing and protection measures, to major overhead and underground service diversions.

3.3.13 In addition to National Grid electrical infrastructure, the following utilities have been identified in the vicinity of the new section of motorway.

- British Telecom and Virgin Media infrastructure, including fibre optic cables.
- Dwr Cymru Welsh Water (DCWW) potable water pipelines and sewers (including trunk sewers and rising mains).
- Wales and West Utilities gas mains.
- Western Power Distribution services, including the electrical feed to the Severn Tunnel pumping system, electricity pylons and towers.
- infrastructure belonging to:
 - Solutia - gas pipelines and an effluent pipeline;
 - Air Products, including oxygen, nitrogen and hydrogen pipelines;
 - Tata Steel - an effluent pipeline;
 - Traffic Wales communications equipment;
 - Magor Brewery - raw water feed and effluent pipe; and
 - ABP, including storm water provisions and utilities connections.

3.3.14 Details of the proposed mitigation measures, including diversions where required, are provided in the Buildability Report (Appendix 3.1).

Railway Interface

3.3.15 Two new underbridges would be constructed over the South Wales to London Mainline at Duffryn (Coedkernew) and Llandevenuey (Magor) to accommodate the new section of motorway. Construction would also be in close proximity to Network Rail's Uskmouth spur line, which connects to Uskmouth power station.

3.3.16 Working adjacent to the railway line would be managed by 'possession planning', whereby sections of the railway track would be closed to allow construction activities to be undertaken safely whilst minimising disruption to the train network. Further information on the construction activities to be undertaken and the proposed safety measures (including possessions) is provided in the Buildability Report (Appendix 3.1).

Earthworks

3.3.17 The main earthworks activities for the new section of motorway would include the following.

- Pre-earthworks drainage.
- Soil stripping.
- Bulk earthworks.

- Breaking, ripping or blasting rock.
- Haulage of excavated materials.
- Remediation of contaminated material.
- Temporary storage of excavated materials.
- Placing and compacting of suitable material.

3.3.18 These operations may be supplemented with additional works at some locations depending on conditions encountered, for example, processing of demolition arisings from bridge demolition works and road planings from the motorway tie-in works.

Remediation

3.3.19 The new section of motorway would pass through areas where existing contamination is present. These areas include the sludge lagoons at Tata Steel, the municipal landfill at Docks Way, various industrial and commercial uses at Newport Docks, and the chemical works operated by Solutia. The contamination issues associated with these sites are discussed further in Chapter 11: Geology and Soils of this ES.

3.3.20 In addition to the sites above, there are other areas of land where contamination has been identified as well as areas where contamination may potentially be present based on the previous land uses. These areas are identified in Annex D in the Land Contamination Assessment Report (Appendix 11.1 of the ES).

3.3.21 An Outline Remediation Strategy has been prepared (Appendix 11.2) which sets out the approach that would be followed in areas of known or potential contaminated land. The approach is based on guidance from the Environment Agency and Defra (Model Procedures for the Management of Land Contamination – CLR 11 (Defra/Environment Agency, 2004)) and comprises the following stages.

- Risk assessment – defines whether the contamination poses a risk to human health and/or the environment (refer to Appendix 11.1 of the ES).
- Options appraisal – evaluates the possible remediation options to identify a preferred option or combination of options (Appendix 11.2 of the ES).
- Implementation of remediation – manages the contamination and proves that it has been addressed. Contaminated land would be remediated in accordance with remedial targets set in the Outline Remediation Strategy at Appendix 11.2.

3.3.22 The extent and methodology of remediation required would be determined through further investigation and materials testing. A Land Contamination Management Strategy (Appendix 11.3) has been developed in discussion with Natural Resources Wales (NRW), Newport City Council and Monmouthshire County Council. The strategy describes the general approach to the characterisation of the land contamination risks as well as the design, implementation and verification of remedial works. Control measures to minimise the risk of cross contamination are also summarised in the Pre-Construction Environmental Management Plan (Appendix 3.2).

3.3.23 In the case of land at Tata Steel the material to be remediated would be treated using a stabilisation and solidification technique where the material would be treated with a predetermined quantity of cement. Subject to the results of this testing, this material would be re-used for embankment fill material on the new section of motorway. Further details of the proposed approach to remediation are set out in the Outline Remediation Strategy provided at Appendix 11.2.

Ground Treatment

3.3.24 Ground conditions across the Gwent Levels comprise soft, organic soils and a very high groundwater table. Construction of embankments over such soft soils can lead to settlement over a long period of time, resulting in potential instability of the embankment. To speed up the process of settlement and to ensure a consistent rate of settlement is achieved, vertical band drains would be installed prior to the construction of the embankments. The band drains would allow water within the soil (i.e. pore water) to drain more quickly and reduce the build up of pore water pressure. In combination with the installation of the band drains, additional material (up to 1 metre in height) would be added to the embankment in a process called ‘surcharging’, whereby the additional load would achieve settlement in a shorter period. The surcharge material would be removed after approximately 12 months once consolidation of the embankment has been achieved. Testing would be undertaken to confirm that settlement has been achieved.

3.3.25 This technique of ground treatment (i.e. to accelerate the settlement process) would be applied to embankments up to 5 metres in height. Where higher embankments are required (i.e. above 5 metres) ground treatment would comprise the installation of precast piles to support the embankment fill material. A working platform would be created by laying geotextile on the existing ground upon which up to 1,000 mm in height of stone would be placed. The precast piles would then be installed and the arisings would be stored in stockpiles located at either end of the new section of motorway (i.e. the unsuitable material storage areas). The working platform would become the main haul road during construction (see the Construction Traffic Access section).

Temporary Land Requirements

3.3.26 As with most major infrastructure projects, temporary land would be required during the construction phase to facilitate the works. The following section summarises the key temporary land requirements for the new section of motorway.

Temporary Structures

3.3.27 Four temporary bridges are likely to be required for the construction of the new section of motorway. The location of the bridges would be as follows.

- Across the South Wales to London Mainline at Duffryn.
- Across the South Wales to London Mainline at Llandevenny.
- Across the B4245 Newport Road at Magor.
- Across the existing M4 at Magor.

3.3.28 The bridges would be constructed early in the programme to facilitate the earth moving operation for the new section of motorway. The bridges would be single span structures (with the exception of the bridge over the existing M4, which would be double span) built upon embankments and abutments. It is considered likely that the majority of the abutments would be piled.

3.3.29 The bridges would remain in position until the permanent structures are installed and can be used by construction plant. The temporary bridges would then be removed and the granular material (for the abutments and approach ramps) would be reused as backfill elsewhere within the construction programme.

3.3.30 The construction of the temporary re-en crossings is described in the Water Drainage and Management section below.

Site Compounds and Storage

3.3.31 Three types of compounds would be provided during the construction of the new section of motorway.

- Main compound.
- Section offices.
- Satellite compounds.

3.3.32 A description of the different compounds is provided below and their location is shown in Appendix 3.1.

3.3.33 The main compound would be established to the south of Imperial Park close to the A48 at Coedkernew. The main compound would accommodate approximately 100 staff and would provide car parking, office, training and welfare facilities, overnight plant storage, small tool and material stores and areas for traffic management. It would also house a precast pile manufacturing facility with its own dedicated concrete plant.

3.3.34 Section offices would be provided at either side of the River Usk Crossing and at the Castleton and Magor Interchanges. On the western side of the River Usk, the office would accommodate the staff working on the west approach viaduct, the western part of the River Usk Crossing and construction staff for the River Ebbw Underbridge, totalling approximately 260 staff. The office on the east side of the River Usk Crossing would accommodate up to 170 staff working on the east approach viaduct and eastern part of the cable-stayed bridge. The section offices at the River Usk Crossing would provide offices, training and welfare accommodation and overnight plant storage as well as precast yards and concrete batching plants (one on each side of the river). The precast yards would be used for the manufacture and storage of the precast slabs that would form the deck of the approach viaducts and cable-stayed bridge.

3.3.35 The section offices at Magor and Castleton Interchanges would be slightly smaller and would provide office, training and welfare accommodation for over 100 staff. They would also include overnight plant storage, and small tool and material storage for works on the structures.

3.3.36 The compounds and offices would typically be accessed from the existing road network. However, the section office at the Magor Interchange would only be accessible from the B4245 by cars and small vans. A temporary works access

would be provided for Heavy Goods Vehicles (HGVs) and construction plant from the M48 westbound slip road.

3.3.37 Satellite compounds would be established at structure locations (for example, at North Row). These areas would be used to store plant, equipment and materials, as well as providing mixed storage areas for subcontractors and traffic management. The compounds would also be used for preassembly of reinforcement and construction of formwork.

3.3.38 The majority of compounds would provide welfare facilities, ranging from simple toilet facilities and a canteen at the satellite compounds, to showers, lockers and mess facilities at the main compound and section offices.

3.3.39 Fuel would be stored in dedicated bunded areas at several compounds including the main compound and the section offices. Fuel would not be stored in compounds located within the Gwent Levels Sites of Special Scientific Interest (SSSIs) to reduce the risk of damaging the sensitive environment.

3.3.40 Drainage from the office facilities would be connected to a foul sewer or collected in tanks and periodically removed from site. Oil interceptors would be installed in the compound vehicle parking areas to control runoff. Pollution control measures would be implemented elsewhere in the compounds where required (for example, chemical storage areas).

3.3.41 Overnight parking for earthworks plant would be provided at the following locations.

- Berryhill Farm (for plant serving the works at Castleton and mass haul activities).
- TATA remediation area.
- Magor (for plant serving the works at Magor).
- Ifton quarry (for plant serving the quarry and mass haul activities).

Soil Storage Areas

3.3.42 Topsoil (and subsoil) stockpiles would be created at the Castleton and Magor Interchanges early in the construction programme and would be in place for the duration of the construction phase. The location of the proposed stockpiles is shown in Appendix 3.1. The stockpiles would be used to store the soil stripped prior to the bulk earthworks at the junction tie-in works at Castleton and Magor and from the borrow pit areas. The topsoil from the soil storage areas would not be stripped, but instead the topsoil would be protected *in situ* by geo-textile matting.

3.3.43 A Soil Handling Methodology would be prepared for the new section of motorway which would identify the methods for stripping, handling, storage and replacement of soils. The key issues that would be included in the methodology are set out in the Pre-Construction Environmental Management Plan (Appendix 3.2).

3.3.44 The topsoil and subsoil stockpiles would be up to 3 metres (topsoil) and 5 metres (subsoil) in height and the sides would be graded to prevent ponding. Once the stockpiles have been prepared, they would be seeded with a standard Rye Grass seed mix to minimise soil erosion and colonisation by nuisance weeds.

3.3.45 Following completion of the construction works, topsoil storage areas would be restored to their former use. An aftercare management plan would be developed for each area.

Unsuitable Material Storage Areas

3.3.46 Other storage areas would be provided for unsuitable material (see Appendix 3.1). These stores would predominantly comprise organic and clay material generated during the initial works (for example, arisings from piling and the construction of culverts). This material is considered unsuitable to be used in the construction of the embankments of the new section of motorway (due to high moisture content and high organic matter content) and instead would be used to restore the borrow pits.

3.3.47 The preparation and management of the unsuitable material stores would follow the same approach as the topsoil stockpiles (i.e. topsoil remains *in situ* protected by geotextile matting and seeded to prevent erosion). Additional measures (for example, bunding) may also be required to contain the stores due to the potential instability of the unsuitable material. The height of the unsuitable material stores would be up to 7 metres.

3.3.48 Following completion of construction activities, unsuitable material would be used to restore the borrow pits (see below) and the storage areas would be restored to their former use.

Borrow Pits

3.3.49 Borrow pits would be located at both ends of the new section of motorway at Castleton (mainly at Berryhill Farm) and Magor (see Appendix 3.1). The borrow pits would provide general fill material that would be used to construct the highway embankments across the Gwent Levels. The area around Castleton is underlain by mudstones and clay, which would be excavated using tracked excavators. The Magor area is underlain by limestone and sandstone and is likely to require a combination of open cut excavation and controlled blasting. This material would be processed *in situ* and then removed from the excavation. It is intended that the blasting would be carried out once a day under controlled conditions during the period of major earthworks. Local residents and businesses would be given advanced warning of when the blasting would take place. Further details on the controlled blasting are provided in Appendix 3.1. Environmental measures to limit the dust and noise issues associated with blasting are described in Chapter 7: Air Quality, Chapter 13: Noise and Vibration and the Pre-Construction Environmental Management Plan (Appendix 3.2).

3.3.50 The borrow pits would typically be up to 5 metres in depth. However, this would depend on the local geological conditions. The pits would be restored using the unsuitable material generated from the creation of the water treatment areas towards the end of the construction phase. The material would be excavated and directly placed into the borrow pits to avoid double handling. Other unsuitable material already excavated and stored in the stockpiles would also be used to restore the borrow pits.

Batching Plants

3.3.51 Dedicated batching plants would be provided to ensure a continuous supply of materials is available. A summary of the batching plants is set out below.

- Concrete (structural and cement bound material): Two mobile concrete batching plants located at either side of the River Usk Crossing would provide a supply of concrete for all structural and cement bound material mixes. The existing readymix plants at Cardiff and Newport would provide the early requirements for concrete until the new dedicated mobile plants are established. They also may be used to provide alternative or back-up supplies during construction, if required.
- Cementitious Grout: Generally this would be batched in small quantities close to the point of use (for example, where soil nailing and rock anchoring works may be required at Castleton and Magor).
- Precast Concrete: Concrete for the precast piles would be supplied by the batching plant located at the main compound at Imperial Park and the River Usk Crossing precast yards.

Construction Traffic Access

Traffic Strategy

3.3.52 The key objective of the construction traffic management strategy would be to avoid the use of the existing M4 and local road network where possible. There would be instances where this is unavoidable, for example early in the construction programme for the transport of materials and plant until construction access points have been established; during tie-in works with the existing highways and junction remodelling at Castleton and Magor; and during pavement laying operations.

3.3.53 The early establishment of haul roads is essential to delivering the programmed earthworks as they provide a direct route between each section of work along the route. Three types of haul road would be used during the construction of the new section of motorway, all of which would be within the construction boundary i.e. with the limits of the permanent and temporary land take. These haul roads would include the following.

- Earthworks haul road.
- Structures haul road.
- Combined haul road.

3.3.54 The majority of haul movements would use the earthworks haul road. It would extend along the main line of the new section of motorway within the permanent land take and would use the working platform installed as part of the ground treatment works (see Ground Treatment section). The haul road would be kept to one side of the carriageway footprint using the working platform, whilst works are undertaken on the other half of the carriageway. On completion of the works, the haul road would be moved to the other side of the carriageway to allow the remaining ground treatment and embankment construction works to be undertaken. For further details refer to Appendix 3.1.

- 3.3.55** The earthworks haul road would have a running surface of 10 metres width to allow the safe passing of vehicles, outside of which would be temporary bunded areas to control surface runoff. These bunded areas are described in more detail in the Water Management and Drainage Section and Appendix 3.1. For the majority of its length, the earthworks haul road would only be used by earthworks plant and vehicle. However, the section between Nash Road and the River Usk Crossing (eastern works access) would be stabilised to allow its use by road vehicles.
- 3.3.56** In addition to the earthworks haul road, there would also be a dedicated earthworks haul road located at the eastern end of the new section of motorway to the boundary of Ifton Quarry. It would be used to haul rock from the quarry.
- 3.3.57** The structures haul road would be used for delivering materials and plant for constructing structures (such as overbridges, underbridges and culverts). It would be up to 7 metres wide and formed of aggregate material. An alternative approach may be adopted for the section of new motorway to the east and west of Lighthouse Road and Nash Road, where early access is required to begin the culvert installation and the piling works for structures. This alternative approach would involve the construction of a stabilised haul road where a predetermined quantity of cement and lime would be mixed with topsoil to a depth of approximately 500 mm and then rolled and covered with stone. The stabilised haul road would be located along the centre line of the proposed new section of motorway and would form part of the working platform for the ground treatment (see Ground Treatment section). This approach provides a quicker method of construction and uses fewer resources.
- 3.3.58** The combined haul road would be used by earthworks and structures traffic. It would be up to 10 metres wide and constructed of quarried material. It would be used at pinch points along the new section of motorway at areas where there would be construction of structures, culverts and piled embankments and where haul roads are required to cross temporary bridges (for example, the Duffryn and Llandevenny Overbridges). The combined haul road would be maintained to a standard to allow it to be used by road-going vehicles such as concrete truck mixers and material deliveries.

Abnormal Load Holding Areas

- 3.3.59** Some deliveries would be categorised as abnormal loads. These are likely to be associated with major earth moving plant, cranes and the steel and pre-cast concrete bridge beam elements. Temporary holding areas would be required to control the deliveries of abnormal loads to the works areas. The proposed holding areas are summarised below.
- Wilcrick (Magor) – following the relocation of the existing Wilcrick Depot early in the construction programme, the depot would be demolished. The remaining upper yard would be used to accommodate abnormal loads, in particular controlling the delivery of steel bridge beams for the eastern side of the River Usk Crossing. From the depot, abnormal loads would travel along the B4245 to access the works areas at Magor. To access the works areas at the River Usk Crossing, Nash /Meadows Road and Glan Llyn the abnormal loads would use the B4245 and the A4810.

- A449 Newbridge on Usk (South of Usk) – the existing southbound layby on the A449 near Newbridge on Usk would be used for bridge beam storage for the western side of the River Usk Crossing, the River Ebbw Underbridge and other structures west of the Ebbw, including Castleton Interchange. Abnormal loads would travel on the A449 to the M4, leaving the motorway at Junction 28 and onto the A48 to access the works areas.
- Docks Way – an access would be constructed from the existing Newport SDR onto the new Docks Way. This would provide a holding area within the compound area for a number of beam deliveries for the western side of the River Usk Crossing and the River Ebbw Underbridge.

Construction Traffic

3.3.60 Indicative construction traffic numbers for the key access routes have been calculated and can be found in Appendix 3.3.

Temporary Road Diversions

3.3.61 A number of road diversions would be required during the construction programme. These diversions would vary in duration from a few hours for a total motorway closure to a number of months for a strategic side road closure.

3.3.62 To construct the new Junction 23 at Magor, a number of side roads would require long term closure and diversion.

- St Brides Road would be closed for public use for the duration of the construction phase. This would accommodate utility protection works within St Brides Road, existing structure extension works north and south of the existing underbridge and provide construction traffic routes to and from Ifton Quarry and the borrow pits at Magor beneath the existing M4. The main diversion would be via St Brides Road, Rockfield Lane Underbridge, the Elms and the B4245. A diversion for would also be provided running from the Junction 23 roundabout to the north of the motorway services and connecting to St Brides Road north of the M4.
- Knollbury Lane would be closed for a duration of one year for utilities diversions and the construction of the new Knollbury Lane Overbridge to span the link between the reclassified M4 and the new M48 roundabout. The main diversion would be via Vinegar Hill, the B4245, the Elms and Rockfield Lane Underbridge.
- Rockfield Lane and Bencroft Lane would be subject to day/night closures over a period of three weeks. This is to accommodate the installation of the bridge beams to the new Rockfield Lane and Bencroft Lane Underbridges. It is expected that these underbridges would be constructed before the construction of the new Knollbury Lane Overbridge so as to avoid further disruption to the local highway network. The local north – south side road routes may require localised upgrading with the provision of temporary passing places in the lanes.
- Church Lane Overbridge would be built offline. Its northern approach embankment would obstruct the current junction of Church Lane with the adjacent roundabout. Traffic would be diverted along Church Lane and back onto the existing network via the new roundabout and link road. The

roundabout would be constructed in phases to maintain vehicular access to commercial premises.

3.3.63 Whilst St Brides Road would be closed to the public for the duration of the construction period, the closure of the other local roads in the Magor area (i.e. Knollbury Lane, Rockfield Lane and Bencroft Lane) would be managed to ensure that at least one of these roads remains open for public use.

3.3.64 Temporary road diversion construction works would be avoided in most locations where the existing side roads are bisected by the new section of motorway; i.e. Lighthouse Road, Nash Road, Newport Road, North Row and Bareland Street. At these locations, new over or underbridges would be provided. The existing side roads would remain open to traffic until the new permanent overbridges are complete. These overbridges, underbridges and modifications to the existing highway are described in Chapter 2 (Scheme Description) of this ES.

Water Management and Drainage

Pre-Earthworks Drainage

3.3.65 Runoff from exposed ground and material stockpiles is one of the main potential sources of sediment during the construction programme. Rainfall and associated surface water runoff during construction works may mobilise and transport sediment and other pollutants into the water environment causing potential harm to plants and animals. To minimise potential runoff from topsoil stripping and storage, the following measures would be implemented.

- Where possible, vegetation and topsoil would be left in place to minimise the area of ground exposed to runoff. Where topsoil is stripped, vegetation clearance and soil stripping operations would take place as late as possible prior to other works in the area. Appropriate control measures would be implemented where stripping would take place within 10 metres of a watercourse. These measures are described in the Pre-CEMP (Appendix 3.2).
- Topsoil stores would be managed by establishing a grass cover.
- Silt fencing would be installed around the margins of topsoil mounds and other areas where appropriate, to minimise the risk of sediment-laden runoff reaching watercourses.

3.3.66 In the work areas at Castleton and Magor Interchanges, cut off ditches would be constructed, where required, on the uphill side of the works area. These ditches would intercept overland flow from adjacent land areas to reduce the flow over exposed ground and thereby reduce the amount of silt-laden runoff generated. The cut off ditches would drain under gravity to existing field ditches. At each outfall to a field ditch, straw bales wrapped in geotextile would be staked across the channel to act as a primary filter and reduce suspended sediment that may have been disturbed in the newly cut ditches.

3.3.67 Baffles would be created within the cut off ditches to break up the flow distances and promote the settlement of fines. The baffles would be constructed from clean stone within geotextile bags and would be placed where there is a significant fall in the ditch gradient and/or long ditch sections leading to a single outfall.

Water Management across the Gwent Levels

3.3.68 For the majority of its length, the new section of motorway would cross the Gwent Levels, which contain a large number of interconnecting watercourses (reens and field ditches) which feed into the Severn Estuary. The reens are ecologically sensitive and the area is designated as a series of Sites of Special Scientific Interest (SSSIs). The proposed new section of motorway would result in the loss of reen and ditch habitat, which would have consequent effects on insects and invertebrates. Ecological mitigation measures that would be implemented are contained within a SSSI Mitigation Strategy (Appendix 10.35).

3.3.69 A number of existing reens crossed by the new section of motorway would be maintained as part of the design. The effect of construction on water quality and the current function of the reen system with respect to flood risk are described in Chapter 16: Road Drainage and the Water Environment.

3.3.70 The key stages of constructing reen crossings are set out below.

- Temporary pipes would be installed within the existing reens and ditches early in the construction programme to maintain connectivity of the watercourses and to provide temporary plant crossings. The number of pipes installed would vary according to the reen channel dimensions and the discharge rate.
- The permanent box culverts would be installed with piled foundations. In areas where precast driven piles are used, the permanent box culvert would be installed after the piling is installed.
- The permanent culvert installation would take place once the haul road is constructed. The culverts would be constructed on a half and half basis (i.e. constructing half of the culvert, switching the haul road to the other side of the carriageway then construct the other half of the culvert) to maintain the haul route access through the site.

3.3.71 During construction, surface water runoff from the embankments would be managed by capture and settlement before being released to the existing reen system. The runoff would be captured in a bunded area located along the corridor of construction between the main line embankment and the permanent parallel field ditch/replacement reen. The bund would be approximately 1 metre above ground level. The adjacent channel would remain vegetated (i.e. the topsoil would not be stripped) for the following purposes.

- To protect the underlying organic material.
- To reduce the amount of unsuitable material generated.
- To retard the flow of water towards the outfall point. The grass would also act as a filter.
- To facilitate the deposition of sediment and the retention of oily residues and organic matter, which would be broken down in the top layer of soil and vegetation.

3.3.72 Due to the minimal longitudinal falls across the Levels, the bunded areas would act as lateral settlement lagoons. Silt fences and settlement weirs would be installed at reens to prevent runoff from entering the reens prior to settlement. Runoff would migrate to natural low areas within the bunded areas and would be

pumped to the nearest water treatment area. It is intended to use the location of the permanent water treatment areas as temporary lagoons for water management during construction.

3.3.73 The temporary lagoons would be formed by approximately 1 metre high perimeter bunds on top of the existing ground surface. The size and layout of the lagoons would be designed to achieve the required degree of settlement and water quality as well as the capacity to accommodate storm events. A water sampling regime would be implemented to ensure that the settled water achieves the required turbidity parameters and can be discharged into the ree network.

3.3.74 Towards the end of construction, the temporary lagoons would be cleaned out of sediments and the permanent water treatment areas would be constructed. The location of the water treatment areas is shown in Figure 2.5. The construction sequence for the permanent water treatment areas is set out below.

- Secure the water treatment areas with permanent or temporary fencing.
- Complete the bund around the attenuation pond (if not done completely during the temporary state).
- Clean out the sediment and excavate the pollution control lagoon, attenuation lagoon and reed bed. The excavated material would be deposited directly within the borrow pits as part of their restoration.
- Install and secure the liner as specified to prevent the seepage of wastewater to the environment.
- Install the carrier pipe from the motorway and to the outlet ree.
- Fill the reed bed with pea gravel and topsoil.
- Install the permanent security fence.

Construction Lighting

3.3.75 Lighting would be provided as required during periods of normal working hours in autumn and winter and for night time working. As far as possible, task lighting would be used for specific works to direct light towards the working areas during the night time. Such task lighting would be positioned at low level on posts and directed at the most frequently used areas of work.

3.3.76 Inward facing security lighting would be provided at construction compounds on a 24 hour basis.

3.3.77 A lighting strategy for the construction period would be developed to identify the type of lighting to be used and measures to be implemented to reduce light spill. The strategy would be agreed with the local planning authority and the regulator.

Security and Fencing

3.3.78 Temporary boundary fencing would be installed around the new section of motorway to mark the temporary boundary during the construction phase. Security fencing and gated access points would be provided at the main compound, section compounds and satellite compounds. All visitors to the compounds would be required to sign in and out. CCTV and/or security staff would be employed at the compounds where necessary.

3.3.79 The proposed western compound for the River Usk Crossing would be located on land owned by the Association of British Ports (ABP). The compound would be divided into four areas all of which would be fenced and secure gates provided. The construction works would not compromise ABP's existing security arrangements and the north/south access for ABP would be maintained during the construction period. If required, an additional security gate would be provided for the crossing of West Way Road.

Construction Waste

3.3.80 The types and estimated quantities of waste likely to be generated during the construction phase have been identified within the Outline Site Waste Management Plan (Annex F to Appendix 3.2) based on experience from similar projects. The Plan sets out a series of measures for managing the waste, which are in accordance with the waste hierarchy principle, duty of care requirements and industry best practice. The Site Waste Management Plan is a live document that would be updated during the detailed design and construction process to document the management of waste.

Use of Natural Resources

3.3.81 The use of natural resources for the construction of the new section of motorway is considered in the Chapter 12: Materials of this ES. The chapter provides details on the source of materials (both on and off site), the construction materials balance, processing and storage of materials, contamination and the suitability for re-use of site won materials.

3.3.82 The logistics strategy for the bulk import of materials would be to source material on site or close to site wherever practicable. Suitable and acceptable material for highway embankment construction (for example, surcharge materials and class 2 fill) would be sourced at either end of the new section of motorway, where the geology comprises mudstones (Castleton) and sandstone, limestone and conglomerate (Magor). Nearby quarries (such as Ifton and Machen quarries) would be used to source imported granular and rock fill materials.

Residues and Emissions

3.3.83 Details of residues and emissions in relation to air (for example, dust), noise and vibration, soil and water are set out in Chapters 7, 13, 11 and 16 of this ES respectively. Details of construction lighting are provided within this chapter and considered within Chapters 9 and 10 of this ES, where relevant. As set out in Chapter 5 of this ES, the Scheme is not likely to give rise to heat or radiation emissions during its construction phase.

Land Restoration

3.3.84 Following completion of works, all temporary construction work sites would be removed. The land affected by temporary works would be restored.

3.3.85 The borrow pit areas would be re-profiled using material generated from the works deemed unsuitable for use in the construction of highways. In some cases, areas would be planted and restored to woodland as part of the proposed environmental mitigation. The material required to refill certain borrow pits along the new section of motorway is likely to fall short of the amount of material

extracted. In such areas, the land would be re-profiled in sympathy with local surroundings.

3.4 Complementary Measures

3.4.1 The Complementary Measures are described in Chapter 2 (Scheme Description) of the ES. The construction activities required to implement these measures are relatively limited, with most of the measures being undertaken within the existing highway boundary. Existing roadwork elements such as emergency roadside telephones would be retained and there would be no enhancement of the road drainage. Traffic signs along the existing motorway would be changed from motorway signs to trunk road signs (i.e. from blue to green).

3.4.2 An overview of the construction activities is set out below.

- From Junction 23A to Junction 24 the existing lane 1 and hard shoulder would be hatched out of use by road markings.
- From Junction 24 to Junction 25 on the westbound carriageway the existing lane 1 would be hatched out of use by road markings.
- Through Junction 28, the existing lane 1 and hard shoulder would be hatched out of use by road markings.
- The westbound diverge slip road for Junction 25 would be widened (within the highway boundary) by the construction of a new retaining wall.
- New connecting slip roads would be constructed between the Junction 25-25A link roads and the motorway, which would fall outside of the existing pavement footprint.

3.5 Pre-Construction Environmental Management Plan

3.5.1 A Pre-Construction Environmental Management Plan (Pre-CEMP) has been developed during the EIA process and is provided as Appendix 3.2 to this chapter. The Pre-CEMP sets out the means by which the various construction activities would be managed to comply with the relevant environmental legislation and best practice to minimise effects on local residents and environmental receptors. Following publication of the draft Orders and the Public Local Inquiry, the Pre-CEMP would be developed into a full CEMP, which would be in place before construction begins. The CEMP would be incorporated into the Health and Safety Environmental Management Plan (HASEMP).

3.5.2 The CEMP would be agreed with key stakeholders including Natural Resources Wales and the local planning authorities. The CEMP would integrate the construction activities with the requirements of environmental legislation and best practice. It would comprise detailed statements for the methods and controls proposed to safeguard the environment and mitigate the adverse effects of construction. It would be a mandatory requirement for both the main contractor and all subcontractors to comply with the CEMP to ensure best practice is implemented during construction and to safeguard the environment.

3.5.3 Further details of the purpose of the Pre-CEMP and CEMP are provided in Chapter 18 of this ES and Appendix 3.2.

3.5.4 A separate CEMP would be in force for the Complementary Measures as this would be constructed under a separate construction contract.

Working Hours

3.5.5 The normal working hours would be 07.00 to 19.00 hours (Monday to Friday), and 07.00 to 17.00 hours on Saturdays. The majority of construction activities would be undertaken within this period. In certain circumstances, specific works may have to be undertaken outside the normal working hours. Night working would also be required in some cases. This would include work to be carried out with enhanced safety requirements and, in some cases, to minimise disruption to daytime road users. These works would include the demolition of the existing overbridges at the A48(M) and Pound Hill, the installation of the decks on the underbridges and overbridges at the Castleton Interchange and the construction of the pylon upper legs on the River Usk Crossing.

3.5.6 On a few occasions, weekend closures of the highway would be required where 24 hour working is needed for some essential and complex operations.

3.5.7 Any working outside the normal hours would be agreed with the local Environmental Health Officer (or equivalent) and local residents would be informed.

Community Liaison

3.5.8 Prior to commencing construction activities, a Public Liaison Officer (PLO) would be appointed for the Scheme. The PLO would be the main direct contact for Community Councils, local planning authorities, local residents, businesses and stakeholder groups and would be responsible for managing and implementing the Communications Strategy.

3.5.9 The Communications Strategy sets out the measures that would be used to contact Community Councils, local planning authorities, local residents and businesses to provide information on the construction programme and upcoming construction works in their area. The Strategy also describes how the wider public could obtain information on the Scheme.

3.5.10 The key communication methods are set out below.

- Public meetings would be held to update local people and other interested parties on progress of the works and future activities.
- A visitor and resource centre would be established within the main project office.
- Exhibitions at local events would offer a range of information relating to the Scheme.
- A Scheme website would be established.
- Quarterly newsletters would be published and distributed to promote the overall progress of the Scheme and upcoming works. The newsletters would be distributed to residential and business premises in the vicinity of the construction works. Copies would also be placed in local libraries, the visitor centre and on the Scheme website.

- Leaflet drops would supplement newsletters. They would be targeted at residents and businesses that may be affected by specific construction activities to provide advanced notice of works.
- Notice and display boards would be erected in public areas and regularly updated with Scheme information.
- A 24-hour public help line would be set up, the details of which would be promoted on site notice boards, newsletters, flyers and press releases.

3.5.11 A complaints procedure would be established for the Scheme. The procedure would be managed using the Incidents, Complaints and Enquiries (ICE) Database. All complaints would be recorded with the intention of resolving the complaint within seven days of being reported. The action taken to resolve the complaints would also be recorded.

3.5.12 An Environmental Liaison Group has been established for the Scheme comprising key stakeholders such as Natural Resources Wales. The Group would meet at regular intervals during the construction period.