3. The preferred option

3.1. Full River Sowy and King's Sedgemoor Drain Enhancements Scheme

The preferred option for the full River Sowy and King's Sedgemoor Drain Enhancements Scheme will provide up to a 40% increase in the nominal flow capacity of the Sowy (from 17m³/s to 24m³/s) and for the KSD (from 17m^3 to 27m^3). This will be achieved by a combination of enhanced capacity (channel widening and/or raising or setting back of informal flood embankments) and enhanced operation of Monk's Leaze Clyce.

3.2. River Sowy and King's Sedgemoor Drain Enhancements Scheme: Phase 1 (the Proposed Scheme)

3.2.1. Scheme design

Phase 1 of the full River Sowy and King's Sedgemoor Drain Enhancements Scheme focusses on capacity enhancements between Monk's Leaze Clyce on the Sowy and Parchey Bridge on the KSD as shown on Figure 3.1 (Appendix A) and set out in Table 3.1 below.

Table 3.1 Proposed capacity enhancement works, by location

Location		Bank raising	Channel widening
Upper Sowy	Sowy between Monk's Leaze Clyce and A372 Beer Wall	Raising of existing informal flood banks on right bank by up to 0.5m to achieve capacity of 17m^3/s.	None
Lower Sowy	Sowy between A372 Beer Wall and A361	Raising of existing informal flood banks on left and right bank by up to 0.3m to achieve a capacity of 24m^3/s.	On the right banks: • One embayment • One section of two-stage channel
	Sowy between A361 and Sowy/KSD confluence	Raising of existing informal flood banks on left bank by up to 0.3m to achieve a capacity of 24m^3/s. No bank raising on the right bank.	On the right bank: • One embayment • One section of two-stage channel
KSD	KSD between Sowy/KSD confluence and Parchey Bridge	Raising of existing informal flood banks on left and right bank by up to 0.5m to achieve a capacity of up to 27m^3/s	On the right bank: • One embayment • One backwater

Location		Bank raising	Channel widening
			• One section of two-stage channel

Raising and re-profiling of existing informal flood embankments

Where existing informal flood embankments are to be re-profiled or raised, the crest width will be maintained at a minimum of 3m or increased to 3m, with formed battered embankment sides of 1 in 3 slopes on the channel side and 1 in 5 slopes on the landward side (see Figure 3.2 on p19) and indicative cross sections provided in Appendix H). Material required for raising of the existing informal flood embankments on the KSD will be won through re-profiling of the existing informal flood embankments on the right bank and left bank in the locations shown on Figure 3.1 (Appendix A), in accordance with the process shown in Figure 3.2 (p19). Material required for raising of the existing informal flood embankments on the Upper and Lower Sowy will be imported under CL:AIRE Code of Practice (CoP) from a soils processing plant located off the A372 near Westonzoyland (see Figure 3.1, Appendix A). Material won through creation of channel widening features will be landscaped on the landward side of the existing informal flood embankments.

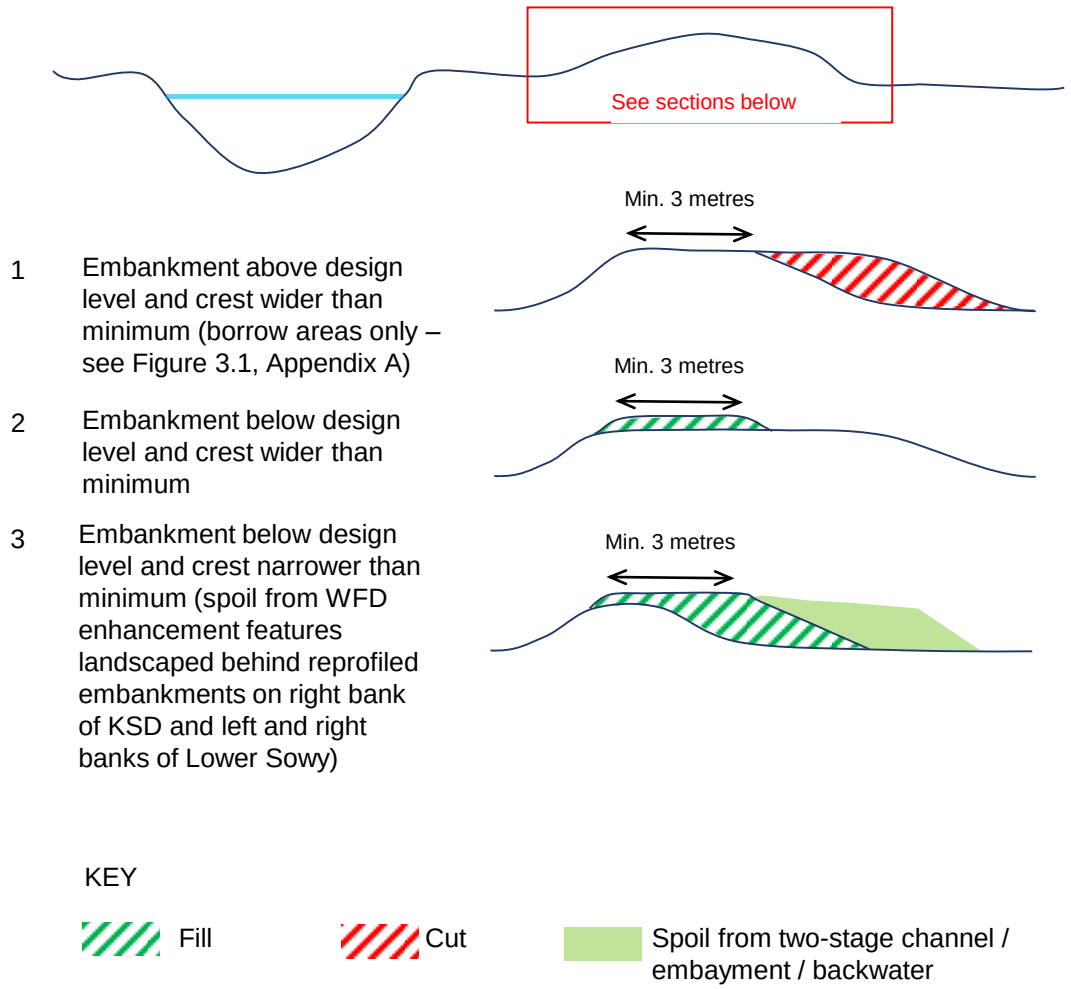

Figure 3.2 Schematic illustration of bank re-profiling process

Channel widening: embayments, two-stage channel and back waters

The Proposed Scheme includes creation of channel bank features on the right bank of the KSD and Lower Sowy at the locations indicated on Figure 3.1 (Appendix A) and outlined in Table 3.1 which both provide a small degree of additional channel capacity within the Sowy and KSD corridor and help to increase the diversity of aquatic and riparian habitats available within these man-made artificial waterbodies.

- Two-stage channels: 150m in length, with channel widening of 1.5-2m and a c. 5m marginal shelf with shelf level of 300mm below summer pen
- Embayments: 135-150m in length depending on location and 5-6m in width, with shelf level of 300mm below summer pen
- Backwaters: 100-150m in length depending upon location, back channel 5-6m wide, with a “planted island” of 5m width

Proposed locations for the WFD enhancement features, along with typical plan view layouts and cross sections for each type of enhancement (e.g. embayment, two-stage channel and backwater), are shown on the indicative design drawings provided in Appendix H as well as the Landscape Masterplan (LMP) in Appendix I.

Landscaping

Landscaping proposals include riparian ‘wet scrub’ planting on the backwater ‘island’ to provide biodiversity habitat and bank stabilisation benefits and replacement tree planting (birch, crack willow and goat willow) at a 1:5 ratio for any trees which will be removed to facilitate bank raising works.

Re-profiled flood embankments, new channel banks and working areas will be reseeded with a neutral wet grassland (NWG) or other appropriate seed mix. Full landscaping proposals are illustrated on the LMP (Appendix I) and described further within Chapter 11.

Additional works

The Cossington Right and Chilton Right outfalls (see Figure 3.1, Appendix A) both include concrete headwalls and steel sheet-piled wing walls. Crest levels of both structures are below the required design level and will be modified as shown in the design drawings provided in Appendix H to provide a continuous defence level when combined with the bank raising works identified in Table 3.1.

3.2.2. Operation and maintenance (including Mitigation Action Plan provisions)

Operation

Existing water control structures will continue to provide a mechanism to achieve the required summer and winter pen levels on the moors. Uncontrolled flooding across the wider floodplain will also continue to occur when either one or both of the spillways run when the channel capacity of the Sowy and informal flood embankments is exceeded. This effect is particularly noticeable at the Aller Moor spillway because a culverted crossing immediately downstream causes a throttle effect with excess water spilling over the Sowy, into Middle Moor and, from there through Aller Moor and down to Beer Wall (Figure 3.3, p21). However, due to the increase in channel capacity there could be a reduction in the frequency, duration and extent of some of the more regular, low level events that provide temporary ‘splash’ conditions that are beneficial for water birds during the winter months. This situation would typically occur once the full River Sowy and King’s Sedgemoor Drain Enhancements Scheme (all phases) have been completed and the ‘enhanced operation’ aspects of the Scheme implemented.

The Proposed Scheme (Phase 1 of the full River Sowy and King’s Sedgemoor Drain Enhancements Scheme) includes only a proportion of the capacity enhancement element of the full River Sowy and King’s Sedgemoor Drain Enhancements Scheme. Nevertheless, together with Natural England (NE) and the Somerset Drainage Board Consortium (SDBC), we have developed a Mitigation Action Plan (MAP) (see Appendix J). This will ensure that there is no deterioration in habitat availability or quality within the Somerset Levels and Moors Special Protection Area (SPA), as a consequence of the combined effects of the full River Sowy and King’s Sedgemoor Drain Enhancements Scheme and the Oath to Burrowbridge Dredging scheme undertaken by the Parrett Internal Drainage Board (IDB) in 2019.

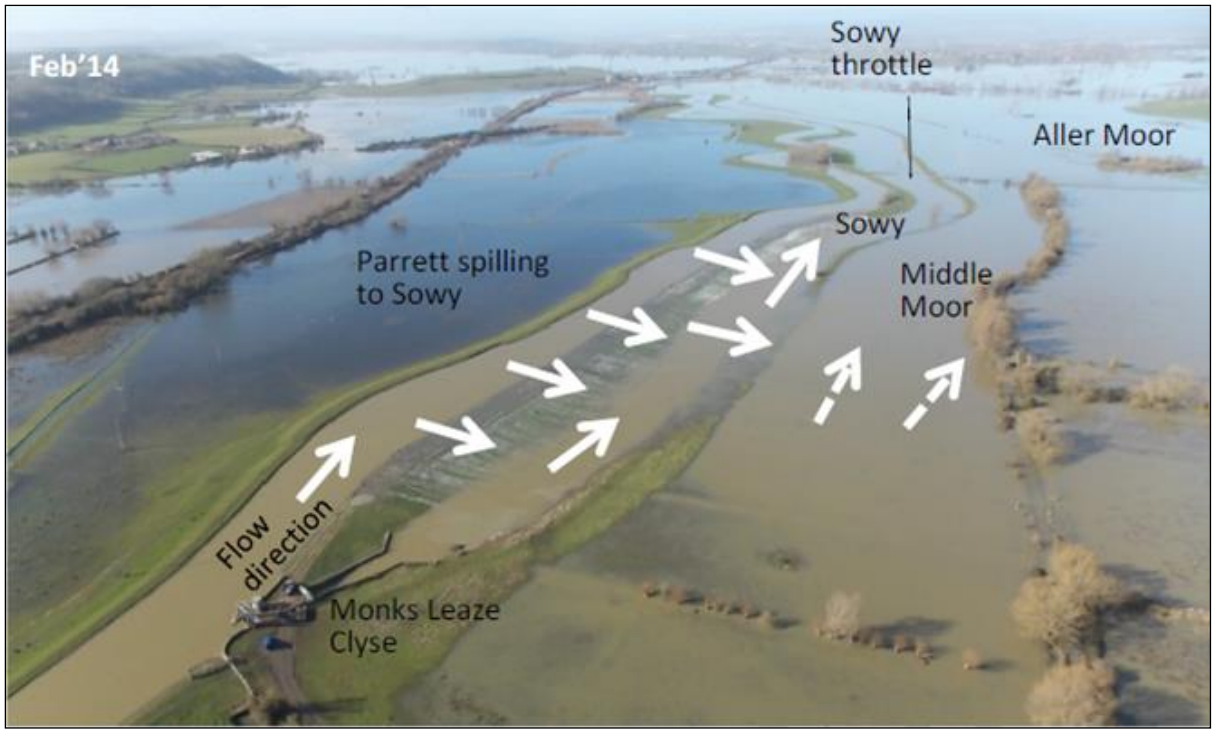

Figure 3.3 Flood pathways when the Sowy capacity is exceeded and Aller Moor spillway is running

Parrett Dredging and River Sowy and King's Sedgemoor Drain Enhancements Scheme Mitigation Plan

The MAP was developed between the EA, IDB and NE and includes both general mitigation measures and short (<5 years) and longer (5 years plus) term site specific mitigation measures for each SSSI component of the SPA. Measures included within the MAP were informed by hydraulic modelling undertaken by the Parrett IDB to explore the potential effects on the combined full River Sowy and King's Sedgemoor Drain Enhancements Scheme and Oath to Burrowbridge Dredging scheme on the Somerset Levels and Moors SPA.

General measures include, but are not limited to:

- Extension of existing Water Level Management Plans (WLMPS) to include functionally linked land in areas impacted by the combined project and where current WLMPs do not include winter penning levels for nature conservation
- Review of existing channel maintenance procedures to ensure these are sympathetic to nature conservation
- Site specific mitigation actions identified consist of: (i) monitoring of ecological changes within the SPA and water level monitoring and (ii) mitigation actions to be implemented should detrimental change to the SPA as a consequence of the combined projects be identified through monitoring. Site specific mitigation actions include the following types of measures:
- Replacement or new water control structures – Replace failing structures, or build new structures, that are necessary to effect 'no change' to existing surface water conditions during winter months (December to February). Refurbishment of existing water level control structures at Moorlinch, West

Moor and Egypt's Clyce will be completed during summer 2020 in advance of construction of the Proposed Scheme.

- Operational protocols – Where monitoring indicates it is necessary, and it is agreed that other measures are less suitable, existing water level control structures such as pumping stations and sluices can be operated to effect 'no change' to existing surface water conditions during winter months (December to February)
- Update WLMPs – WLMPs will be reviewed with partner organisations by 2022. Changes to water control structures and water levels, agreed in the intervening period, will be incorporated in WLMPs
- Maintain a depth of water (minimum of 300mm) in ditches through the winter period
- Creation of in-field wet features – to maintain surface water conditions for water birds in winter, such as creation of shallow water scrapes and wet field gutters
- The MAP also includes alternative options for mitigation, such as the opportunity to develop new RWLAs on functionally linked land, as well as strategic longer term mitigation options that could be implemented in the longer term which focus more on soft engineering measures to enhance flood plain connectivity and potentially permit flood storage.

The delivery of the MAP and thereafter future management of the outcomes will be facilitated through the existing governance framework established for the current Water Level Management Plans and the SRA Management Group; to agree the outcomes and actions outlined in the MAP, based on results of ongoing monitoring. This will be achieved through their regular meetings, as deemed necessary and managed by a small group of officers from each partner organisation (Natural England, Environment Agency and the SDBC).

Further detailed discussions regarding the MAP will also take place with landowners which will happen in parallel with the ES consultation.

Additional information regarding general and site specific measures outlined in the MAP, including implementation timescales, can be found in Appendix J.

Maintenance

Current reactive maintenance undertaken on the section of the KSD included within the Proposed Scheme may include removal of fallen branches or occasional desilting. Desilting works were undertaken at Parchey Bridge during 2018.

The principal current maintenance activity along the Sowy is routine weed cutting and clearing, carried out at least once, and sometimes twice, per year depending on need. In theory, this work is undertaken from alternate banks in order to share the burden of deposited cut weed on the adjacent farm land. However, the majority of the work is undertaken from the right bank as there are fewer access (and therefore safety) constraints. A new maintenance regime will be developed in conjunction with our internal specialist teams, however the onus will remain on newly created WFD enhancement feature habitats developing naturally following completion of the initial construction aftercare period.

3.2.3. Decommissioning

No decommissioning works are proposed.

3.2.4. Mitigation embedded with the Proposed Scheme design

The design process has been continually improved to “design out” key risks, ultimately reducing its impact on the local environment and where appropriate, provide an improvement to the present conditions. This is referred to as “embedded mitigation” as these aspects of the design are considered to be an intrinsic part of the Proposed Scheme. Some of these design elements were identified within the PEIR and have now been developed further for inclusion within the Proposed Scheme (as shown on the LMP provided in Appendix I). Elements of the design considered to be embedded mitigation are detailed below.

WFD enhancement features

Placement and dimensions of embayments, two-stage channels and backwaters have been designed to minimise the risk of disturbance to known and unknown buried archaeology (including paleoenvironmental deposits), maximise benefit to water vole through providing good quality habitat within areas currently identified as sub-optimal and avoid impacts to trees and conflicts with known badger setts.

Alignment and cross-section of re-profiled informal flood banks

The alignment and design (crest width, angle of back-slope) have been designed to:

- Ensure continued access along Public Rights of Way (PRoW)
- Minimise loss and/or potential adverse impacts on established vegetation including trees
- Minimise the requirement for land take, whilst ensuring the new flood defences are resilient to damage from cattle poaching
- Minimise requirement for encroachment within 5m of the KSD, KSD back ditch, Sowy or Langacre Rhyne channel bank to reduce risks of disturbance to water vole burrows

3.2.5. Design uncertainties

It should be noted that it is currently uncertain whether the full programme of works set out in Table 3.1 can be undertaken within the currently available funding and within the programme identified in section 3.3.1.

Should funding or programme constrain delivery of the Proposed Scheme, raising of the existing informal flood embankments on the Lower Sowy (between the confluence of the Sowy and KSD and Beer Wall) and the Upper Sowy (between Monk’s Leaze Clyce and Beer Wall) will be prioritised along with the WFD enhancement features along this stretch. The next priority for Phase 1 delivery will then be raising of the existing informal flood embankments on the KSD along with the WFD enhancement features along this stretch. Any works not delivered in Phase 1 will be undertaken as part of the Phase 2 proposals.

The assessments provided in this report consider the likely worst-case scenario in terms of effects on environmental receptors, within the bounds of the current design uncertainties identified above.

3.3. Construction of the Proposed Scheme

3.3.1. Programme

Construction of the Proposed Scheme will commence at the earliest in September 2020, taking up to eight weeks for the completion of earthworks activities. Landscape planting for areas of new wet woodland and alder planting (as shown on the LMP in Appendix I) will then be undertaken in early November 2020 (subject to agreement with NE).

There will be up to five gangs working at any one time during the eight-week construction period. Four gangs will be required for bank raising works, with one gang working on each of the KSD right bank, KSD left bank, Lower Sowy right bank and Lower Sowy left bank. Works on the KSD and Lower Sowy will be undertaken concurrently. On the Lower Sowy raising will start at the mid-point between access locations, working backwards towards the access locations. This will prevent the need for construction traffic to cross areas of completed raising work. Once one of the gangs on the KSD have completed their works, they will move onto the right bank of the Upper Sowy to complete the works in this section. The fifth gang will focus on creation of the WFD enhancement features, starting on the right bank of the Lower Sowy and moving onto the KSD.

3.3.2. Construction footprint

The extents of the construction footprint for the Proposed Scheme, including site accesses, locations of main (off site) and satellite compounds and temporary 'just in time' material stockpiles and temporary fencing requirements are shown in Figure 3.1 (Appendix A). The main compound for Proposed Scheme will be offsite, however given the nature and scale of the project it is anticipated that very minimal traffic movements associated with works travelling to site, or between the offsite compound and site, will be required.

All PRoW within the construction footprint will remain open throughout the construction phase. Users of BW 8/6 and BW 36/5 will be segregated from the works area using post and rope fencing, and a banksman will marshal crossings where required.

3.3.3. Material haulage

Material for bank raising on the Upper and Lower Sowy will be transported from a soil reprocessing facility located directly off the A372 near Westonzoyland to site using a combination of 20t HGVs (for the A372 and A361 site accesses only) and tractor with trailer (8t). Figure 3.1 (Appendix A) shows the proposed haul routes for road based material transport and the location of the soil reprocessing site. Average daily two-way movements between the source of imported material and the Lower and Upper Sowy are shown below:

- Lower Sowy: up to 36 HGV movements per day (i.e. 18 return journeys) over a 4-week period and 38 tractor and trailer movements per day (i.e. 19 return journeys) over an 8-week period
- Upper Sowy: up to 8 tractor and trailer movements in total (i.e. 4 return journeys per day)

A Construction Traffic Management Plan (CTMP) and Dust Management Plan (DMP) will be prepared in advance of the start of construction and agreed with the relevant authorities as detailed within the Environmental Action Plan (EAP) (Appendix K) for the Proposed Scheme.

Material transferred by HGV will be deposited adjacent to the proposed site access points from the A361 and A372 (see 'just in time' stockpile locations on Figure 3.1, Appendix A) and immediately transferred onto site using light weight tracked dumpers. Should ground conditions be suitable, material transported onto site via other access routes will be transported to the location that is needed by tractor and trailer. If ground conditions are poor then either lightweight tracked dumpers or short

lengths of aluminium tracking will be used to help reduce ground disturbance or where required to protect the Scheduled Monument at Sutton Hams (see LMPs, Appendix I) or in proximity to active badger setts in accordance with a Badger Method Statement (see Chapter 7 and Appendix F).

A Materials Management Plan (MMP) and Site Waste Management Plan (SWMP) will be prepared by the contractor and agreed with the relevant authorities in advance of the start of construction to ensure that any excess imported material, or material won on site and found to be unsuitable for use in bank raising, is appropriately managed and disposed of (if found necessary).

3.3.4. Re-profiling of existing informal flood embankments

A 25t excavator will be used to strip and stockpile topsoil won from the 'borrow' areas on the right and left bank of the KSD that will provide fill material for bank raising on the KSD. In areas where bank raising is required, topsoil will be stripped to a depth of up to 150mm in areas where bank raising or re-profiling required using a bulldozer. As for the borrow areas, this will be completed on an 'as and when' basis.

Lightweight tracked dumpers will transfer material from either the borrow areas on the right and left bank of the KSD (for KSD only) or from the 'just in time' stockpiles of imported material described above (for Upper and Lower Sowy) onto the footprint of the area to be raised, and a bulldozer used to place the material to the required profile. Fill will be compacted using either the bulldozer or other plant, with either a roller (potentially vibratory) used on the Upper and Lower Sowy. Topsoil will then be reinstated and reseeded for 'borrow areas' and re-profiled embankments
Two stage vegetation clearance is required in some areas of the Proposed Scheme (see Chapter 7 for further detail) which provide suitable habitat for grass snake, and this will be undertaken in accordance with a method statement prepared and agreed with our internal ecological specialists. Tree protection measures will be implemented as identified within the Arboricultural Impact Assessment (AIA) and Arboricultural Method Statement (AMS) (Appendix L) for the Proposed Scheme and outlined in the EAP (Appendix K)

3.3.5. Headwall raising at Cossington Right Rhyne and Chilton Right Rhyne outfalls

The existing steel sheet piled wing walls at Cossington Rhyne and Chilton Right Rhyne will be replaced with new steel sheet piled walls. The existing steel will be removed from site. The crest level of the headwall will be raised with the addition of new coping. The steel sheet piles will be driven to the design level and finished with a steel capping beam. New steel sheet piles will be vibro-driven to reduce noise during installation.

3.3.6. Temporary works to Chedzoy New Cut and Cossington Right Rhyne culverts

The existing culvert crossings on the left bank of the KSD at Chedzoy New Cut and Cossington Right Rhyne near Parchey Bridge (see Figure 3.1, Appendix A) will need to be strengthened prior to commencement of construction works. This will involve replacing the existing edge protecting fencing and utilising a combination aggregate and matting to reinforce the existing track surface.

3.3.7. WFD enhancement features and landscaping

Long reach excavators will be used for the creation of the WFD enhancement features, which is programmed towards the end of the earthworks phase in order to minimise the risk of adverse impacts to water quality (dissolved oxygen). In addition, a Surface Water Management Plan (SWMP) will be developed and agreed with the relevant authorities in advance of the start of construction. This will include measures such as the use of silt curtains, provision for dissolved oxygen monitoring where necessary, and other measures to protect water quality during construction (see EAP provided in Appendix K for further details). Creation of the WFD enhancement features will be undertaken under an archaeological watching brief (see Chapter 8).

Aquatic planting of the WFD enhancement features will be completed immediately following their construction to minimise the risk of sediment erosion. Riparian planting of the backwater island and on the right bank of the KSD and Upper Sowy will require access by 4x4 only and will be completed in early November 2021 pending agreement with NE.

3.3.8. Site reinstatement

All land within the construction footprint will be fully reinstated with reseeding completed in late 2020. It is anticipated that land reinstatement within the construction footprint, including fencing to the existing specification (including provision of stiles and gateways where footpaths BW 8/6 and BW 36/5 pass through the construction footprint), will be completed in early 2022 once vegetation cover is well established once again. However, we will take every opportunity to return the land sooner to the landowners if seed germination and sward development allows – this will be in agreement with landowners.