Legend

- Limit of Permanent and Temporary Works for New Section of Motorway
- Proposed Water Treatment Area (WTA)
- Potential Borrow Pit Area
- Drainage Zone
- Site of Special Scientific Interest (SSSI)
- Watercourse
- Reen

Llywodraeth Cymru
Welsh Government

Environmental Statement

Site Setting

Figure: 16.1a	Revision: -
Date: March 2016	Status: At Issue
Drawn: RJJ	Checked: ARG

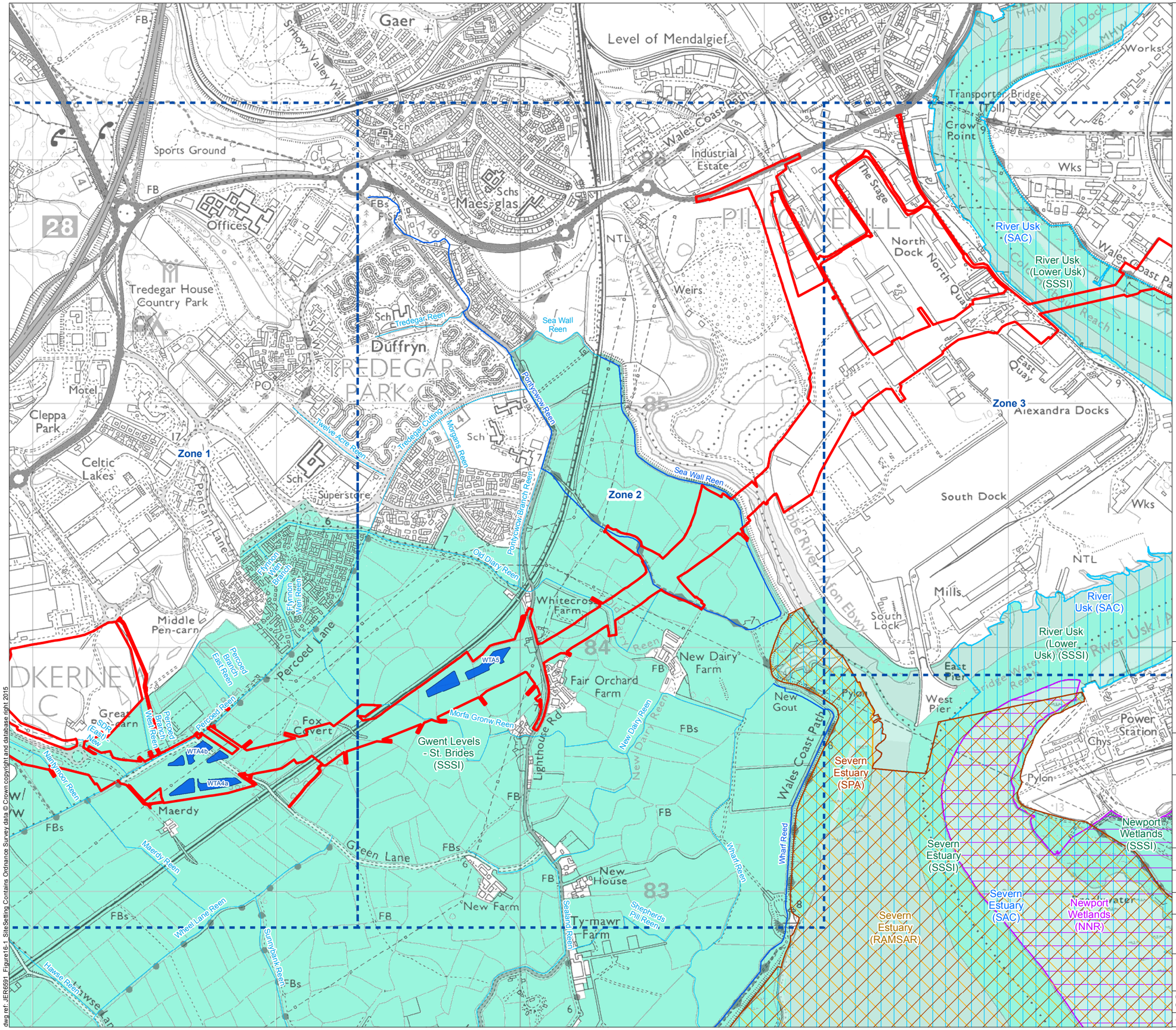
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Legend

- Limit of Permanent and Temporary Works for New Section of Motorway
- Proposed Water Treatment Area (WTA)
- Drainage Zone
- National Nature Reserve (NNR)
- RAMSAR
- Site of Special Scientific Interest (SSSI)
- Special Area of Conservation (SAC)
- Special Protection Area (SPA)
- Watercourse
- Reen

Llywodraeth Cymru
Welsh Government

Environmental Statement

Site Setting

Figure: 16.1b	Revision: -
Date: March 2016	Status: At Issue
Drawn: RJJ	Checked: ARG

Scale: A3 @ 1:15,000

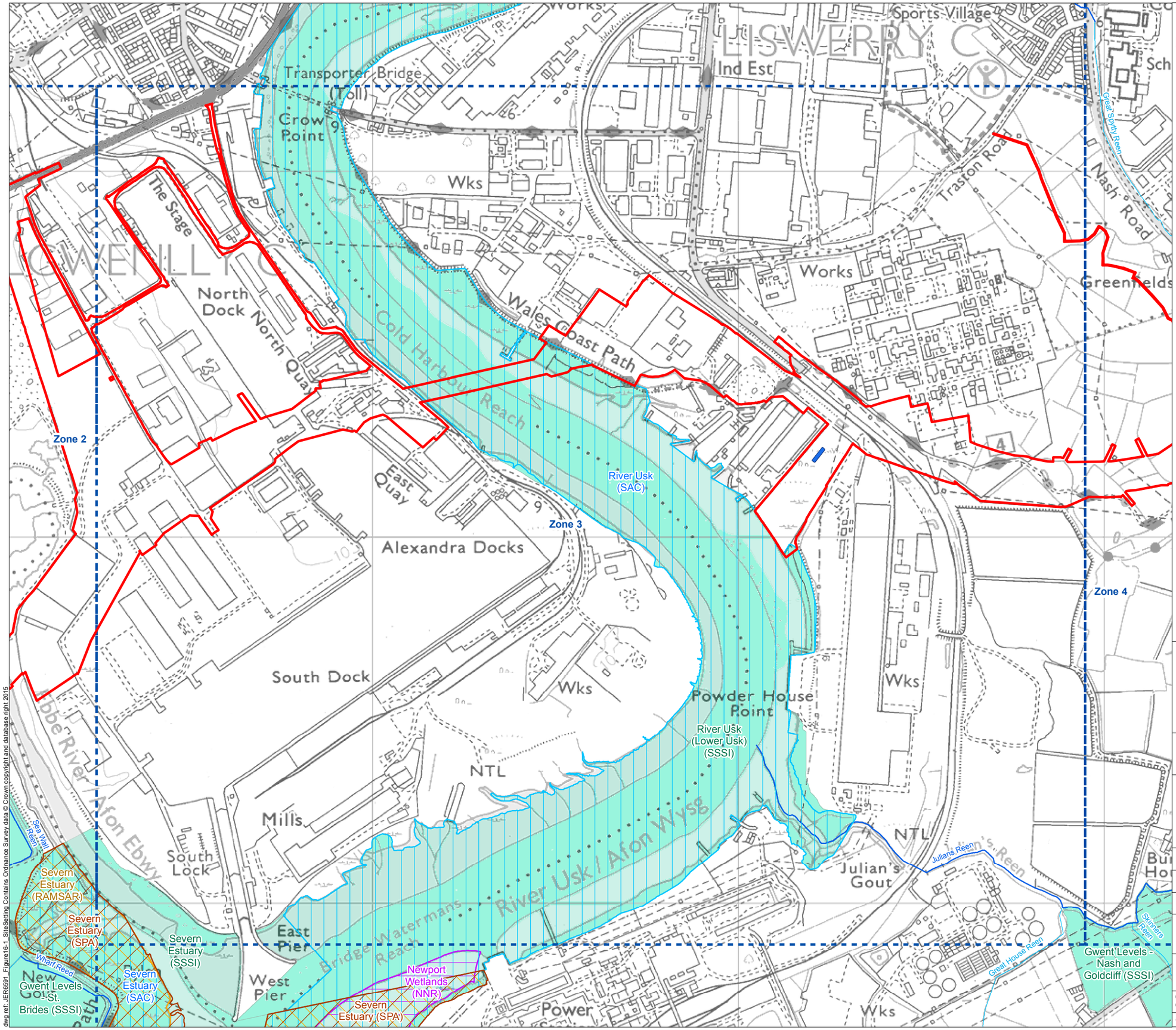
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Legend

- Limit of Permanent and Temporary Works for New Section of Motorway
- Proposed Water Treatment Area (WTA)
- Drainage Zone
- National Nature Reserve (NNR)
- RAMSAR
- Site of Special Scientific Interest (SSSI)
- Special Area of Conservation (SAC)
- Special Protection Area (SPA)
- Watercourse
- Reen

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Welsh Government

Environmental Statement

Site Setting

Figure: 16.1c	Revision: -
Date: March 2016	Status: At Issue
Drawn: RJJ	Checked: ARG

Scale: A3 @ 1:10,000
0 165 330 m

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dwg ref: JER6591_Figure16-1_SiteSetting

Legend

- Limit of Permanent and Temporary Works for New Section of Motorway
- Proposed Water Treatment Area (WTA)
- Potential Borrow Pit Area
- Drainage Zone
- National Nature Reserve (NNR)
- RAMSAR
- Site of Special Scientific Interest (SSSI)
- Special Area of Conservation (SAC)
- Special Protection Area (SPA)
- Watercourse
- Reen

Llywodraeth Cymru
Welsh Government

Environmental Statement

Site Setting

Figure: 16.1d	Revision: -
Date: March 2016	Status: At Issue
Drawn: RJJ	Checked: ARG

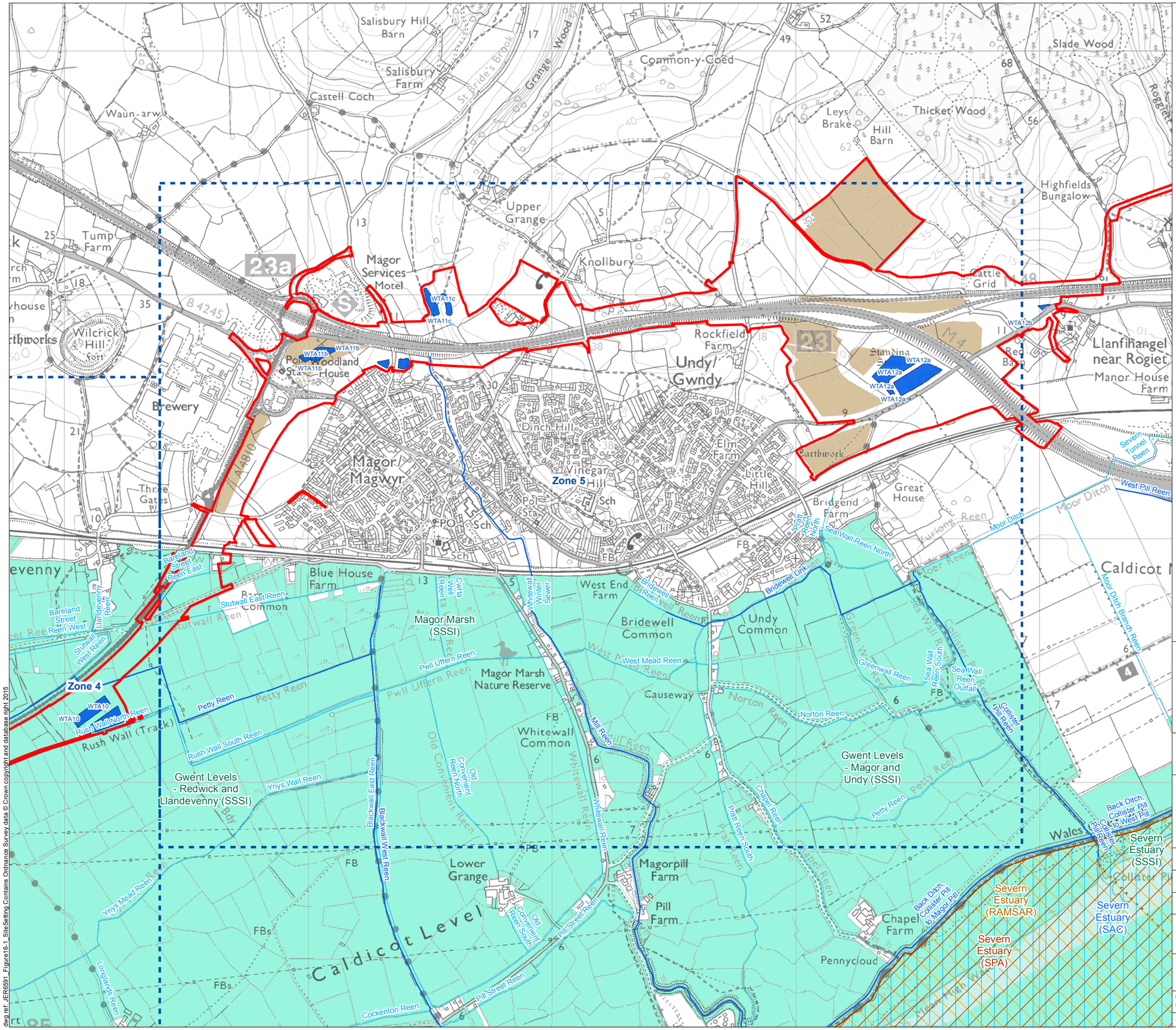
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Legend

- Limit of Permanent and Temporary Works for New Section of Motorway
- Proposed Water Treatment Area (WTA)
- Potential Borrow Pit Area
- Drainage Zone
- RAMSAR
- Site of Special Scientific Interest (SSSI)
- Special Area of Conservation (SAC)
- Special Protection Area (SPA)
- Watercourse
- Reen

Llywodraeth Cymru
Welsh Government

Environmental Statement

Site Setting

Figure: 16.1e	Revision: -
Date: March 2016	Status: At Issue
Drawn: RJJ	Checked: ARG

Scale: A3 @ 1:15,000
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Legend

- Limit of Permanent and Temporary Works for New Section of Motorway
- Proposed Water Treatment Area (WTA)
- Potential Borrow Pit Area
- Drainage Zone
- Potential Area of Land Contamination
- Active Landfill Site
- Historical Landfill Site

BGS 1:50k Bedrock Geology

- Mercia Mudstone Group (MMG)
- Raglan Mudstone Formation (RMF)
- St. Maughan's Formation (SMF)

Llywodraeth Cymru
Welsh Government

Environmental Statement

Bedrock Geology & Topography

Figure: 16.2a	Revision: -
Date: March 2016	Status: At Issue
Drawn: RJJ	Checked: ARG

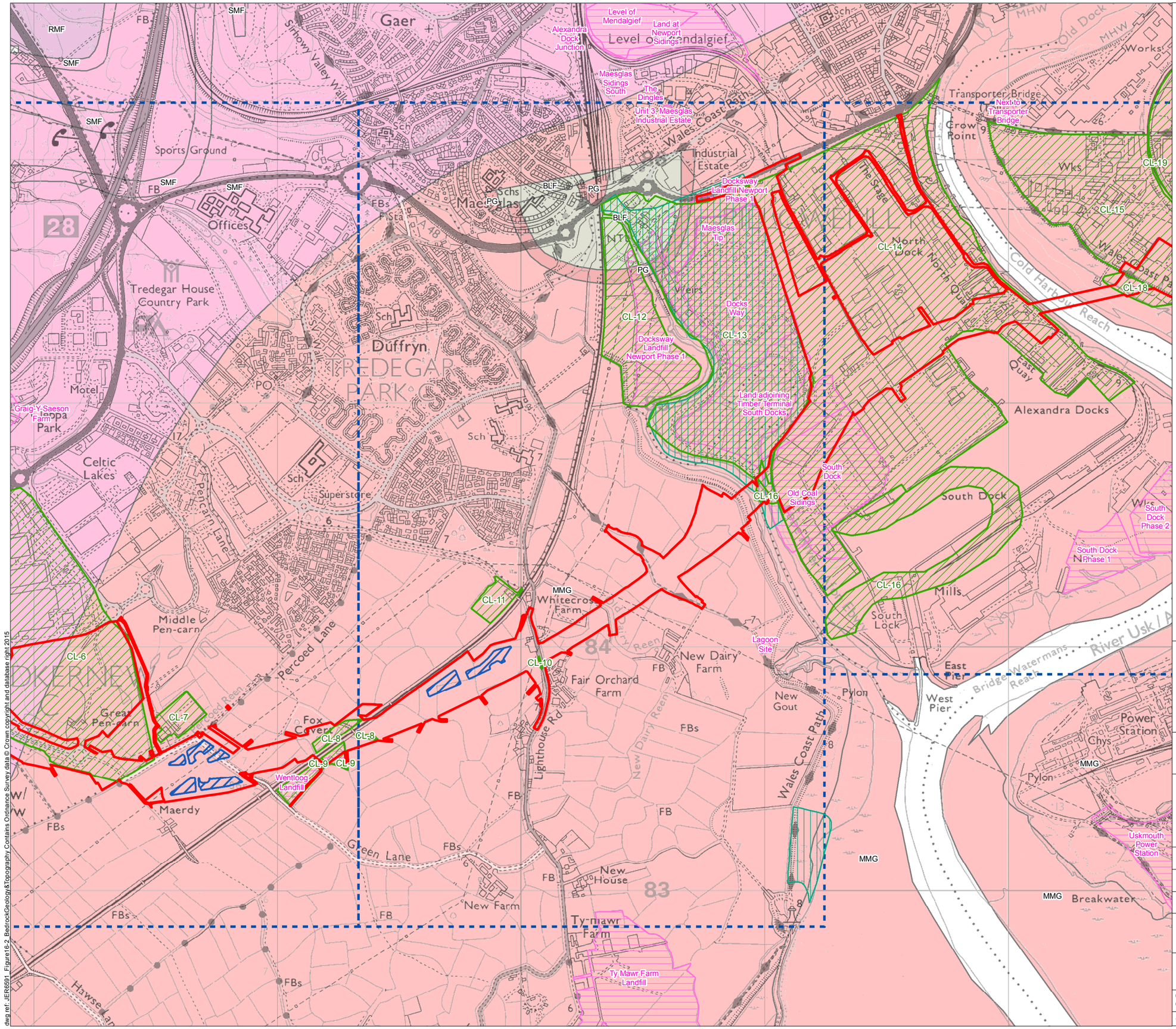
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Legend

- Limit of Permanent and Temporary Works for New Section of Motorway
- Proposed Water Treatment Area (WTA)
- Drainage Zone
- Potential Area of Land Contamination
- Active Landfill Site
- Historical Landfill Site

BGS 1:50k Bedrock Geology

- Blue Lias Formation (BLF)
- Mercia Mudstone Group (MMG)
- Penarth Group (PG)
- Raglan Mudstone Formation (RMF)
- St. Maughan's Formation (SMF)

Llywodraeth Cymru
Welsh Government

Environmental Statement

Bedrock Geology & Topography

Figure: 16.2b	Revision: -
Date: March 2016	Status: At Issue
Drawn: RJJ	Checked: ARG

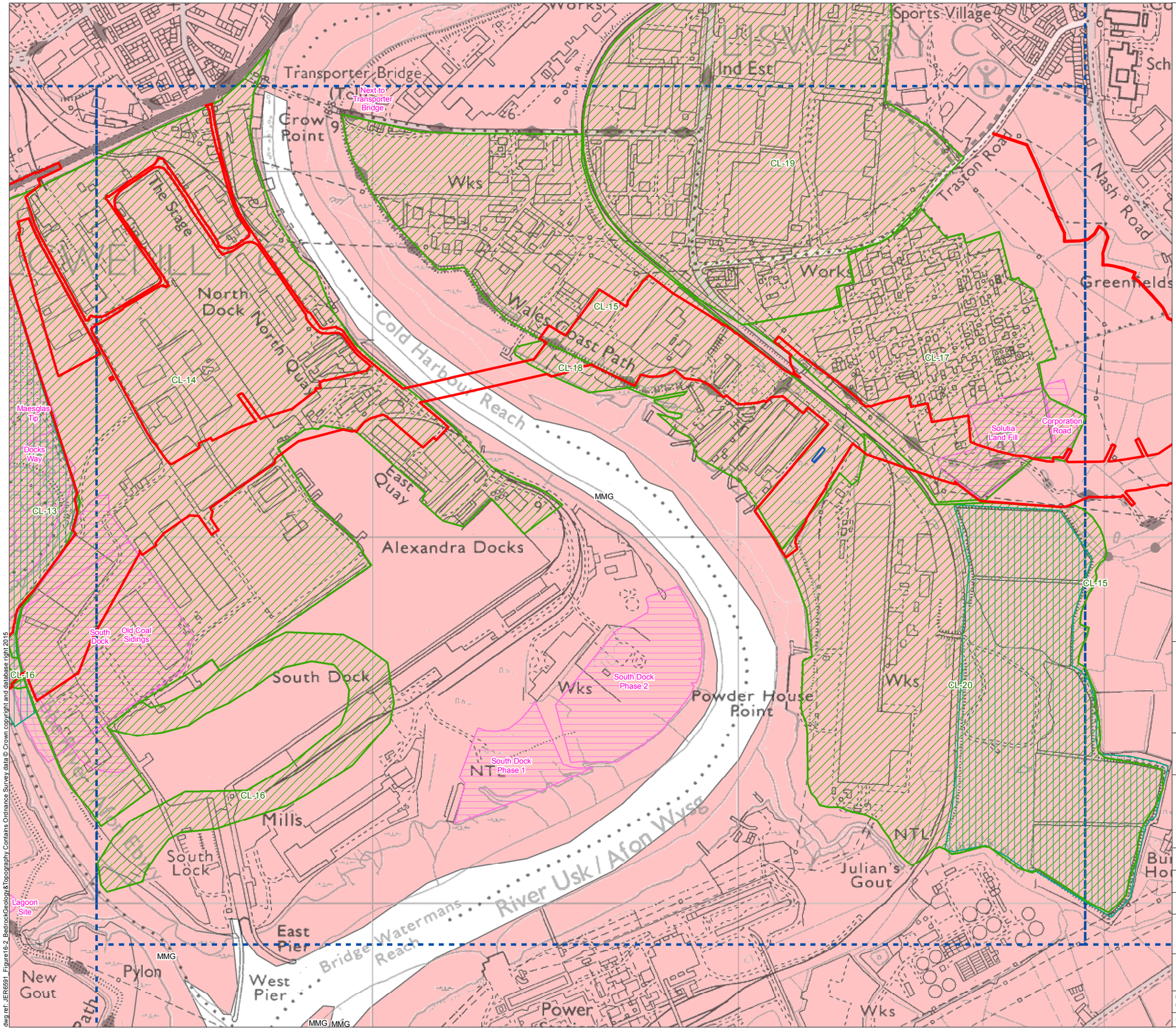
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Legend

- Limit of Permanent and Temporary Works for New Section of Motorway
- Proposed Water Treatment Area (WTA)
- Drainage Zone
- Potential Area of Land Contamination
- Active Landfill Site
- Historical Landfill Site

BGS 1:50k Bedrock Geology

- Mercia Mudstone Group (MMG)

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Welsh Government

Environmental Statement

Bedrock Geology & Topography

Figure: 16.2c	Revision: -
Date: March 2016	Status: At Issue
Drawn: RJJ	Checked: ARG

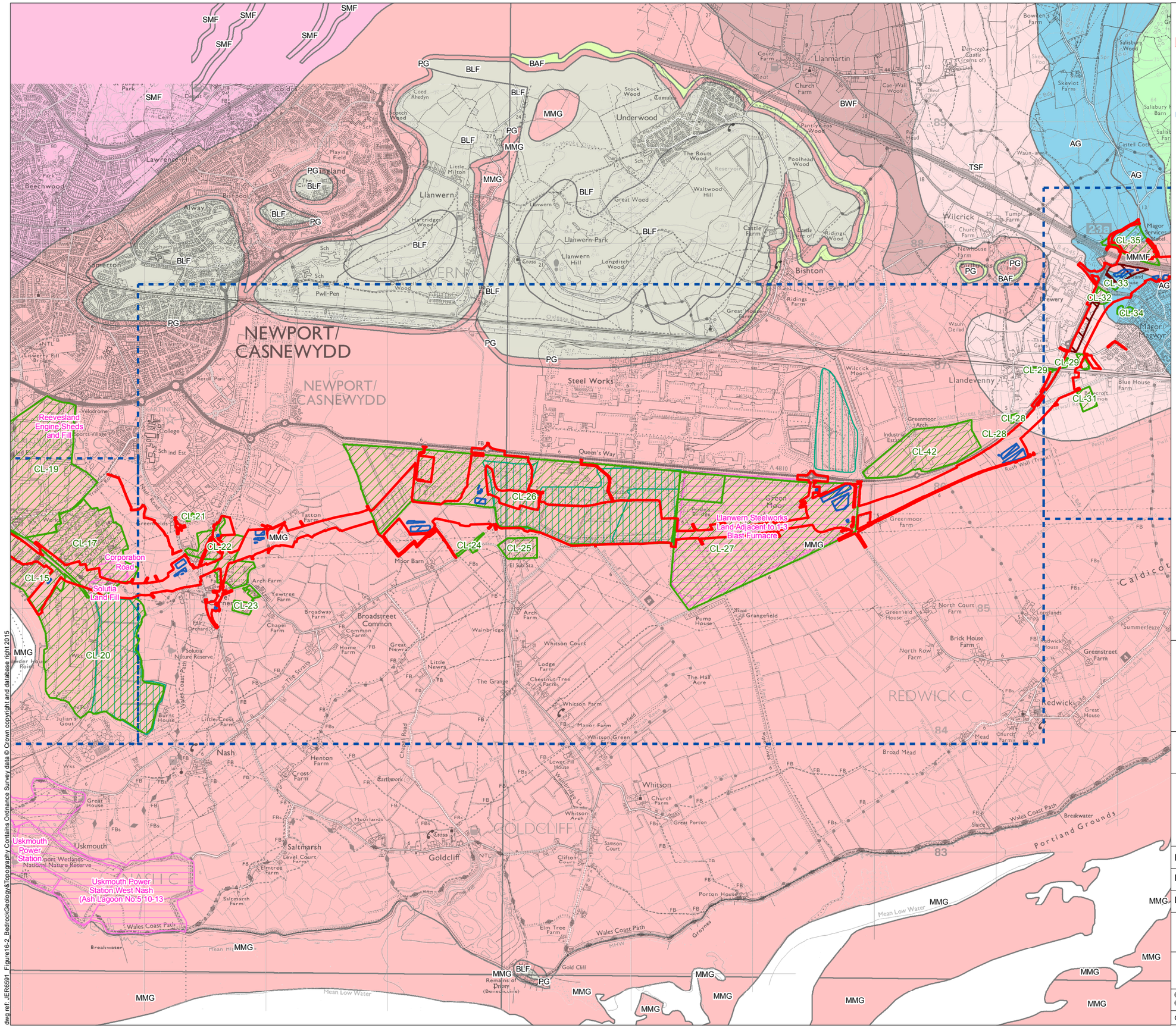
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Environmental Statement

Bedrock Geology & Topography

Figure: 16.2d	Revision: -
Date: March 2016	Status: At Issue
Drawn: RJJ	Checked: ARG

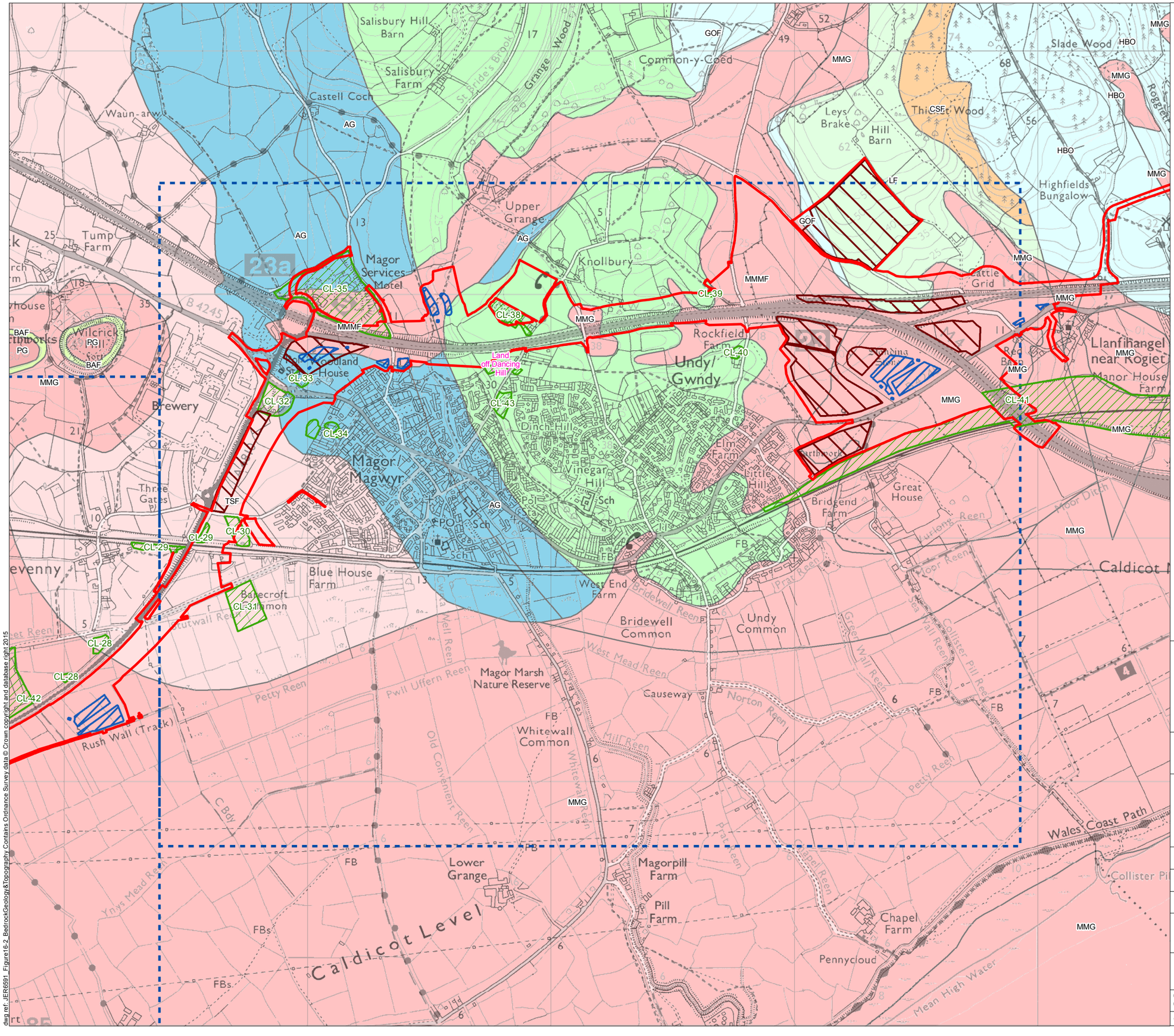
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Legend

- Limit of Permanent and Temporary Works for New Section of Motorway
- Proposed Water Treatment Area (WTA)
- Potential Borrow Pit Area
- Drainage Zone
- Potential Area of Land Contamination
- Historical Landfill Site

BGS 1:50k Bedrock Geology

- Avon Group (AG)
- Black Rock Limestone (BRL)
- Blue Anchor Formation (BAF)
- Cromhall Sandstone Formation (CSF)
- Gully Oolite Formation (GOF)
- Hunts Bay Oolite (HBO)
- Llanelly Formation (LF)
- Mercia Mudstone Group (MMG)
- Mercia Mudstone Group (Marginal Facies) (MMMF)
- Penarth Group (PG)
- Tintern Sandstone Formation (TSF)

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Welsh Government

Environmental Statement

Bedrock Geology & Topography

Figure: 16.2e	Revision: -
Date: March 2016	Status: At Issue
Drawn: RJJ	Checked: ARG

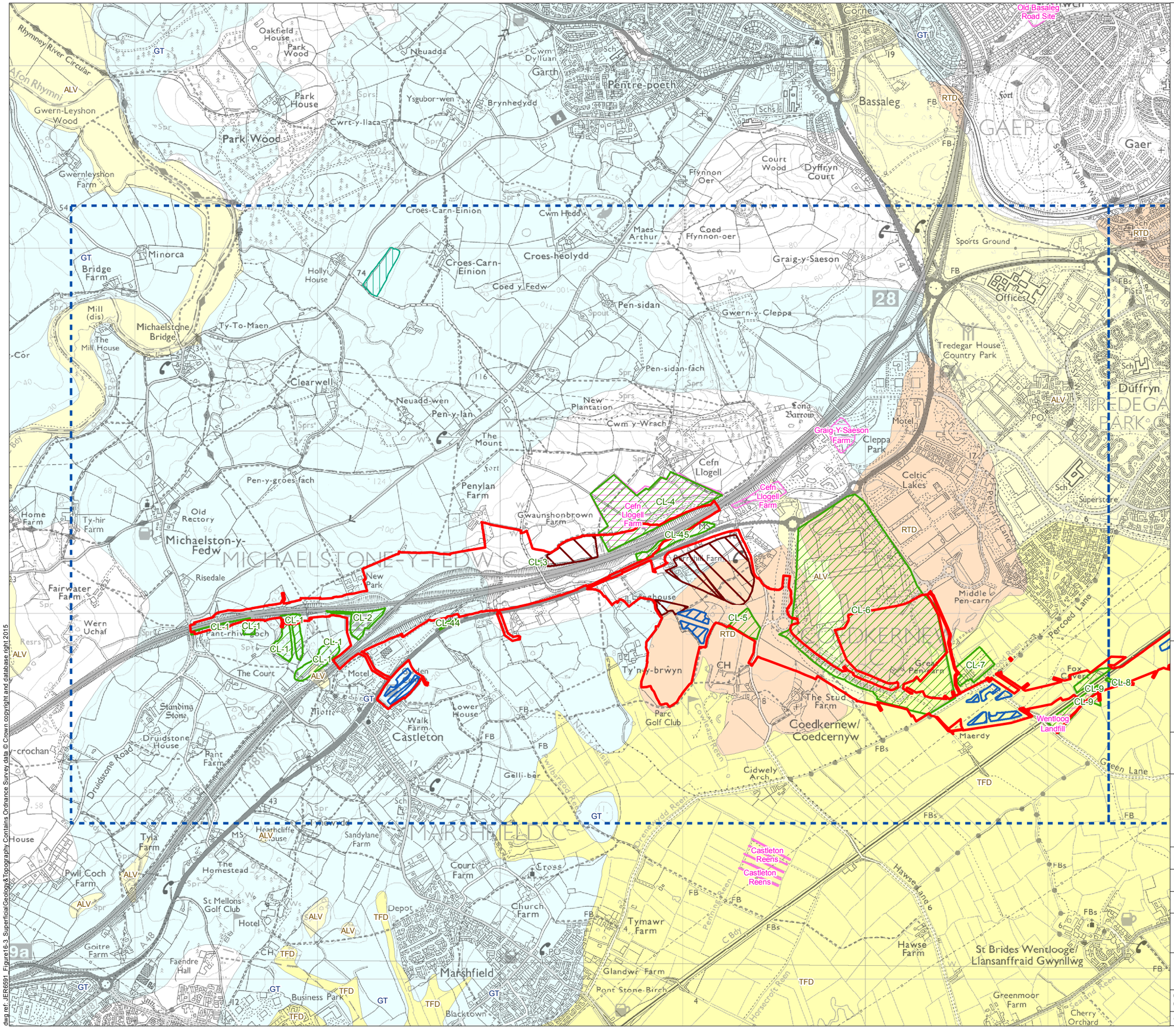
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Legend

- Limit of Permanent and Temporary Works for New Section of Motorway
- Proposed Water Treatment Area (WTA)
- Potential Borrow Pit Area
- Drainage Zone
- Potential Area of Land Contamination
- Active Landfill Site
- Historical Landfill Site

BGS 1:50k Superficial Geology

- Alluvium (ALV)
- Glacial Till (GT)
- Head (HD)
- River Terrace Deposits (RTD)
- Tidal Flat Deposits (TFD)

Llywodraeth Cymru
Welsh Government

Environmental Statement

Superficial Geology & Topography

Figure: 16.3a	Revision: -
Date: March 2016	Status: At Issue
Drawn: RJJ	Checked: ARG

Scale: A3 @ 1:20,000
0 330 660 m

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Legend

- Limit of Permanent and Temporary Works for New Section of Motorway
- Proposed Water Treatment Area (WTA)
- Drainage Zone
- Potential Area of Land Contamination
- Active Landfill Site
- Historical Landfill Site

BGS 1:50k Superficial Geology

- Alluvium (ALV)
- Glacial Till (GT)
- Head (HD)
- River Terrace Deposits (RTD)
- Tidal Flat Deposits (TFD)

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Welsh Government

Environmental Statement

Superficial Geology & Topography

Figure: 16.3b	Revision: -
Date: March 2016	Status: At Issue
Drawn: RJJ	Checked: ARG

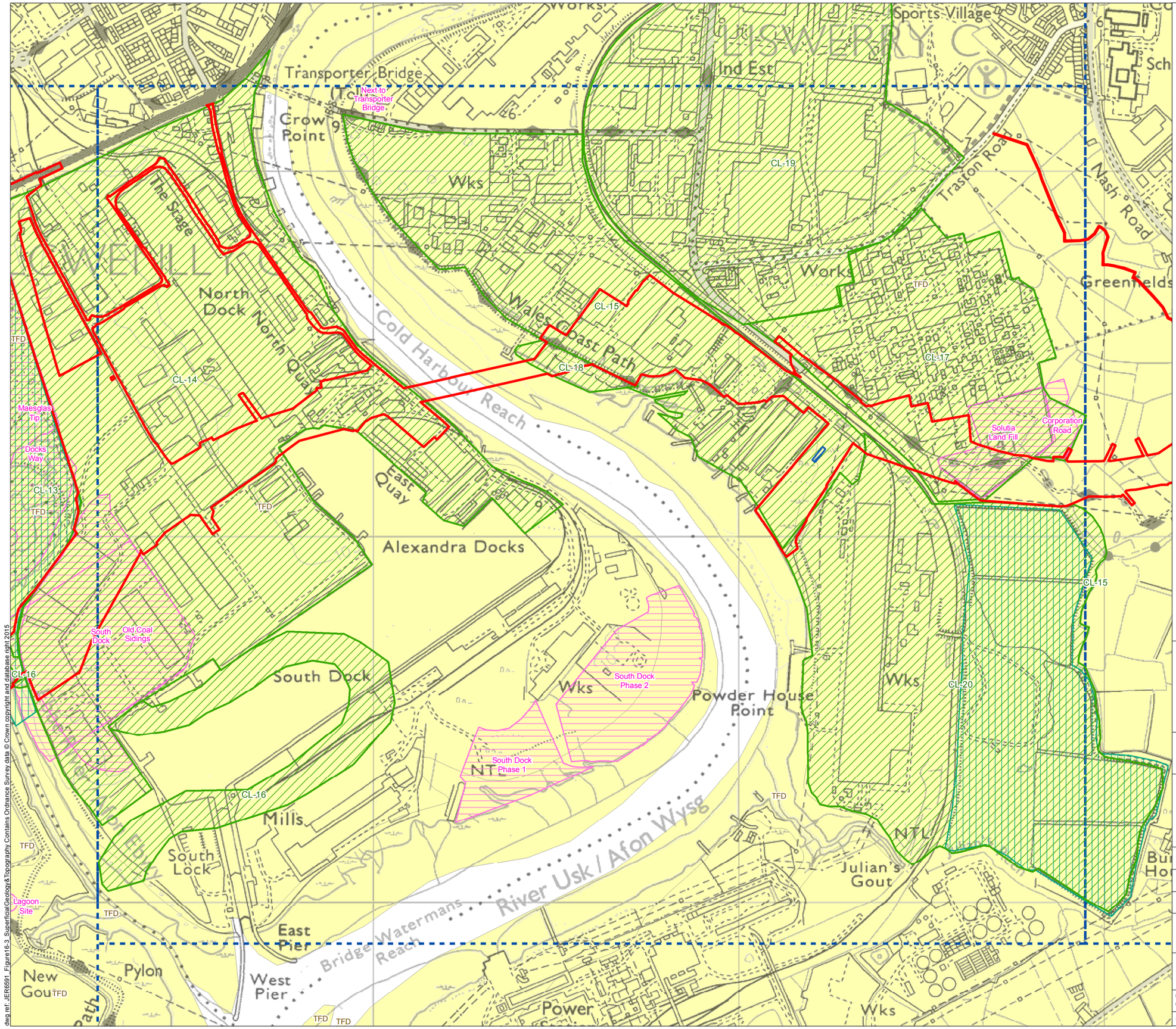
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Legend

- Limit of Permanent and Temporary Works for New Section of Motorway
- Proposed Water Treatment Area (WTA)
- Drainage Zone
- Potential Area of Land Contamination
- Active Landfill Site
- Historical Landfill Site

BGS 1:50k Superficial Geology

- Alluvium (ALV)
- Glacial Till (GT)
- Head (HD)
- River Terrace Deposits (RTD)
- Tidal Flat Deposits (TFD)

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Welsh Government

Environmental Statement

Superficial Geology & Topography

Figure: 16.3c	Revision: -
Date: March 2016	Status: At Issue
Drawn: RJJ	Checked: ARG

Scale: A3 @ 1:10,000

0 165 330 m

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Legend

- Limit of Permanent and Temporary Works for New Section of Motorway
- Proposed Water Treatment Area (WTA)
- Potential Borrow Pit Area
- Drainage Zone
- Potential Area of Land Contamination
- Active Landfill Site
- Historical Landfill Site

BGS 1:50k Superficial Geology

- Alluvium (ALV)
- Glacial Till (GT)
- Head (HD)
- River Terrace Deposits (RTD)
- Tidal Flat Deposits (TFD)

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Welsh Government

Environmental Statement

Superficial Geology & Topography

Figure: 16.3d	Revision: -
Date: March 2016	Status: At Issue
Drawn: RJJ	Checked: ARG

Scale: A3 @ 1:30,000
0 500 1,000 m

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Legend

- Limit of Permanent and Temporary Works for New Section of Motorway
- Proposed Water Treatment Area (WTA)
- Potential Borrow Pit Area
- Drainage Zone
- Potential Area of Land Contamination
- Historical Landfill Site

BGS 1:50k Superficial Geology

- Alluvium (ALV)
- Glacial Till (GT)
- Head (HD)
- River Terrace Deposits (RTD)
- Tidal Flat Deposits (TFD)

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Welsh Government

Environmental Statement

Superficial Geology & Topography

Figure: 16.3e	Revision: -
Date: March 2016	Status: At Issue
Drawn: RJJ	Checked: ARG

Scale: A3 @ 1:15,000
0 250 500 m

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Legend

- Limit of Permanent and Temporary Works for New Section of Motorway
- Proposed Water Treatment Area (WTA)
- Potential Borrow Pit Area
- Drainage Zone
- Site of Special Scientific Interest (SSSI)
- NRW Watercourse
- Reen
- Sluice
- NRW Discharge Consent
- NRW Groundwater Abstraction License

Surface Water Monitoring Locations

- RPS (2015/16)
- Titan Surveys (2008)
- NRW (Ongoing)

Water Abstractions

- Well
- Spring
- Well (No Longer In Use)
- Spring (Not Used)
- Indicative Hydrogeological Connectivity

Llywodraeth Cymru
Welsh Government

Environmental Statement

Hydrology

Figure: 16.4a	Revision: -
Date: March 2016	Status: At Issue
Drawn: RJJ	Checked: ARG

Scale: A3 @ 1:20,000
0 330 660 m

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Legend

- Limit of Permanent and Temporary Works for New Section of Motorway
- Proposed Water Treatment Area (WTA)
- Drainage Zone
- Site of Special Scientific Interest (SSSI)
- NRW Watercourse
- Reen
- Sluice
- Tidal Flap
- NRW Discharge Consent

Surface Water Monitoring Locations

- RPS (2015/16)
- Titan Surveys (2008)
- NRW (Ongoing)

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Welsh Government

Environmental Statement

Hydrology

Figure: 16.4b	Revision: -
Date: March 2016	Status: At Issue
Drawn: RJJ	Checked: ARG

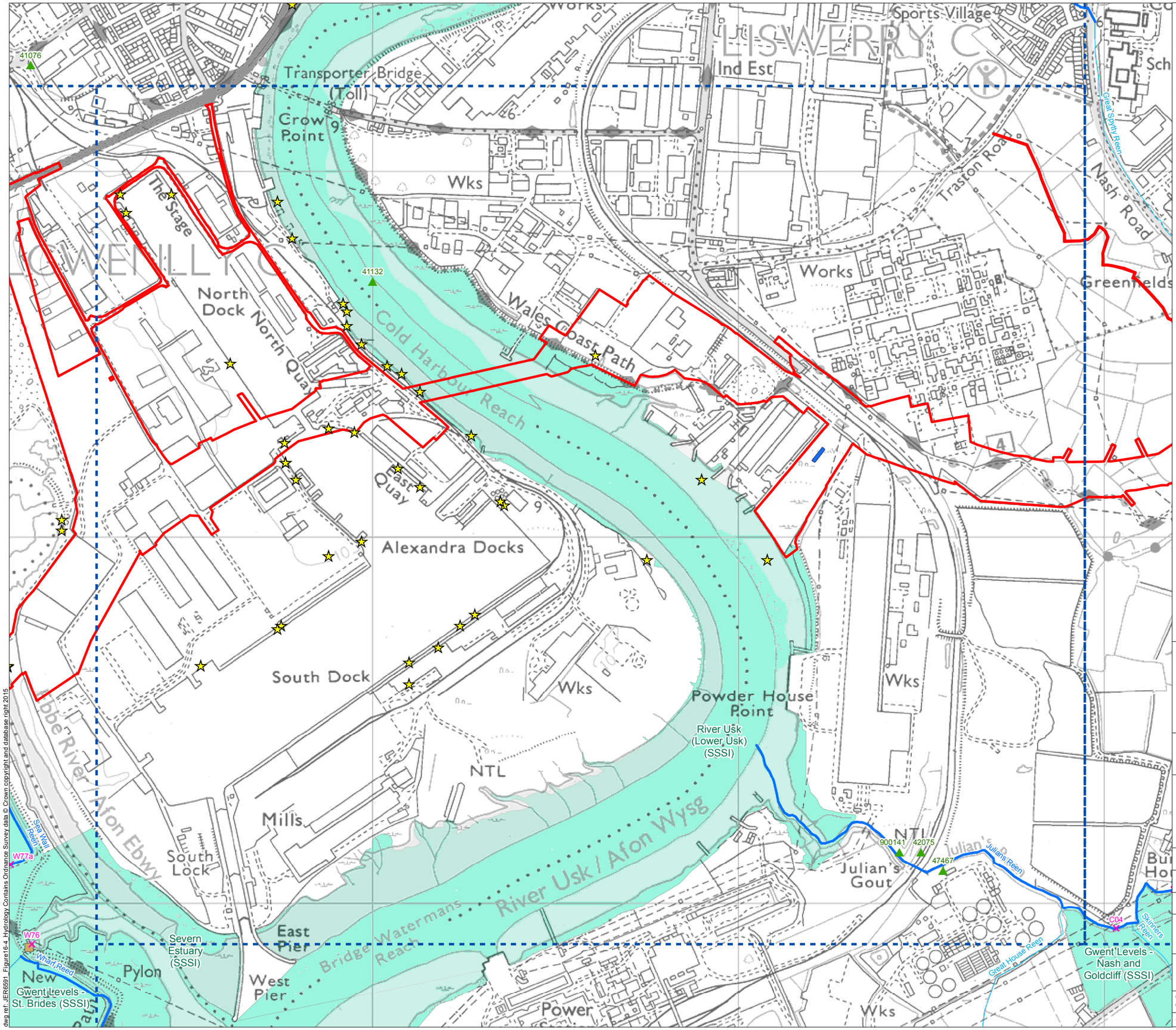
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Legend

- Limit of Permanent and Temporary Works for New Section of Motorway
- Proposed Water Treatment Area (WTA)
- Drainage Zone
- Site of Special Scientific Interest (SSSI)
- NRW Watercourse
- Reen
- Sluice
- Tidal Flap
- NRW Discharge Consent
- NRW (Ongoing)

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Welsh Government

Environmental Statement

Hydrology

Figure: 16.4c	Revision: -
Date: March 2016	Status: At Issue
Drawn: RJJ	Checked: ARG

Scale: A3 @ 1:10,000
0 165 330 m

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Legend

- Limit of Permanent and Temporary Works for New Section of Motorway
- Proposed Water Treatment Area (WTA)
- Potential Borrow Pit Area
- Drainage Zone
- Site of Special Scientific Interest (SSSI)
- NRW Watercourse
- Reen
- Sluice
- Tidal Flap
- NRW Discharge Consent

Surface Water Monitoring Locations

- RPS (2015/16)
- Welsh Government (2015)
- Titan Surveys (2008)
- NRW (Ongoing)

Water Abstractions

- Well (No Longer In Use)
- Spring (Not Used)

Llywodraeth Cymru
Welsh Government

Environmental Statement

Hydrology

Figure: 16.4d	Revision: -
Date: March 2016	Status: At Issue
Drawn: RJJ	Checked: ARG

Scale: A3 @ 1:30,000
0 500 1,000 m

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Legend

- Limit of Permanent and Temporary Works for New Section of Motorway
- Proposed Water Treatment Area (WTA)
- Potential Borrow Pit Area
- Drainage Zone
- Site of Special Scientific Interest (SSSI)
- NRW Watercourse
- Reen
- Sluice
- Tidal Flap
- NRW Discharge Consent
- NRW Groundwater Abstraction License

Surface Water Monitoring Locations

- RPS (2015/16)
- Welsh Government (2015)
- Titan Surveys (2008)

Water Abstractions

- Well
- Well (No Longer In Use)

Llywodraeth Cymru
Welsh Government

Environmental Statement

Hydrology

Figure: 16.4e	Revision: -
Date: March 2016	Status: At Issue
Drawn: RJJ	Checked: ARG

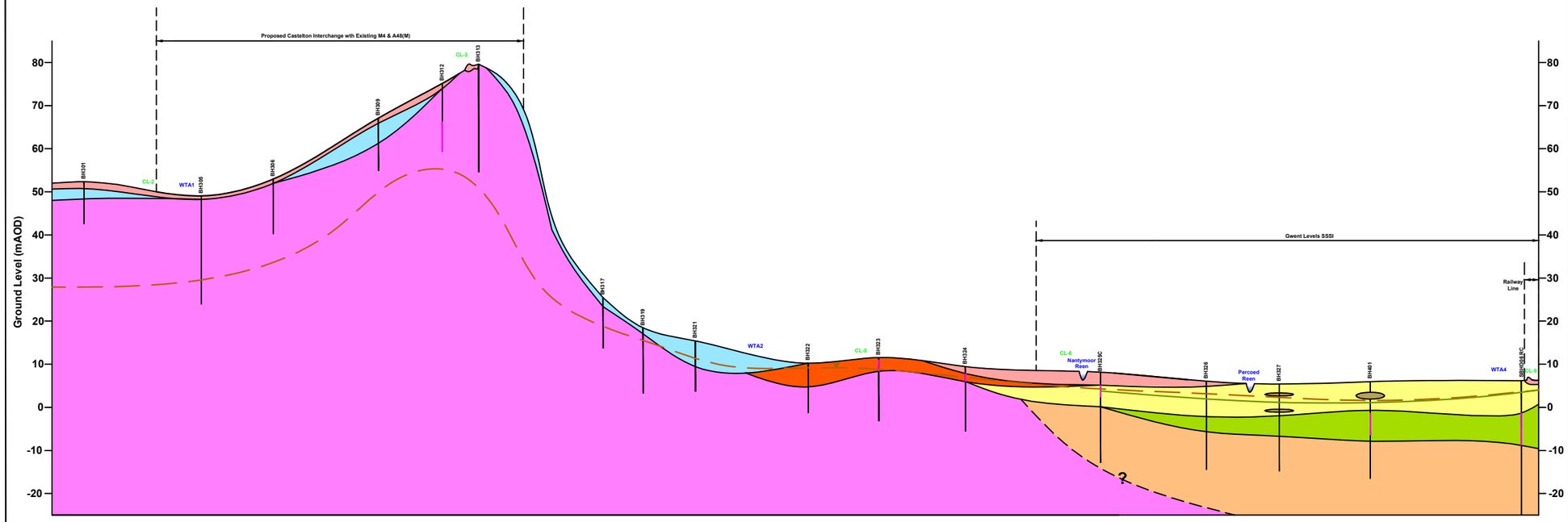
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Legend

- Made Ground - MG
- Glacial Till Deposits - GTD
- Glaciofluvial Deposits - GFD
- River Terrace Deposits - RTD
- Tidal Flat Deposits - TFD
- Peat
- Mercia Mudstone - MM
- St. Maughan's Formation - SMF
- Inferred Potentiometric Surface for MM / SMF
- Potentiometric Surface for GFD
- Borehole
- Response Zone

Llywodraeth Cymru
Welsh Government

Environmental Statement

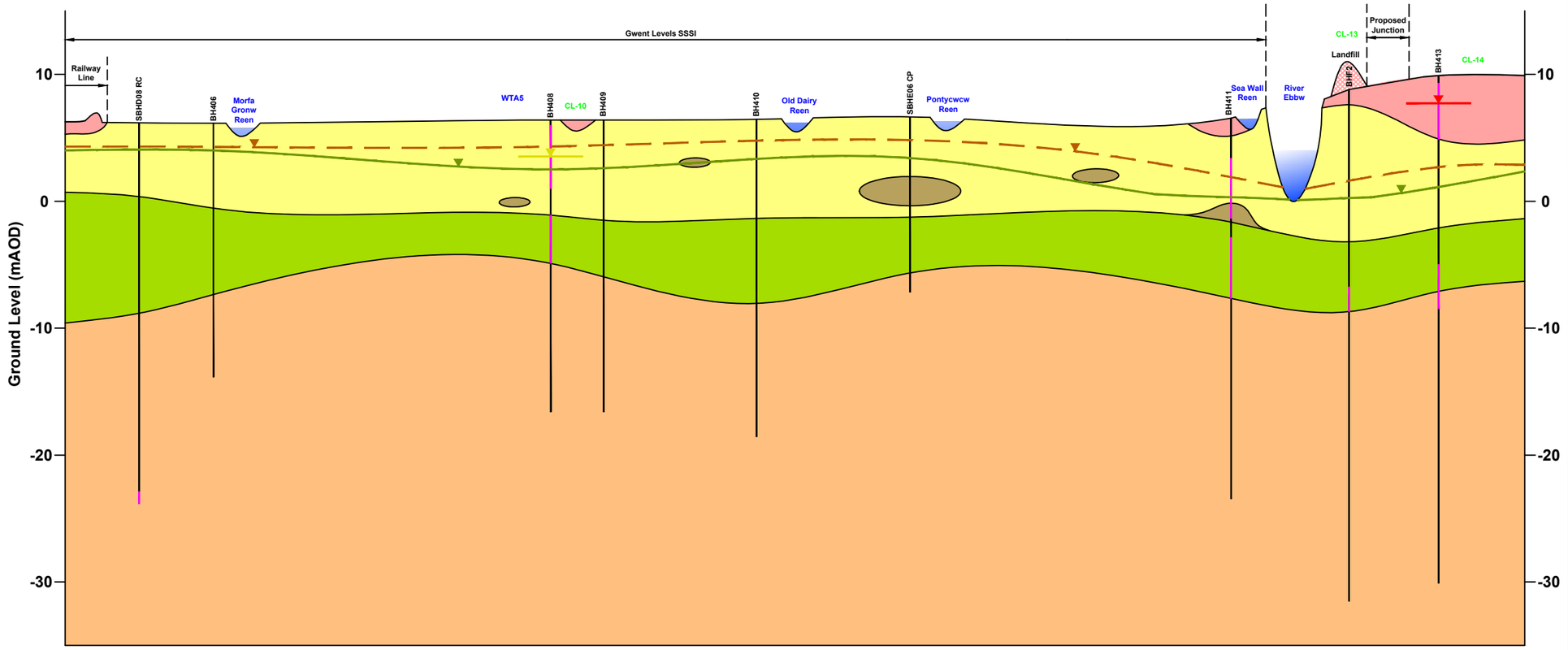
Conceptual Hydrogeological Model

Figure: 16.5a	Revision: -
Date: March 2016	Status: At Issue
Drawn: RJJ	Checked: ARG

Not to Scale

dwg ref:JER6591_Figure16-5a_ConceptualHydrogeologicalModel

dwg ref: JER6591_Figure16-5a_ConceptualHydrogeologicalModel



Legend

- Made Ground - MG
- Glaciofluvial Deposits - GFD
- Tidal Flat Deposits - TFD
- Peat
- Mercia Mudstone - MM
- Inferred Potentiometric Surface for MM
- Potentiometric Surface for GFD
- Perched Groundwater in TFD
- Perched Groundwater in MG
- Borehole
- Response Zone

Llywodraeth Cymru
Welsh Government

Environmental Statement

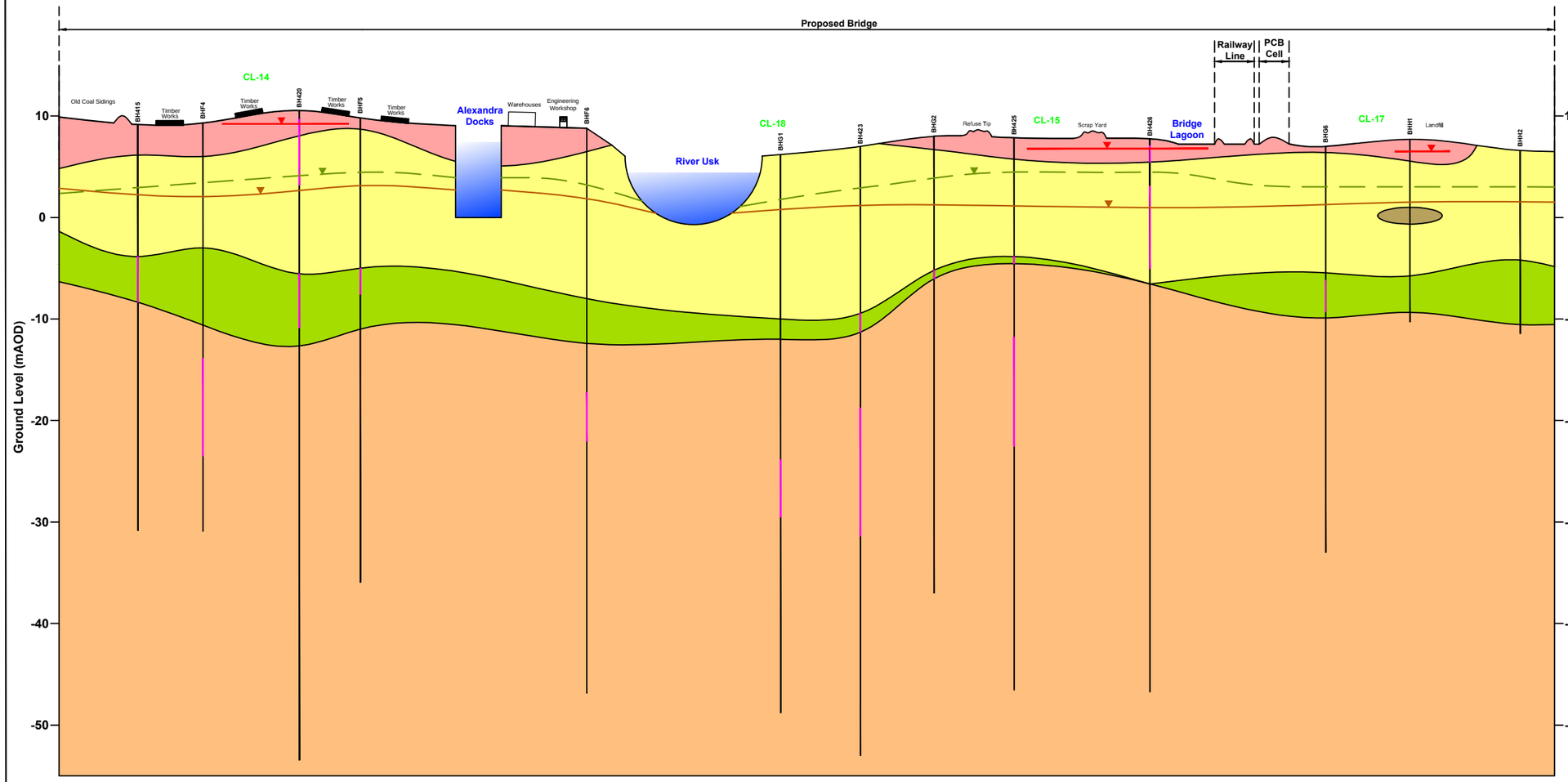
Conceptual Hydrogeological Model

Figure: 16.5b	Revision: -
Date: March 2016	Status: At Issue
Drawn: RJJ	Checked: ARG

Not to Scale

dwg ref:JER6591_Figure16-5b_ConceptualHydrogeologicalModel

dwg ref: JER6591_Figure16-5b_ConceptualHydrogeologicalModel



Legend

- Made Ground - MG
- Glaciofluvial Deposits - GFD
- Tidal Flat Deposits - TFD
- Peat
- Mercia Mudstone - MM
- Inferred Potentiometric Surface for MM
- Potentiometric Surface for GFD
- Perched Groundwater in MG
- Borehole
- Response Zone

Llywodraeth Cymru
Welsh Government

Environmental Statement

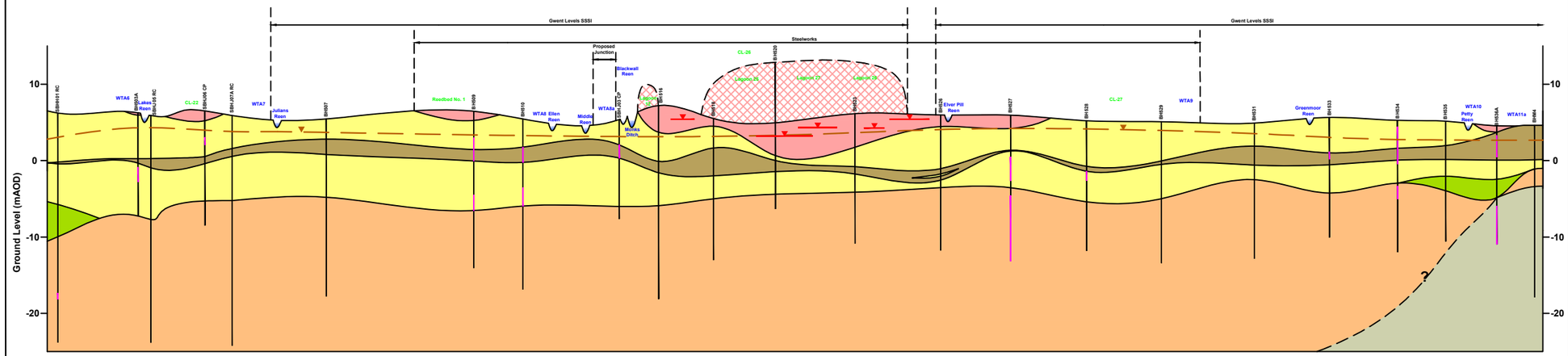
Conceptual Hydrogeological Model

Figure: 16.5c	Revision: -
Date: March 2016	Status: At Issue
Drawn: RJJ	Checked: ARG

Not to Scale

dwg ref:JER6591_Figure16-5c_ConceptualHydrogeologicalModel

dwg ref: JER6591_Figure16-5c_ConceptualHydrogeologicalModel



Legend

- Made Ground - MG
- Glaciofluvial Deposits - GFD
- Tidal Flat Deposits - TFD
- Peat
- Mercia Mudstone - MM
- Tintern Sandstone Group - TSG
- Potentiometric Surface for MM
- Potentiometric Surface for GFD
- Borehole
- Response Zone

Llywodraeth Cymru
Welsh Government

Environmental Statement

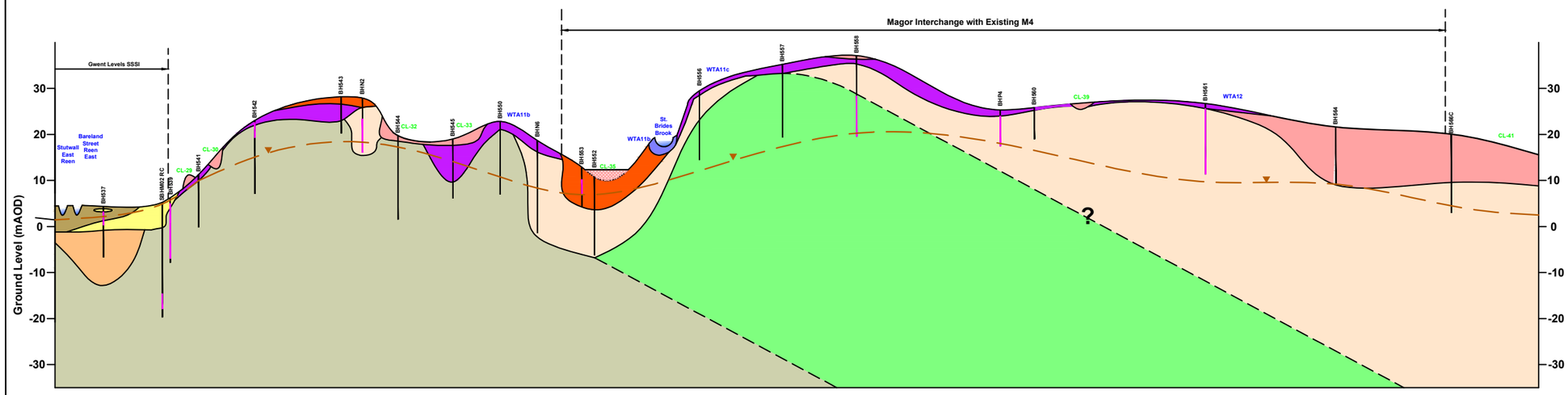
Conceptual Hydrogeological Model

Figure: 16.5d	Revision: -
Date: March 2016	Status: At Issue
Drawn: RJJ	Checked: ARG

Not to Scale

dwg ref:JER6591_Figure16-5d_ConceptualHydrogeologicalModel

dwg ref: JER6591_Figure16-5d_ConceptualHydrogeologicalModel



Legend

- Made Ground - MG
- Alluvium - AL
- Glaciofluvial Deposits - GFD
- Head Deposits - HD
- River Terrace Deposits - RTD
- Tidal Flat Deposits - TFD
- Peat
- Carboniferous Limestone - CL
- Mercia Mudstone - MM
- Mercia Mudstone (Marginal Facies) - MFMMG
- Tintern Sandstone Group - TSG
- Inferred Potentiometric Surface for MM/TSG/MFMMG/CL (Bedrock)
- Borehole
- Response Zone

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Environmental Statement

Conceptual Hydrogeological Model

Figure: 16.5e	Revision: -
Date: March 2016	Status: At Issue
Drawn: RJJ	Checked: ARG

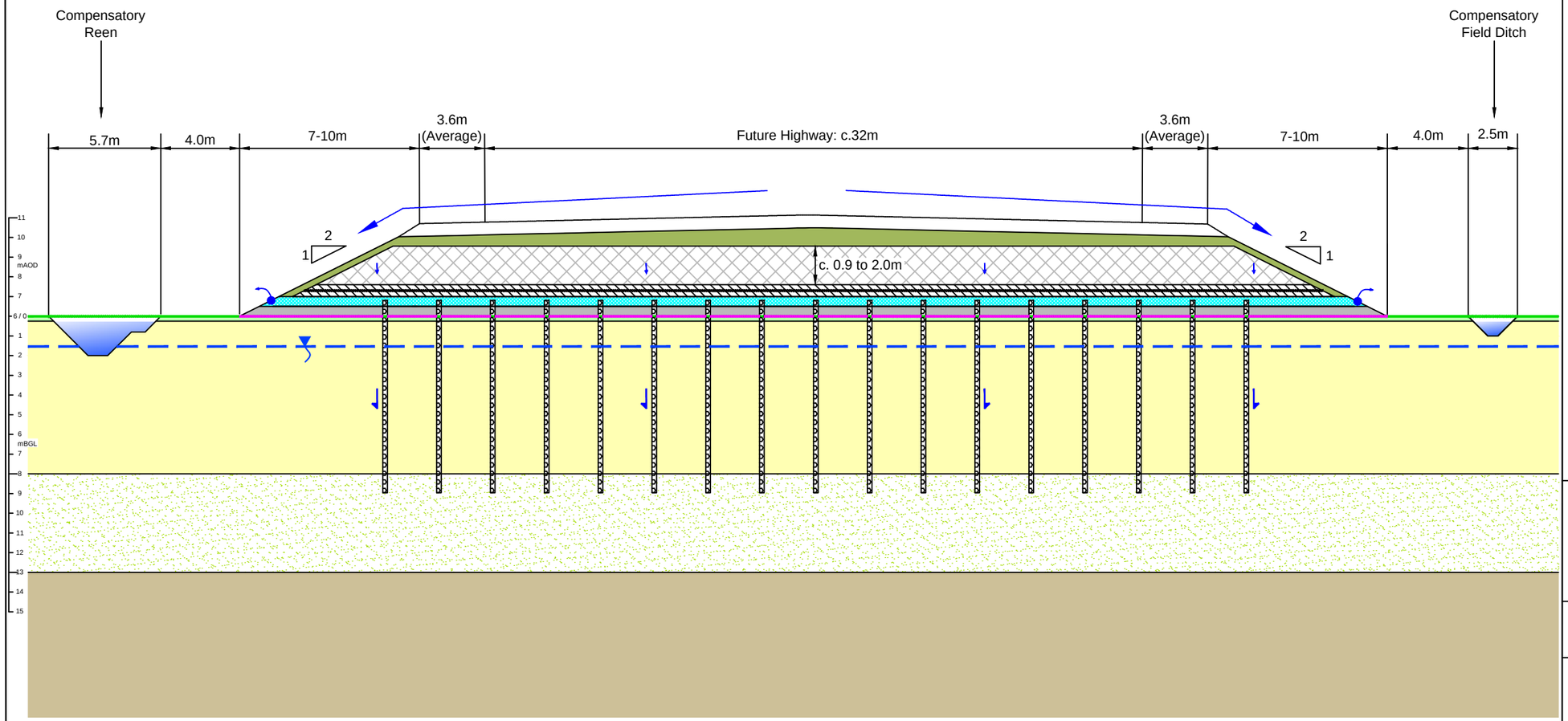
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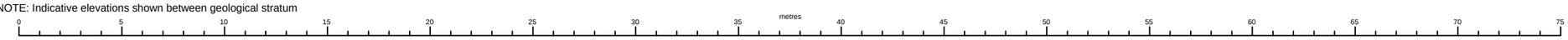
dwg ref: JER6591_Figure16-5e_ConceptualHydrogeologicalModel

MODEL 1A: SURCHARGING PHASE (CONSTRUCTION)

(<5.0m EMBANKMENT IN THE GWENT LEVELS (BAND DRAINS)



NOTE: Indicative elevations shown between geological stratum



Legend

Geology & Hydrogeology

- Indicative Ground Level
- Topsoil
- Tidal Flat Deposits (TFD)
- Glaciofluvial Deposits (GFD)
- Mercia Mudstone Group (MMG)
- Potentiometric Surface of GFD/MMG Aquifer (c.4.5mAOD)

Highway Structure

- Cover Layer (c.0.3m on Slopes, c.1.0m on Platform)
- General Embankment Fill (c.0.9 to 2.0m)
- Reinforcement Blanket (c.0.6m)
- Geotextile Reinforcement
- Drainage Blanket (c.0.5m)
- Working Platform (c.0.5m)
- Geotextile Separator
- Compensatory Reen (c.2.0m Deep)
- Compensatory Field Ditch (c.1.0m Deep)
- Band Drain (c.2.5m Spacing)
- Surface Run-Off
- Potential Infiltration through Embankment Fill
- Potential Discharge from Drainage Blanket
- Potential Leakage through Band Drain

Llywodraeth Cymru
Welsh Government

Environmental Statement

Schematic Conceptual Embankment - Surcharging Phase: <5m Height within the Gwent Levels

Figure: 16.6	Revision: -
Date: March 2016	Status: At Issue
Drawn: RJJ	Checked: ARG

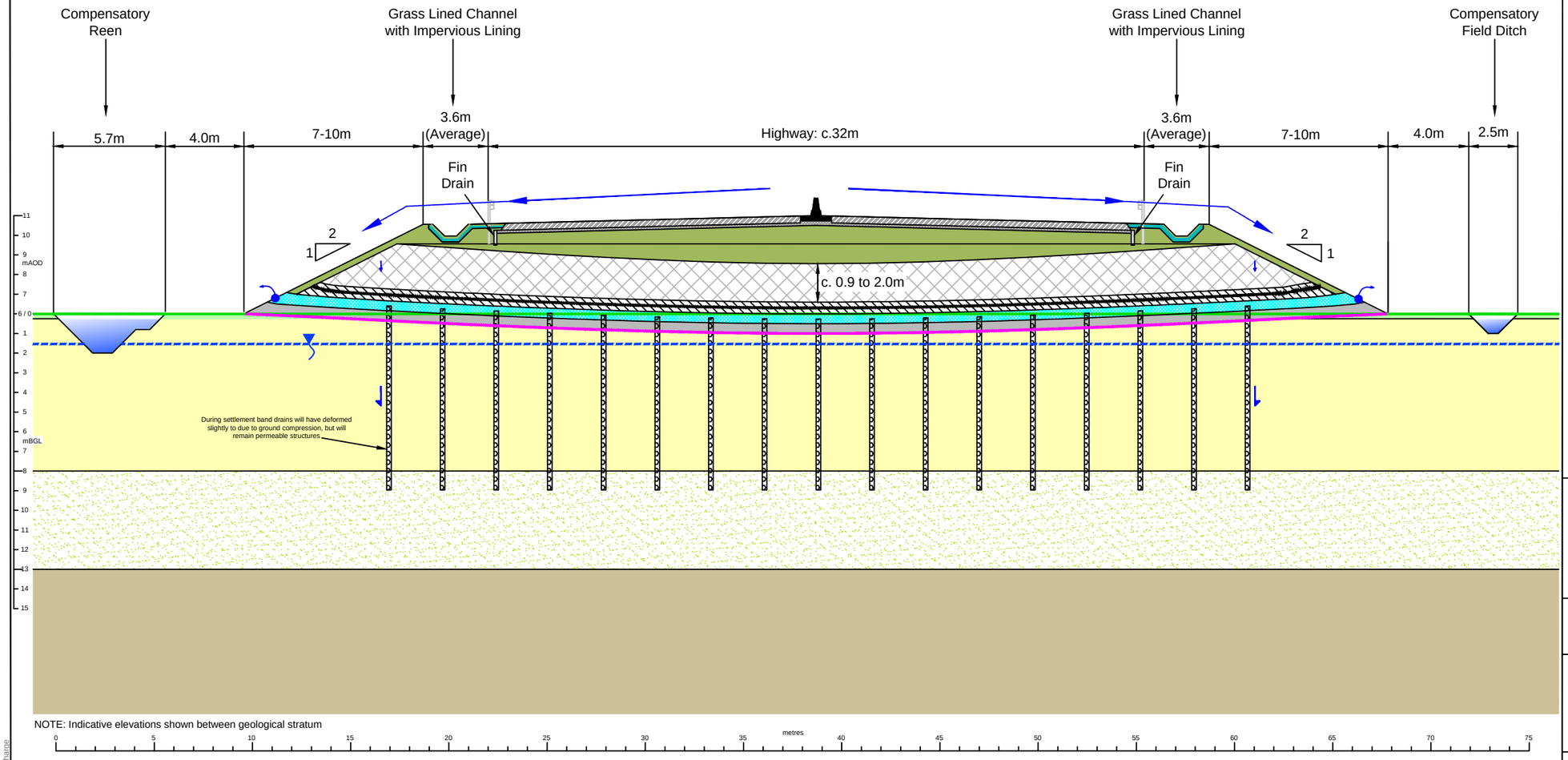
Scale A3 @ 1:250

dwg ref:JER6591_Figure16-6_EmbankmentUnder5MSurcharging

dwg ref: JER6591_Figure16-6_EmbankmentUnder5MSurcharging

MODEL 1B: POST-SURCHARGE PHASE (OPERATIONAL)

(<5.0m EMBANKMENT IN THE GWENT LEVELS (BAND DRAINS)



NOTE: Indicative elevations shown between geological stratum

Legend

Geology & Hydrogeology

- Indicative Ground Level
- Topsoil
- Tidal Flat Deposits (TFD)
- Glaciofluvial Deposits (GFD)
- Mercia Mudstone Group (MMG)
- Potentiometric Surface of GFD/MMG Aquifer (c.4.5mAOD)

Highway Structure

- Tarmac (c.0.35m)
- Sub-Base (c.0.15m)
- Cover Layer (c.0.3m on Slopes)

c. Up to 2.0m on Platform

- Grass-Lined Channel with Impervious Lining
- General Embankment Fill (c.0.9 to 2.0m)
- Reinforcement Blanket (c.0.6m)
- Geotextile Reinforcement
- Drainage Blanket (c.0.5m)
- Working Platform (c.0.5m)
- Geotextile Separator
- Compensatory Reen (c.2.0m Deep)
- Compensatory Field Ditch (c.1.0m Deep)
- Band Drain (c.2.5m Spacing)
- Highway Run-Off
- Surface Run-Off
- Potential Infiltration through Embankment Fill
- Potential Discharge from Drainage Blanket
- Potential Leakage through Band Drain

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Environmental Statement

Schematic Conceptual Embankment - Post-Surcharge Phase: <5m Height within the Gwent Levels

Figure: 16.7	Revision: -
Date: March 2016	Status: At Issue
Drawn: RJJ	Checked: ARG

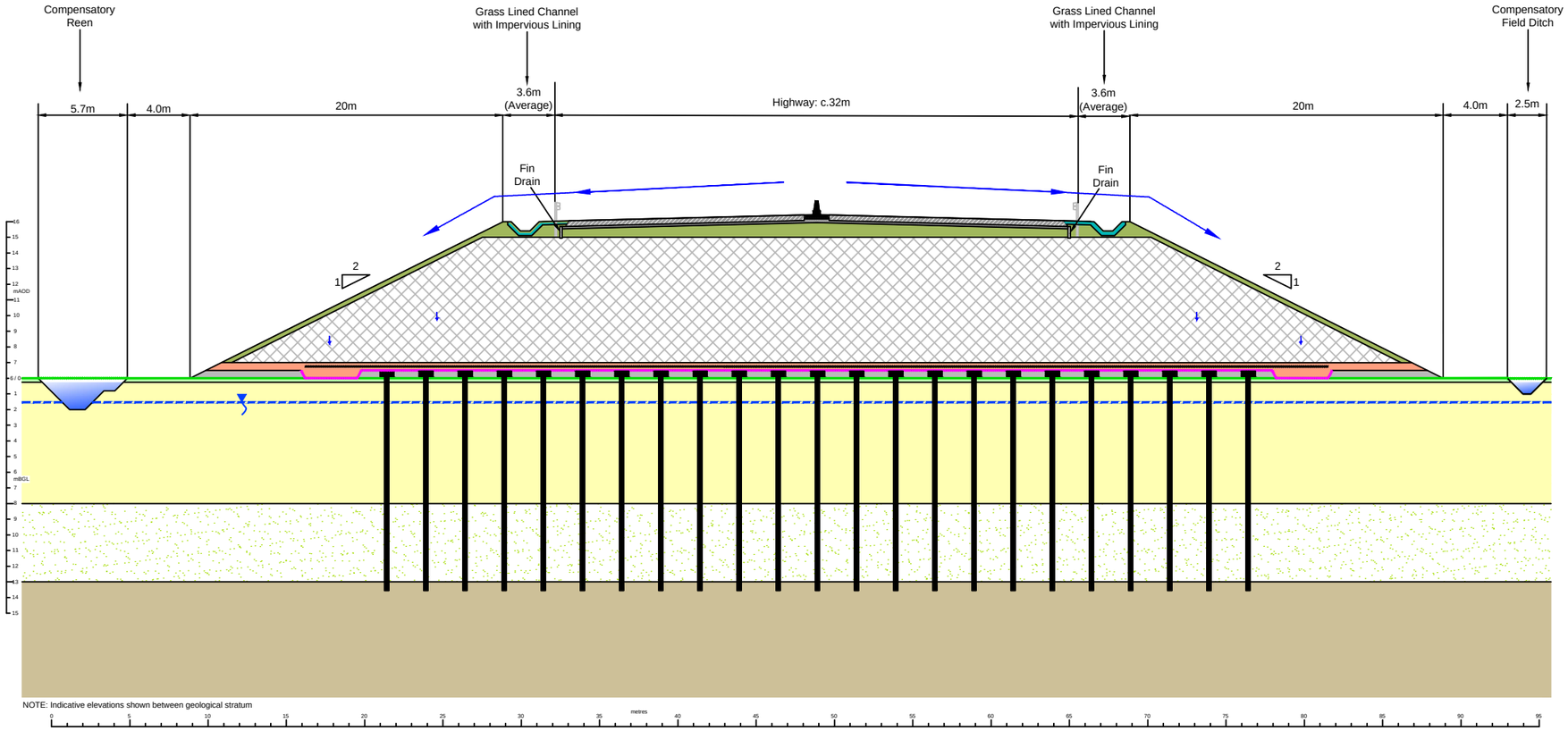
Scale A3 @ 1:250

dwg ref:JER6591_Figure16-7_EmbankmentUnder5MPostSurcharge

dwg ref: JER6591_Figure16-7_EmbankmentUnder5MPostSurcharge

MODEL 2: CONSTRUCTION & OPERATION

(10m EMBANKMENT IN THE GWENT LEVELS (PILED FOUNDATIONS - NO BAND DRAINS)



Legend

Geology & Hydrogeology

- Indicative Ground Level
- Topsoil
- Tidal Flat Deposits (TFD)
- Glaciofluvial Deposits (GFD)
- Mercia Mudstone Group (MMG)
- Potentiometric Surface of GFD/MMG Aquifer (c.4.5mAOD)

Highway Structure

- Cover Layer
- General Embankment Fill
- Longitudinal Geogrid
- Basal Layer - Compacted Granular Material
- Piling Platform - Compacted Granular Material (c.0.5m)
- Transverse Geogrid
- Compensatory Reen (c.2.0m Deep)
- Compensatory Field Ditch (c.1.0m Deep)
- Driven Pile (0.275m Width with 0.9 x 0.35m Cap) - Indicative 2.5m Spacing Shown
- Highway Run-Off
- Surface Run-Off
- Potential Infiltration through Embankment Fill

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Environmental Statement

Schematic Conceptual Embankment - Post-Surcharge Phase: >5m Height within the Gwent Levels

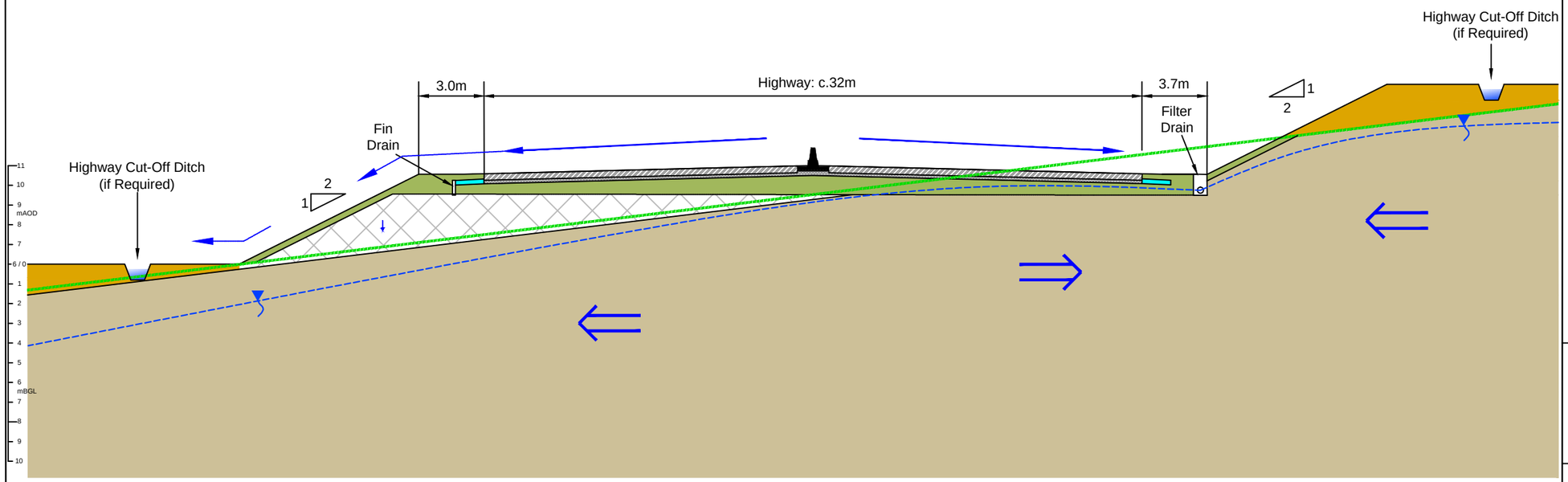
Figure: 16.8	Revision: -
Date: March 2016	Status: At Issue
Drawn: RJJ	Checked: ARG

Scale A3 @ 1:350

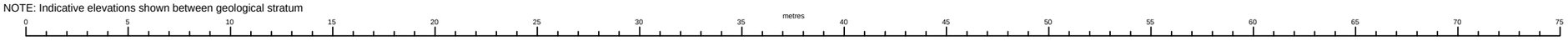
dwg ref:JER6591_Figure16-8_EmbankmentOver5m

dwg ref: JER6591_Figure16-8_EmbankmentOver5m

MODEL 3: CUT & FILL (OUTSIDE OF GWENT LEVELS)



NOTE: Indicative elevations shown between geological stratum



Legend

Geology & Hydrogeology

- Indicative Ground Level
- Mercia Mudstone Group (MMG)
- Potentiometric Surface of GFD/MMG Aquifer (c.4.5mAOD)

Highway Structure

- Tarmac (c.0.35m)
- Sub-Base (c.0.15m)
- Cover Layer (c.0.3m on Slopes)

(c. Up to 2.0m on Platform)

- General Embankment Fill (c.0.9 to 2.0m)
- Fill Material
- Highway Cut-Off Ditch
- Highway Run-Off
- Surface Run-Off
- Potential Infiltration through Embankment Fill
- Potential Discharge from Drainage Blanket
- Potential Leakage through Band Drain

Llywodraeth Cymru
Welsh Government

Environmental Statement

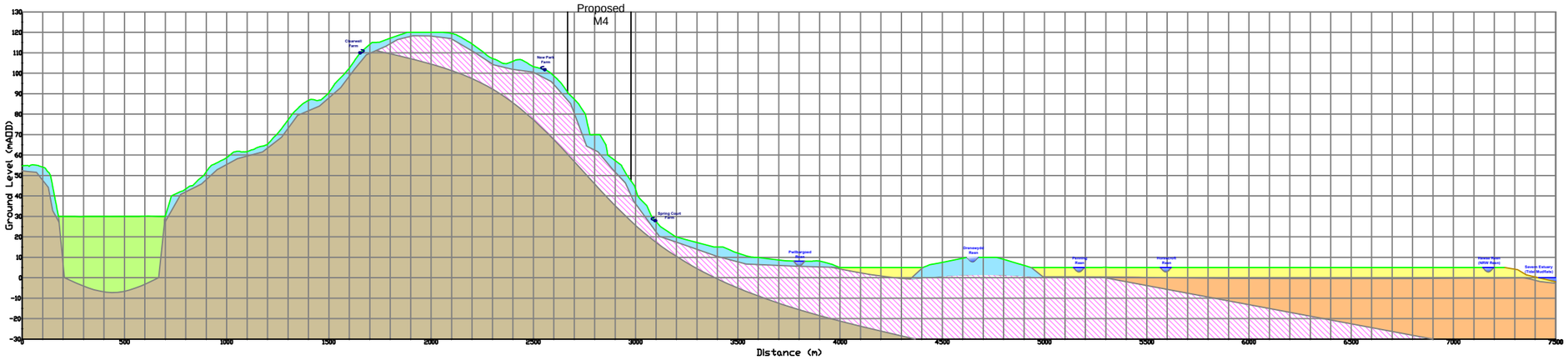
Schematic Conceptual Embankment - Cut & Fill: Outside of Gwent Levels

Figure: 16.9	Revision: -
Date: March 2016	Status: At Issue
Drawn: RJJ	Checked: ARG

Scale A3 @ 1:250

dwg ref:JER6591_Figure16-9_EmbankmentCut&Fill

dwg ref: JER6591_Figure16-9_EmbankmentCut&Fill



Vertical Exaggeration of 10:1

Legend

- Topsoil
- Glacial Till Deposits - GTD
- Alluvium - AL
- Tidal Flat Deposits - TFD
- Raglan Mudstone Formation - RMF
- St. Maughan's Formation - SMF
- Mercia Mudstone Group - MMG
- Watercourse / Reen
- Spring Water Abstraction

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Welsh Government

Environmental Statement

Hydrogeological Cross Section for Private Water Users

Figure: 16.10	Revision: -
Date: March 2016	Status: At Issue
Drawn: RJJ	Checked: ARG

Scale A3 @ 1:25,000

dwg ref:JER6591_Figure16-10_HydrogeologicalCrossSection

dwg ref: JER6591_Figure16-10_HydrogeologicalCrossSection