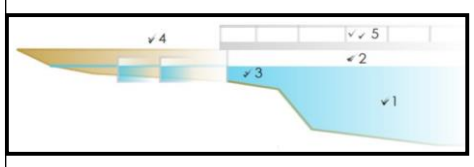
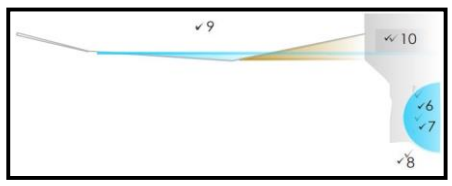
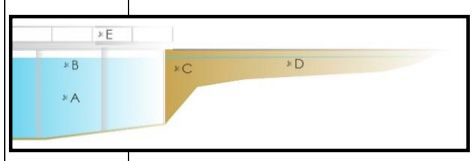
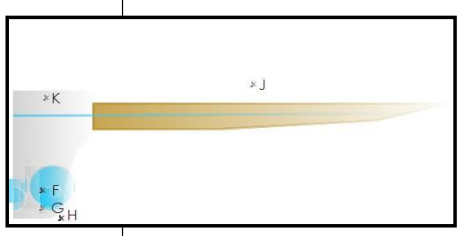
Hydraulic Assessment & Design Standards - Section 50 Watercourse Crossings (Ref. OPW, 2019)		
Item Description	**Applicability**	**Comment**
General Hydraulic Design Standards		
A bridge or culvert must be capable of passing a fluvial flood flow with a 1% annual exceedance probability (AEP) or 1 in 100 year flow without significantly changing the hydraulic characteristics of the watercourse.	Applicable	Design will allow for 1 in 100 1% AEP storm event, plus 20% allowing for climate change.
In addition to the above fluvial flood flow standard, if a bridge or culvert is located within a tidal zone, it must cater for a tide level with a 0.5 % (AEP) or 1 in 200 year flow without significantly changing the hydraulic characteristics of the watercourse.	Not Applicable	Site is not within a tidal flood zone
A bridge must be capable of operating under the above design conditions while maintaining a freeboard of at least 300 mm.	Applicable	Design will allow for 1 in 100 1% AEP storm event, plus 20% allowing for climate change and at least 300mm of freeboard.
If the land potentially affected does not include dwellings and infrastructure, a culvert must be capable of operating under the above design conditions while causing a hydraulic loss of no more than 300 mm (excluding the culvert gradient).	Not Applicable	Infrastucture on site
If the land potentially affected includes dwellings and infrastructure, it must be demonstrated that those dwellings and/or infrastructure are not adversely affected by constructing the bridge or culvert.	Applicable	Infrasturcture on site and dwelling in close proximity
A culvert diameter, height and width must not be less than 900 mm to facilitate maintenance access and reduce the likelihood of debris blockage.	Applicable	Design will allow for height and width of 900mm minium .
Hydrological Considerations for Analysis		
The hydrological analysis submitted in support of an application should be representative of the rainfall and flood flows that can be expected at the site of the proposed bridge or culvert. It should therefore:	If the level of risk or uncertainty warrants, a **HIGHER** design standard may be required. A **LOWER** design standard may be considered by the OPW if there is a sufficiently low risk. In such cases, adequate justification must be provided with the application.	
Define the hydrological characteristics of the watercourse catchment upstream of the location of the proposed bridge or culvert.	Applicable	This is completed as part of **SSFRA Stage 1 & 2**.
Utilise all appropriate and available rainfall and hydrometric data.	Applicable	This will be completed as part of **SSFRA Stage 3** Advanced Assessment & Modelling.
Where appropriate, use a range of techniques to estimate the design peak flood flow.	Applicable	**SFRA Stage 3**
Incorporate any expected change in the catchment's hydrological characteristics due to "climate change".	Applicable	**SFRA Stage 3**
Hydraulic Considerations for Analysis		
The hydraulic analysis submitted in support of an application should be representative of the bridge or culvert that will be constructed. It should therefore take into account:	If the information required to review your application is not submitted, the OPW will place your application on hold pending the receipt of outstanding or additional information.! Any change to the hydraulic designof the bridge or culvert made after receipt of consent from the OPW under Section 50 will invalidate that consent.	
All losses associated with the bridge or culvert (e.g. entrance, exit, friction and pier losses).	Applicable	This will be completed as part of SSFRA Stage 3 Advanced Assessment & Modelling.
Any ancillary works that may affect the hydraulic performance of the bridge or culvert (e.g. erosion control works and debris screens)	Applicable	This will be completed as part of SSFRA Stage 3 Advanced Assessment & Modelling.
The effect of the downstream water level on the hydraulic performance of the bridge or culvert, including tides.	Applicable	This will be completed as part of SSFRA Stage 3 Advanced Assessment & Modelling.
The hydraulic implications of any environmental measures incorporated into th bridge or culvert design (e.g. depression of the invert or the installation of baffles).	Applicable	This will be completed as part of SSFRA Stage 3 Advanced Assessment & Modelling.
Level of Technical Anaylsis		
The level of technical analysis that may be required in support of an application.	Applicable	Refer to **Table 8** of the **SSFRA**
Some features of Hydraulically Efficient Bridge and Culvert		
1. The use of piers is minimised. This helps to retain the existing channel Cross section, velocities and turbulence. It also reduces The likelihood of debris blockage. **2.** The bridge is designed to operate with a freeboard between the flood level and the bridge deck. This reduces the likelihood of debris blockage and also allows for uncertainties in hydrological and hydraulic design calculations. **3.** The encroachment of the bridge abutments into the channel is minimised. This helps to retain the existing channel cross section, velocities and turbulence. **4.** Any existing overland flow paths are either retained or replaced. This reduces the likelihood of the blockage and diversion of floodwaters onto otherwise unaffected parts of the floodplain. **5.** The bridge abutments and any piers are parallel with the existing direction of flow. **6.** The restriction of the existing channel is minimised through the use of the largest practical culvert size. This helps to retain the existing channel cross section, velocities and turbulence. **7.** The number of barrels is minimised. This reduces the likelihood of debris blockage **8.** The culvert invert is set below the bed level of the existing channel. This reduces the likelihood of scour under the culvert barrel. **9.** Any existing overland flow paths are either retained or replaced. This reduces the likelihood of the blockage and diversion of floodwaters onto otherwise unaffected parts of the floodplain. **10.** The culvert is designed to operate without a reliance on excessive head loss across the structure. This reduces the likelihood of high velocities and turbulence in the culvert and channel.	This willl be considered in **Stage 3** of the **SSFRA**   	
Some features of Hydraulically Inefficient Bridge and Culvert		
A. An excessive number of piers are included in the bridge design.This reduces the existing channel Cross section and as a result may increase in-channel velocities and turbulence. It may also increase the likelihoodof debris blockage. **B.**There is inadequate freeboard between the design flood leveland thebridge deck. This increases the likelihood of floating debris blockageand does not allow for any uncertainties in the hydrological and hydraulic design calculations. **C.**The bridge abutments encroach intothe existing channel.This reduces the existing channel cross section and as a result may increase in-channelvelocities and turbulence. **D.** Existing overland flow paths are blocked. This maycause the diversion of floodwaters onto otherwise unaffected partsof the floodplain. **E**.The bridge abutments and anypiers are notaligned parallel to the existing direction of flow. This is likely to decrease the hydraulic performance of the bridge **F**.The culvert diameter is smallrelative tothe existing channelcross section.This increases the upstreamwater level,increases velocities and turbulence, and alsoincreasesthe likelihood of debris blockage. **G.**The required culvert capacity is achieved by using an excessive number of Barrels.This increases thelikelihood of blockage and mayalso increase maintenance requirements. **H.**The culvert invertis set above the bed levelof the existing channel. This increases tthe likelihood of scour under the culvertbarreland subsequent failure. **J.** Existing overland flow paths are blocked. This may cause the diversion of flood waters onto otherwiseunaffected parts of the floodplain. **K.** The culvertis onlyabletopass the design flow with a significant head loss across the structure. This may result in increased upstream water levels, high velocities and turbulence that may damage the structure and channel.	This willl be considered in **Stage 3** of the **SSFRA**   	
Information checklist Section 50 Application		
Completed application form.	Applicable	Provided on www.assets.gov.ie
Scaled and annotated location plan (including accurate geographic position).	Applicable	This is completed as part of **SSFRA Stage 1 & 2**.
Scaled plan(s) and cross section(s) of all works associated with the bridge or culvert (including the earthworks necessary to form any approaches to the bridge or culvert) referenced to ordnance datum.	Applicable	This will be completed as part of **SSFRA Stage 3** Advanced Assessment & Modelling.
Annotated photographs of the proposed site, the upstream channel and floodplain, and the downstream channel and floodplain. Details of any existing bridges both upstream and downstream of the proposed site are to be included, if applicable.	Applicable	This is completed as part of **SSFRA Stage 1 & 2**.
Technical documentation covering the hydrological and hydraulic analysis completed during the design of the bridge or culvert.	Applicable	This will be completed as part of **SSFRA Stage 3** Advanced Assessment & Modelling.