## State code 18: Constructing or raising waterway barrier works in fish habitats

T**able 18.2.2: Operational work**

| Performance outcomes | Acceptable outcomes | Response |
| --- | --- | --- |
| All development | | |
| **PO1** There is a demonstrated need for the development and alternatives (locations and designs) which have a lesser impact on fish passage or do not involve constructing or raising waterway barrier works are not viable. | No acceptable outcome is prescribed. | Complies with PO# / AO#  Use this column to indicate whether compliance is achieved with the relevant PO or AO (or if they do not apply), and explain why |
| **PO2** Development has a functional requirement to be located within a waterway. Ancillary elements of development occur outside the waterway.  Note: Bed and banks of the waterway and any associated wetlands and riparian areas within the development site should be accurately identified on plans provided with the application, together with the location of highest astronomical tide, mean high water spring and mean low water spring tide heights if the waterway is tidal. | No acceptable outcome is prescribed. |  |
| **PO3** The number and extent of waterway barrier works and the spatial and temporal extent of their impacts on waterways providing for fish passage are minimised. | No acceptable outcome is prescribed. |  |
| **PO4** For the life of the barrier, adequate fish passage must be provided and maintained at all waterway barrier works through:   1. fish way(s) that adequately provide for the movement of fish; or 2. the movement of fish is adequately provided for in another way. | For all crossings:  AO4.1 Hydraulic conditions (depth, velocities and turbulence) from the downstream to the upstream limit of the structure allow for fish passage of all fish attempting to move through the crossing at all flows up to the drownout of the structure.  AND |  |
| AO4.2 For the life of the crossing, the relative levels of:   1. a bed level crossing or a culvert invert 2. bed erosion protection 3. apron scour protection; and 4. the stream bed are maintained to avoid drops in elevation at their joins.   AND |  |
| AO4.3 The crossing and associated erosion protection structures are installed at no steeper gradient than the waterwaybed gradient.  AND |  |
| AO4.4 The crossing and associated erosion protection structures are roughened throughout to approximately simulate natural bed conditions.  AND |  |
| AO4.5 Design and maintenance measures are in place for the life of the crossing to keep crossings clear of blockages through a regular inspection program in order to retain fish passage through the crossing.  AND |  |
| For waterway crossings other than bridges and culverts:  AO4.6 The crossing is built at or below bed level so that the surface of the crossing is no higher than the stream bed at the site.  AND |  |
| AO4.7 The lowest point of the crossing is installed at the level of the lowest point of the natural stream bed (pre-construction), within the footprint of the proposed crossing.  AND |  |
| AO4.8 There is a height difference between the lowest point of the crossing and the edges of the low flow section of the crossing so that water is channelled into the low flow section of the crossing.  AND |  |
| AO4.9 The level of the remainder of the crossing is no higher than the lowest point of the natural stream bed outside of the low flow channel.  AND |  |
| For bridges:  AO4.10 Bridge support piles are not constructed within the low-flow channel and do not constrict the edges of the low-flow channel, and the number of piles in-stream are minimised.  AND |  |
| AO4.11 Bridge abutments and bank revetment works do not extend into the waterway beyond the toes of the banks.  AND |  |
| AO4.12 Suitable fish habitats are maintained within the low-flow channel.  AND |  |
| For culverts:  AO4.13 Culverts are only installed where the site conditions do not allow for a bridge.  AND |  |
| AO4.14 The combined width of the culvert cell apertures are equal to 100 percent of the main channel width.  AND |  |
| AO4.15 The base of the culvert incorporates a low flow channel consistent with the natural low flow channel and:   1. is buried a minimum of 300 millimetres to allow bed material to deposit and reform the natural bed on top of the culvert base; or 2. the base of the culvert is the stream bed; or 3. the base of the culvert cell and any instream scour protection is roughened throughout to approximately simulate natural bed conditions.   AND |  |
| AO4.16 The outermost culvert cells incorporate roughening elements such as baffles on their bankside sidewalls.  AND |  |
| AO4.17 Roughening elements are installed on the upstream wingwalls on both banks to the height of the upstream obvert or the full height of the wingwall.  AND |  |
| AO4.18 Roughening elements provide a contiguous lower velocity zone (no greater than 0.3 metres/second) for at least 100 millimetres width from the wall through the length of the culvert and wingwalls.  AND |  |
| AO4.19 Culvert alignment to the stream flow minimises water turbulence.  AND |  |
| AO4.20 There is sufficient light at the entrance to and through the culvert so that fishare not discouraged by a sudden darkness.  AND |  |
| AO4.21 The depth of cover above the culvert is as low as structurally possible, except where culverts have an average recurrence interval (ARI) greater than 50 years.  AND |  |
| AO4.22 For culvert crossings designed with a flood immunity ARI greater than 50 years, fish passage is provided up to culvert capacity.  For all other development no acceptable outcome is prescribed. |  |
| **PO5** Waterway barrier works are designed, constructed, operated and maintained to provide lateral and longitudinal fish passage for all members of the fish community, regardless of size, species, life-stage or swimming ability, and accommodating future and seasonal increases in fish biomass.  Note: In order to demonstrate compliance with this performance outcome, the seasonal and flow related biomass of the fish community at the location of the proposed waterway barrier works will need to be surveyed and addressed in the design of the fish way by a person suitably qualified and experienced in fish passage biology. In addition, any future increases in fish biomass should be quantified and catered for.  Lateral fish passage refers to the movement into both permanent and temporary offstream systems, including wetlands, lagoons, floodplain etc. Fragmentation of connectivity into and out of these systems must be mitigated via adequate fish passage. | No acceptable outcome is prescribed. |  |
| **PO6** Development is designed and operated so that all components of waterway barrier works (for example scour protection, intake and outlet structures, spillway, stilling basin, apron and dissipation structures) and all pathways of potential fish movement provide safe fish passage.  Stepped spillways (including sheet pile weirs) are not acceptable.  Note: Stepped spillway (including sheet pile weirs) have been associated with high mortalities and injuries to fish.  Assessment of this performance outcome will include consideration of adequate tailwater depth at the toe of the spillway (for example: stilling basin) at commencement to spill (for example: 30 percent of the head difference). | No acceptable outcome is prescribed. |  |
| **PO7** The drownout characteristics of the waterway barrier works and the frequency, timing and duration of drownout conditions will provide adequate fish passage for the fish community and biomass moving past the barrier.  Note: Determining adequacy of fish passage will involve consideration of passage achieved during drownout and during other hydraulic conditions and the relative frequencies of these conditions among other things. | No acceptable outcome is prescribed. |  |
| **PO8** Development does not increase the risk of mortality, disease or injury, or compromise the health, productivity, marketability or suitability for human consumption of fisheries resources, having regard to (but not limited to):   1. biotic and abiotic conditions, such as water and sediment quality 2. substances that are toxic to plants or toxic to or cumulative within fish 3. design of structures 4. impacts on reproductive success 5. effect on fish energy reserves 6. whether fish may be physically damaged, injured, killed, trapped or stranded 7. fish passage and access to habitat generally; and 8. the impacts of pest fish and other relevant pest species.   Note: A fish salvage plan may be required to demonstrate compliance with the performance outcome and may form a condition of any approval.  Permits or other authorities may be required under the *Fisheries Act 1994* for the use of regulated fishing apparatus and to posess fisheries resources. | No acceptable outcome is prescribed. |  |
| **PO9** Development:   1. avoids non-essential hardening or unnatural modification of the main channel of the waterway 2. retains natural fish habitat and features such as rock outcrops and boulders, wherever possible 3. avoids channelisation (i.e. straightening) of meandering waterways or where channels need to be significantly modified, simulates natural waterways and habitat features (for example, by including meanders, pools, riffles, shaded and open sections, deep and shallow sections and different types of substrata); and 4. avoids construction during times of elevated flows. | No acceptable outcome is prescribed. |  |
| **PO10** Where waterway barrier works will modify water levels or flow characteristics of the waterway, existing up and downstream structures are upgraded to provide adequate fish passage in accordance with the new levels or flow characteristics. | No acceptable outcome is prescribed. |  |
| **PO11** Sufficient water exchange and flow is maintained and provided to sustain and where necessary restore, water quality and the health and condition of fisheries resources, ecological functions and fish passage. | No acceptable outcome is prescribed. |  |
| **PO12** Development likely to cause drainage or disturbance to acid sulfate soils, prevents the release of contaminants and impacts on fisheries resources and fish habitats.  Note: Management of acid sulfate soil is consistent with the current Queensland acid sulfate soil technical manual: Soil Management Guidelines V4.0, Department of Science, Information Technology, Innovation and the Arts, 2014. | No acceptable outcome is prescribed. |  |
| **PO13** Construction avoids direct and indirect disturbance, or where avoidance is not possible, minimises direct and indirect disturbance to beds, banks and vegetation adjacent to the permanent development footprint. | No acceptable outcome is prescribed. |  |
| **PO14** After completion of in-stream works, disturbed areas of the bed and banks of the waterway outside the permanent development footprint are returned to their original profile and stabilised to promote regeneration of natural fish habitats.  Note: Monitoring of the success of fish habitat regeneration, within and adjacent to the work site, is likely to be conditioned as part of any development approval. | No acceptable outcome is prescribed. |  |
| **PO15** The natural substrate of the waterway bed is retained or reconstructed so that the post-construction substrate is comparable to the natural substrate; for example in terms of size and consistency. | No acceptable outcome is prescribed. |  |
| **PO16** Development does not adversely impact on community access to tidal land and waterways. | No acceptable outcome is prescribed. |  |
| **PO17** Development does not adversely impact on community access to fisheries resources and fish habitats including recreational and indigenous fishing access.  Note: In some cases, compensation for impact on fisheries access, operations and/or productivity may be necessary. The Guideline on fisheries adjustment provides advice for proponents on relevant fisheries adjustment processes and is available by request from the Department of Agriculture and Fisheries. | No acceptable outcome is prescribed. |  |
| **PO18** Development does not adversely impact on commercial fishing access and linkages between a commercial fishery and infrastructure, services and facilities.  Note: In some cases, compensation for impact on fisheries access, operations and/or productivity may be necessary. The Guideline on fisheries adjustment provides advice for proponents on relevant fisheries adjustment processes and is available by request from the Department of Agriculture and Fisheries. | No acceptable outcome is prescribed. |  |
| Development involving fish ways | | |
| **PO19** Having regard to the hydrology of the site and fish movement characteristics, the fish way is capable of operating, and will operate:   1. for as long as the waterway barrier work is in position; and 2. whenever there are inflows into the impoundment or waterway, release out of the impoundment and during overtopping events; and 3. when the impoundment is above dead storage level. | AO19.1 For the life of the waterway barrier works, the lower operational range of the fish way is at least:   1. 0.5 metres below minimum headwater drawdown level; and 2. 0.5 metres below minimum tail water level at the site. |  |
| **PO20** For the life of the waterway barrier works, the hydrology of the development allows for adequate fish movement. | AO20.1 The lower operational range of the fish way is at least:   1. 0.5 metres below minimum headwater drawdown level; and 2. 0.5 metres below minimum tail water level at the site. |  |
| **PO21** Fish way maximises fish movement by providing:   1. continuous attraction flows at the fish way entrance under all flow conditions within the fish way’s operating range 2. additional means of fish attraction are included in the fish way design if appropriate 3. attraction flow velocities are sufficient and variable to attract the whole fish community, and expected future and seasonal biomass 4. adequate holding chamber capacity for the expected fish biomass in any lock, lift, trap and transfer type fish ways 5. adequate exit conditions for downstream fish passage; and 6. for future adjustments in capacity or operation that may be needed once in place. | No acceptable outcome is prescribed. |  |
| **PO22** Fish ways are designed so that:   1. water intakes, outlets, screens and other structures do not cause entrainment, injury or mortality to fish 2. appropriate light levels are maintained at entrances, exits and throughout the fish way to ensure successful use by fish 3. fish attracted to the spillway or outlet flows are able to access the fish way without having to swim back downstream 4. fish are able to exit upstream and downstream fish ways at a water levels over the full range of tailwater and headwater levels 5. exits are located to avoid fish being washed back over the spillway during overtopping 6. adequate hydraulic conditions and minimum water depth for fish passage is maintained throughout the fish way 7. predation on fish using the fish way is avoided 8. rubbish and debris do not impede fish passage or cause blockages or damage the fish way 9. delays in fish movement are avoided when fish are undertaking upstream spawning migrations; and 10. delays in fish movement are avoided immediately after times when there have been flows in the system but no fish passage in the rising hydrograph. | No acceptable outcome is prescribed. |  |
| **PO23** All water releases are directed through the fish way as a priority over the outlet works. | No acceptable outcome is prescribed. |  |
| **PO24** All flows and releases initiate and terminate adjacent to the fish way or are directed parallel to the fish way entrance and all flows are transferred to the fish way as soon as possible during a flow recession.  Note: Flows and releases include but are not limited to spillway overtopping and outlet flows. Such flows must not compete with fish way attraction flows or reduce the operation of a fish way. | No acceptable outcome is prescribed. |  |
| **PO25** Mechanisms are in place to ensure that operational issues in fish ways are promptly rectified for the life of the fish way including but not limited to:   1. all components are designed to be durable, reliable and adequately protected from damage during high flow and flood events 2. all components can be replaced; and 3. a contingency plan ensures provision of alternate adequate fish passage during the fish way re-instatement process.   Note: Fish way downtime greater than 14 consecutive calendar days is likely to have a significant impact to fisheries resources. | No acceptable outcome is prescribed. |  |
| **PO26** Development provides for:   1. installation of monitoring equipment (such as traps and lifting equipment); and 2. access for monitoring, maintenance and operational purposes. | No acceptable outcome is prescribed. |  |
| **PO27** Water supply for the fish ways and attraction flows are sourced from surface quality water or equivalent water quality. | No acceptable outcome is prescribed. |  |
| **PO28** Tailwater control structures such as a gauging weir, rock bar or stream crossings are fitted with a fish way or designed to provide fish passage. | No acceptable outcome is prescribed. |  |
| Development involving floodgates | | |
| **PO29** Floodgates are designed and operated:   1. to provide hydraulic conditions adequate for fish passage over an adequate duration of the tidal cycle; and 2. as tidally activated, automatic floodgates. | No acceptable outcome is prescribed. |  |
| **PO30** The invert of the floodgate is at bed level. | No acceptable outcome is prescribed. |  |
| **PO31** The operation of the floodgate will not result in adverse impacts on water quality that may harm fish or fish habitat. | No acceptable outcome is prescribed. |  |
| Temporary waterway barrier works | | |
| **PO32** The temporary waterway barrier works will exist only for a specified temporary period and provide for adequate fish movement. | AO32.1 The temporary waterway barrier work:   1. is a partial barrier, or 2. does not constrict the area or flows of a low flow channel. |  |
| AND one of the following acceptable outcomes apply:  AO32.2 The temporary structure is only in place outside of known fish spawning or migration periods.  OR |  |
| AO32.3 The barrier is opened periodically every five days for at least 48 hours to allow fish movement and water exchange.  OR |  |
| AO32.4 Fish movement is provided for via a stream diversion. |  |
| **PO33** Temporary barriers are removed at the end of their design life, so that full movement for fish is reinstated and the bed and banks are returned to their original profile and stability. | No acceptable outcome is prescribed. |  |
| **PO34** Where there are species, at the site of the temporary waterway barrier works that require downstream movement during works, provisions are made to allow those species to move downstream. | No acceptable outcome is prescribed. |  |
| **PO35** The condition and value of aquatic macrophytes and other fish habitats is maintained. | No acceptable outcome is prescribed. |  |
| Matters of state environmental significance | | |
| **PO36** Development:   1. avoids impacts on matters of state environmental significance; or 2. minimises and mitigates impacts on matters of state environmental significance after demonstrating avoidance is not reasonably possible; and 3. provides an offset if, after demonstrating all reasonable avoidance, minimisation and mitigation measures are undertaken, the development results in an acceptable significant residual impact on a matter of state environmental significance.   Statutory note: For Brisbane core port land, an offset may only be applied to development on land identified as E1 Conservation/Buffer, E2 Open Space or Buffer/Investigation in the Brisbane Port LUP precinct plan. For the Brisbane Port LUP, see [www.portbris.com.au](https://apac01.safelinks.protection.outlook.com/?url=https%3A%2F%2Furldefense.proofpoint.com%2Fv2%2Furl%3Fu%3Dhttp-3A__www.portbris.com.au%26d%3DDwMFAg%26c%3DtpTxelpKGw9ZbZ5Dlo0lybSxHDHIiYjksG4icXfalgk%26r%3Dj8d4Zfp2C-A5Ercrdvg5iPCyh7dpRoRj6feYer9UrEw%26m%3D1xhbQenzSj-ciNoYi2MCvXAHk8zpAEWoyMMaHGnZz5s%26s%3Dpr51eu27YBAwu5wExmAWPQAqM3-OHQFcVls3qPZYV9I%26e%3D&data=01%7C01%7CKaren.Kenny%40dilgp.qld.gov.au%7C42c843c42f3f4e766bfd08d4c28a9b58%7C7db2bee6535c4748bf78c30733511bcd%7C0&sdata=maUhKUTczEQLl0csTIgKhJv1BE%2F5iNrJLG%2FvaBX%2B0v8%3D&reserved=0).  Note: For the purpose of this code, the matters of state environmental significance assessed are marine plants, waterways that provide for fish passage and declared fish habitat areas.  Guidance for determining if the development will have a significant residual impact on the matter of state environmental significance is provided in the Significant Residual Impact Guideline, Department of State Development, Infrastructure and Planning, 2014. Where the significant residual impact is considered an acceptable impact on the matter of state environmental significance under the Environmental Offsets framework and an offset is considered appropriate, the offset should be delivered in accordance with the *Environmental Offsets Act 2014.* | No acceptable outcome is prescribed. |  |