

	<p>Land Management Standard</p>	<p>Rev 06</p>
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**APPENDIX 8**

**River Crossings**

**Purpose**

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To manage all river crossings in accordance with relevant Russian Federation and adopted international requirements, including appropriate techniques to minimise disturbance to water regime, and to implement best practice mitigation methodologies for protection of all water bodies.

**Who is this for?**

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- *Onshore Asset Manager<sup>1</sup>;*
- *Project Managers,*
- *Contract Holders,*
- *Contractors with work scope including river crossings, and*
- *Site Managers, Construction Managers and HSE Consultants involved in river crossings activities.*

To be clear, this specification is primarily applicable for the construction phase of projects (pipelines, communications lines, bridges, etc.) and project expansions involving river crossings, however it is also applicable to the works involving maintenance during operations phase, repair of pipeline and/or utility lines at the river crossings, and demobilisation activities.

**Requirements**

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- **River Crossings Execution Plan (RCEP) was** prepared and implemented, and shall be (reviewed if required and) implemented in case of any new river crossings being undertaken. [FERC comparison – Wetland and Waterbody Construction and Mitigation Procedures. VB2, VB3, VB4, VB9; EIA V4: 3.7.1.]
  - a. The RCEP was developed with input from internationally experienced specialists in river hydrology, river ecology and erosion control, finalised prior to construction, and specifies for each river crossing:
    - The classification category based on ecological sensitivity and the potential extent of hydromorphological impact;
    - Selected crossing technique;
    - Equipment and resources required;
    - Mitigation measures which shall be applied including construction time, construction period and erosion control measures;
    - Monitoring of river crossings;
    - Method of installation of the Fibre Optic Cable;
    - How riverbed and river bank shall be reinstated; and
    - Parameters on which the crossing shall be monitored.
- **General requirements.**
  - a. Before commencement of works, the condition of water body at the crossing locations shall be documented.
  - b. No works shall be commenced until all project decisions and approvals from applicable regulating authorities are obtained.
  - c. One week before commencement of works, a written notification shall be served to all organisations responsible for water withdrawal for drinking and industrial/domestic water supply downstream of the work site.
  - d. All works shall be accomplished in strict compliance with the developed specific work method statements.
  - e. The natural path of water flow of rivers or streams shall not be permanently diverted or blocked.

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<sup>1</sup> Italicised terms in this document are included in the [Sakhalin Energy HSE Glossary](#).



- f. There shall be no temporary or permanent dewatering of rivers or streams downstream of construction sites.
- g. Buffer strips of natural uncleared vegetation shall be preserved between construction activity and all rivers, streams and water bodies.
- h. For construction activities in streams and rivers, non-erodible coarse, rocky material is to be used for all areas in direct contact with the flow of the watercourse. This includes temporary culvert diversions, bridge construction abutment pads, stream banks, pipeline river crossings, etc.
- i. Wherever possible, no machinery or equipment shall cross the watercourse except for the equipment and machinery needed for laying the bridge. Before commencement of works, specific work method statements shall be developed and agreed upon. Specific work method statements shall include a section describing the methods to mitigate excessive siltation of the water body.
- j. Subject to the requirements of (i) above being met, the methods to be used for watercourse crossing by machinery shall largely depend on characteristics of watercourses at the crossing locations and any restrictions associated with fishery industry (subject to the requirements of the Permit issued by relevant authorities);, and may include:
- Fording;
  - use of decking placed on the river bottom;
  - use of earth embankment over flume pipes
  - use of the existing bridges for vehicles,
  - use of specially constructed temporary bridges.
- k. Special care shall be exercised when fuelling the vehicles.
- NO FUELING is allowed near water protection zones.
  - fuelling shall be performed at least 30 m off the water boundaries.
  - any spill or leak should be reported. Spill response equipment shall be mobilised to the site BEFORE commencement of river crossing activities.
  - all fuel tankers shall be fitted with applicable spill response toolkits and granulators.
  - any maintenance, fuelling and greasing shall be accomplished by specialists only.
- l. Run-off from cleared or disturbed areas near water bodies shall be managed using sediment control methods (e.g. compacted earth berms, geotextile screens, etc.). All erosion and sediment control structures are to be regularly inspected and maintained. Any discharge of drain water not compliant with sedimentation limits (+0,25 mg/l to the background concentration )beyond the construction site shall only be carried out using sediment control structures (e.g. geotextile screens, settling pits, etc.).
- m. During pipeline trenching activities trench plugs will be installed in the excavated trench to prevent water runoff from the trench into the watercourse. Where the site adjoins wetlands, the said trench plugs shall be installed at 15 m from their boundaries. The design and spacing of the trench plugs will be in line with Good International Industry Practice.
- n. Where the trench has to be dewatered, water shall be pumped to sediment treatment areas (e.g. settling pits) prior to discharge of the RoW in order to prevent contamination of the environment or watercourse.
- o. Measures shall be taken prior to the onset of winter to protect the construction sites from erosion in order to minimise the springtime snow-melting impact on water bodies.
- p. The actual footprint of the construction activity for river crossings shall be minimised as much as possible(within the confines of the RoW).
- q. Crossings shall be constructed as close to perpendicular to the axis of the water body channel as engineering and routing conditions permit.
- r. If the pipeline parallels a water body, attempt to maintain at least 5 meters of undisturbed natural vegetation between the water body (including any adjacent wetland) and the construction right of way.
- s. Where water bodies meander or have multiple channels pipeline shall be routed in a way minimising the number of crossings.



- t. Adequate flow rates and velocity shall be maintained to protect aquatic life, prevent drying of watercourse bed, and ensure adequate water flows at any water abstraction points located downstream of the water body (notwithstanding consideration of flume removal during dry cut crossings as described in 9d).
- u. Any additional work sites (additional dumping, etc.) shall be located at least 20 m off the water line except where the territory represents an active tilth.
- v. All spoil generated as a result of crossing construction shall either be stored within the construction site at least 3 m off the water line or be taken out to special areas for extra works. Spoil shall be enclosed by sediment control barrier to prevent ingress of flow with suspended matter.
- w. Limit clearing of vegetation between extra work areas and the edge of the water body to the certificated construction right-of-way, and only do so if the relevant permit is in place.
- x. Limit the size of extra work areas to the minimum needed to construct the water body crossing.
- y. Water body buffers (extra work area setbacks, refueling restrictions, etc.) must be clearly marked in the field with signs and/or highly visible flagging until construction-related ground disturbing activities are complete.

- **Inspection and enhancements.**

- a. Environmental Inspectors shall adjust the final placement of the erosion and sediment control structures to maximise their effectiveness.
- b. All temporary sediment controls shall be routinely inspected by the suitably competent personnel, particularly after rainstorms; and silt fences shall be cleaned out when they are 1/3 full, and repaired or replaced when necessary.
- c. Sediment control barriers on the banks around the crossing areas shall be left in place until vegetation has successfully been established (80% vegetation cover of reseeded and reinstated areas will be considered successful as determined by a competent specialist).
- d. Construction monitoring shall be carried out for rivers of medium and high ecological sensitivity as set in the RCEP.

- **Spawning.**

- a. Construction timing shall be in accordance with the River Crossing Strategy Report and shall be detailed in the River Crossing Execution Plan.
- b. Where a watercourse located adjacent to construction activities has potential or proven importance for fisheries and spawning, construction activities shall be undertaken outside the spawning period. Horizontal Directional Drilling (HDD) activities can be conducted year round. Where stipulated by Sakhyrvod, works within the water protection zone may only be undertaken outside of the migration and spawning seasons, limiting construction to coincide with the winter freeze. [EIA VOL 4, Table 2.3.7]
- c. Implement plan for Visual Observation of Spawning Areas at River Crossings. [EIA Vol. 4, Table 3.7.1]

- **Impact rating of watercourses.**

- a. Sakhalin Energy has prepared a potential impact rating of watercourses based on ecological sensitivity and potential extent of hydromorphological impact. The outline of this process is detailed in the River Crossing Strategy Report. The detail is presented in the River Crossing Execution Plan. [EIA Vol. 4, Section 3.7.1] Responsibility for successful implementation of this assessment process shall lie with the Environmental Specialist and site representatives.

- b. **Rivers of medium and high ecological sensitivity.**



- Using criteria agreed with RF authorities and in line with procedures set out in the River Crossing Strategy Report, **rivers of medium and high ecological sensitivity** that are proposed for crossing shall be crossed using Dry Cut Crossing Methods (Dry cut techniques involve water containment, such as the use of dam and pump or diversion of the watercourse by damming or other means, to allow work in “dry” stream/river beds) during Winter (December–April) or as directed by the permit obtained from the relevant authority. Sakhalin Energy shall ensure that those rivers which fall into the following highest sensitivity category will not be crossed at the periphery of the defined winter season so as to avoid the potential for early thaw or a late freeze:
  - Group I — water bodies which have no salmon spawning or any importance for fishery.
  - Group II — water bodies with little salmon spawning and little importance for spawning fishery— spawning areas less than 10,000 m<sup>2</sup>.
  - Group B1.a — large spawning areas, 50 m downstream and/or 300 m downstream at the crossing location, other than along the centreline of trench;
  - Group B1.b — medium or small spawning areas, 50 m downstream and/or 100 m downstream at the crossing location, other than along the centreline of trench;
  - Group B2.b — medium or small spawning areas at the crossing location (50 m downstream and/or 100 m downstream along the centreline of trench);
  - Group III—water bodies which have importance for salmon spawning and spawning fishery — spawning areas larger than 10,000 m<sup>2</sup>.
  - Group B2.a—large spawning areas located close to the crossing (50 m downstream and/or 100 m downstream along the centreline of trench).

If the water flow rate is found insufficient to maintain the flow downstream river crossing, it is necessary to develop a customised solution for the given crossing or consider the possibility of changing the method of crossing (dry cut method shall be a preferred solution for sensitive rivers).

- c. **The following mitigation measures are recommended for wet cut rivers of medium and high ecological sensitivity:**
- crossings shall be executed in winter, with low flow and outside spawning period;
  - minimising construction time;
  - optimise consecutive crossings;
  - prevent drying of water body downstream of the construction area;
  - adhere to industry standard practice;
  - implement erosion control measures;
  - proper reinstatement in a timely manner.
- d. For the rivers of **high ecological sensitivity** and having a high potential extent of hydromorphological impact, the most optimal construction period (with regard to spawning areas and Sakhalin taimen) shall be selected (such construction period shall be agreed upon with the Environmental Specialist) and emphasis shall be given to “as-close-as-possible” consecutive installation of the two pipelines. In addition HDD shall be considered as a possible crossing method for these rivers.
- e. For all **rivers that are of medium or high ecological sensitivity**, or have a high potential extent of hydromorphological impact, the crossings shall be constructed by dedicated crossing teams under direct management of the contractor. Prior to the construction of each crossing, a kick off meeting shall be held in the presence of relevant Sakhalin Energy, contractor and HSE staff. All crossings shall be attended by a Sakhalin Energy representative who is aware of both construction and environmental issues. Before the construction of the crossing can start, this representative shall ensure that:
- Proper erosion control materials are available on site prior to the start of construction;
  - Appropriate spill response equipment, including containment and recovery equipment, are available on site and that, if necessary, spill response measures are appropriately implemented;
  - The monitoring contractor is timely notified, present and adequately equipped to undertake all necessary measurements during construction of the crossing;
  - All personnel (including external observers) needed for the crossing are present and properly instructed and all necessary equipment is present and in good working order; and



- **Crossings of minor water bodies** (<3 meters wide). [. FERC comparison – Wetland and Waterbody Construction and Mitigation Procedures. VB7.] Minor water bodies may be crossed using the open-cut crossing method, with the following restrictions:
  - a. except for blasting and other rock breaking measures, complete instream construction activities (including trenching, pipe installation, backfill, and restoration of the streambed contours) within 24 hours for each pipeline. Watercourse banks and unconsolidated beds may require additional restoration after this period;
  - b. limit use of equipment operating in the water body to that needed to construct the crossing; and
  - c. equipment bridges are not required at minor water bodies that do not have a state-designated fishery classification (e.g. agricultural or intermittent drainage ditches).
- **Crossings of intermediate water bodies** (>3 meters & < 30 meters from edge to edge). [FERC Comparison—Wetland and Water Body Construction and Mitigation Procedures VB8.] Where a dry cut crossing is not required, intermediate water bodies may be crossed using the open-cut crossing method, with the following restrictions:
  - a. complete instream construction activities (not including blasting and other rock breaking works) within 48 hours for each pipeline, if site conditions make completion within 48 hours feasible; where this is not the case, suitably qualified HSE staff shall be involved in the decision making process to justify the deviation in accordance with the Sakhalin Energy deviation procedures. Conditions requiring a deviation shall be documented and works shall be undertaken in line with the objective of ALARP;
  - b. limit use of equipment operating in the watercourse to that needed to construct the crossing described in Clause 2; and
  - c. all other construction equipment must cross on a bridge.
  - d. The following conditions shall be applied to pipe lowering during the construction of dry cut river crossings:
    - ✓ Dam and pump methods:
      - where water is withdrawn using pumps, such areas shall be enclosed by fine screen or other structures to prevent damage to ichthyofauna;
      - use of sufficiently powerful pumps and availability of spare pumps at the crossing;
      - construction of dikes/dams using the materials preventing contamination of water bodies;
      - use of structures preventing degradation of bottom when the pump is emptied;
    - ✓ Crossing affected using water diversion pipes (flumes):
      - construction of dikes/dams around the pipes using the materials preventing contamination of water bodies;
      - use of pipes of appropriate diameter that prevent water flow rate from fluctuations;
      - use of structures that prevent degradation of bottom at the outlet.
      - where technically feasible the pipeline shall be threaded underneath the flume in order to avoid flow interruption occurring
      - When threading under the flume is not technically possible, Sakhalin Energy will consider on a case-by-case basis the best crossing technique to minimize overall impacts during pipeline lowering in. The time for which the flumes are removed during pipe lowering in will be minimized as far as possible and in any event the following time limits on flume removal will apply: Where 2 to 3 flumes are required in order to control the river flow, all flumes will be reinstalled within 2 hours. For single flume rivers the flume will be reinstalled within 1 hour.
    - ✓ Crossings affected using river bed diversion methods:
      - preparation and consolidation of bottom and walls of water diversion channel, or installation of non-textile material on bottom and walls;
      - construction of dikes in the main bed using the materials preventing contamination of water bodies; and

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- backfilling of temporary water diversion channel and additional consolidation of the shoreline at canal inlet immediately upon completion of construction.
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- **Horizontal Directional Drilling** shall be undertaken for selected rivers as agreed with Russian authorities and where technical feasible.
  - a. To minimise the footprint of Horizontal Directional Drilling (HDD), for each water body or wetland that is crossed using the HDD method, a plan shall be developed that includes:
    - site-specific construction diagrams that show the location of mud pits, pipe assembly areas, and all areas to be disturbed or cleared for construction;
    - a description of how an inadvertent release of drilling mud would be contained and cleaned up;
    - a contingency plan for crossing the water body or wetland in the event the directional drill is unsuccessful and how the abandoned drill hole would be sealed, if necessary.
  - b. Only water-based drilling mud shall be used in horizontal directional drilling (HDD) activities onshore. All associated drilling cuttings and mud generated through these activities shall be temporarily stored until the HDD construction is completed in watertight settling pits and containers. Samples shall be analysed to determine their waste classification, which is anticipated to fall into Hazard Class 4. If classified as Hazard Class 4, the materials will be used as backfill in the pipeline trenches, except in water protection zones. If of a higher classification, disposal will be in accordance with the Waste Management Standard.
  - c. Equipment activity shall be minimised within RoW beyond the water protection zone of water body.
- **Sediment control and reinstatement works.** [FERC comparison Upland Erosion Control, Revegetation & Maint. Plan IVF2]
  - a. Prior to the commencement of pipeline crossing activities of any river, sufficient quantities of all materials and equipment required for permanent reinstatement of the river and riverbank (including clean and suitably sized riprap, Reno mats and seed as appropriate) must be available and held in stock within the section.
  - b. Water course shall be monitored for contaminations before, during and after the works in line with applicable programme. Special attention shall be paid to the following parameters: water flow rate, current velocity, content of suspended matter and oil products upstream and downstream of the impact zone.
  - c. Where water bodies or wetlands are adjacent to any downslope of construction work areas, install sediment barriers along the edge of these areas, to prevent sediment flow into the wetland or water bodies.
  - d. Dewater the trench (either on or off the construction right-of-way) in a manner that does not cause erosion and does not result in heavily silt laden water flowing into any water body, as defined in requirement 17h of the Onshore Pipelines RoW Specification. Remove the dewatering structures as soon as possible after the completion of dewatering activities. [FERC comparison – Wetland and Waterbody Construction and Mitigation Procedures VB11]
  - e. Trench plugs shall be used as required in all water crossings to prevent water from returning to water bodies from the bank trench. Where water is pumped from bank trench during installation, it shall be filtered through a geotextile or vegetation prior to discharge into the watercourse. [EIA VOL 4, Section 3.7.1 and Table 2.35]
  - f. Clean gravel or natural stones shall be used for backfilling the upper layer of trench (20–30 cm deep except as otherwise indicated in the approvals for water crossing) and the area below and above the direct impact zone (to prevent degradation of unsteady soil immediately above the trench)
  - g. The banks adjacent to all high and medium sensitive rivers through which engineering structures (pipelines, FOC, bridges) were constructed shall be permanently reinstated after the growing season has commenced across the full disturbed bank length, which shall be kept at a minimum.



- h. Depending on ground, soil and weather conditions, all permanent erosion control measures shall be installed directly after construction.
- i. Upon completion of river crossing, bottom and banks shall be restored to their natural configuration
- j. Erosion control measures on adjacent slopes to all waterbodies will be performed in accordance with 0000-S-90-04-O-0254-00-E Appendix 6,
- k. Arrange engineering protection of slopes located within 15 m from the water line and having an angle of slope above 5°, to prevent erosion and ingress of soil into water body.
- l. Reinstatement of vegetation (by temporary or permanent seeding with annual and permanent grasses) in the disturbed areas, with a focus on the water protection zone of water bodies. The list of grasses shall be agreed upon with Environmental Specialist or other competent authorities to prevent ingress of invasive species. It is prohibited to use any fertilisers within water protection zone of water bodies.
- m. All temporary screens shall be removed after final reclamation and establishment of permanent vegetation effectively preventing erosion.
- n. Depending on ground, soil and weather conditions, these erosion control measures shall be installed directly after construction. It is however likely that **additional repair work** shall be necessary. Refer Onshore Pipelines Right of Way<sup>2</sup> specification. [River crossing strategy, section 5]

- **Dredging.**

- a. Appropriate environmental surveys and/or studies shall be completed prior to initiation of any dredging activities in surface watercourses, refer Dredging Specification.

- **Vehicle movements, Equipment and Temporary crossings for construction/repair works.**

- a. Measures shall be adopted for the control of vehicle movements in the vicinity of riparian zones / river stream crossings. A 3-5m buffer strip of vegetation shall be maintained between construction activities and watercourses. Alternative routes shall be mapped out around the crossing for other traffic (or temporary bridges installed), i.e. not all construction traffic shall go through the watercourse. Mitigation detailed within specific construction method statements. [EIA V4: 3.7.1]
- b. Vehicle washing activities shall be carried out in a controlled manner to minimise the presence of excess mud on roads. [EIA V4: 3.6.1]
- c. Only clearing equipment and equipment necessary for installation of equipment, Equipment bridges shall be installed [FERC comparison – Wetland and Waterbody Construction and Mitigation Procedures VBa.]
- d. Any equipment bridges shall be constructed to ensure unobstructed flow of the maximum water volumes in the waterbody, and sediment control structures shall be installed to prevent ingress of contaminants into water body. Permanent bridges shall be constructed on the basis of the agreed project. Examples of such bridges include:
  - equipment pads and culvert(s);
  - equipment pads without culverts;
  - clean rock fill and culvert(s); and
  - flexi-float or portable bridges (N/A for wetland crossings).
- e. Other options for equipment bridges may be utilised in order to achieve the performance objectives noted above. Design and maintain each equipment bridge to withstand and pass the highest flow expected to occur while the bridge is in place. Align culverts to prevent bank erosion or streambed scour. If necessary, install energy dissipating devices downstream of the culverts.
- f. If it is unreasonable to install a bridge crossing allowing for passage of a maximum water flow, a temporary bridge may be installed allowing for passage of maximum seasonal flows.

<sup>2</sup> Underlined items in this document refer to Sakhalin Energy Controlled Documents.



- g. However, such bridges shall be dismantled by wintertime and may be reinstalled not until the peak flood flow is over. Design and maintain equipment bridges to prevent soil from entering the water body.
  - h. Upon construction of temporary stream crossings, all materials shall be removed so that no obstruction to normal flow occurs. Remove equipment bridges as soon as possible after permanent seeding. If possible, given timing issues with oil and gas pipeline construction schedules and in the situation where there is more than 1 month between final cleanup and the beginning of permanent seeding, and if an alternative access to the right-of-way is available, dismantle equipment bridges within 2 weeks after completion of construction. Temporary bridge crossings may be left in place only with the written agreement of land users, landowners, and local regulatory authorities.
- **Project demobilisation.**
  - a. Project demobilisation activities will be described in a separate document.