

***Editable versions of the checklists and tables for performing a catchment assessment***

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**Note *– the following document contains editable versions of the various catchment and pollution assessment checklists and tables that are presented in the main body of* Protecting surface water for health*.***

***Please refer to the introductory pages of Section 3.2 within the publication for guidance on how to use these checklists and tables in the context of performing a catchment assessment.***

# **Checklist 1: General checklist for activities in the catchment**

**Presence and distribution of activities in relation to the waterbody**

* Based on documentation available, what are the locations, spatial distribution and scale of potentially hazardous activities identified (generate map if possible)?
* Are there trends or changes in land use, including population forecast studies?
* What is the linear distance to the surface waterbodies and to the drinking-water offtake point(s) from activity points?
* What is the hydrological distance to the surface waterbodies and to the drinking-water offtake point(s) from activity points?
* Are any spills, complaints or deficiencies observed, reported or documented?

**How are potentially contaminating activities in the catchment managed and regulated?**

* What national, regional, local or catchment-specific legislation, rules, recommendations, voluntary cooperation agreements or common codes of good practice are in place?
* Are restrictions of land uses in place for the catchment and the waterbody?
* Is access restricted to particular parts of the catchment and raw water?
* Are management practices in place? How effectively do they control hazard release to the environment, particularly to watercourses?
* What is the level of implementation of land-use restrictions (e.g. water protection zoning; restricted access; passive communication via signage; area directly or actively policed by rangers intermittently or continuously; restrictions successfully or poorly communicated)?
* Are measures applied for integrated catchment management (ICM) or catchment management (i.e. enabling impacts on water quality to be managed across an entire catchment)?
* Is relevant environmental information on the activities available (e.g. environmental impact assessment [EIA])?

**What other controls for reducing impacts are in place?**

* Are education programs implemented to increase local awareness (e.g. information for users about sensitivities of drinking-water catchment)?
* Is there indication of user response to communication and education programmes?
* Are any catchment management groups established?
* Are planning and environmental protection statutory control measures for proper storage and handling of hazardous materials used (e.g. chemicals and manure)?
* Are training programs for operators of activities in place?
* Is the drinking-water subject to treatment before delivery to the consumers?

# **Checklist 2: General checklist for characterizing the catchment and waterbody**

**What are the local climatic and hydrological characteristics?**

* What main local climatic data are available on rainfall regime, average temperatures, relative humidity?
* What is the rainfall depth, duration and intensity; are hydrographs available?
* What is the typical dry weather discharge and the typical pattern of stream flow?
* How frequent are wet weather events, and what is their impact on the raw-water quality and quantity (e.g. reduced flow rate due to decreased precipitation and evaporation during hot dry seasons, siltation or sedimentation due to run-off during rainy season)? Also, what is the impact and frequency of severe weather events based on historical data and future climate change forecasts.
* What are the stormwater quality parameters?
* What is the distribution and magnitude of groundwater discharge into surface waterbodies in the catchment?

**Which catchment characteristics are relevant to hazard occurrence and pathways?**

* What is the extent of the catchment and potentially subcatchments if there is more than one significant tributary to the waterbody?
* What are the discharge volumes (including seasonal patterns) of main inflows (as far as available)?
* What topographical data are available on drainage areas, slopes and lengths, and groundwater levels?
* What are the types of soil, and what is the erosion potential?
* What proportion of land is covered by vegetation?
* What proportion of land has steep slopes?
* Are signs of erosion and degradation visible in the landscape?
* What is the extent of gullying, soil scouring and land-slipping in steep areas in the catchment (including changes over time)?

**Is the catchment subject to flooding (data on frequency, extent)?**

* What are the details of urban and periurban areas in the catchment, and what is the population density in its rural areas?
* What other land uses and activities are present in the catchment?
* Are details available on wildlife populations, including with respect to their potential for introducing pathogen hazards into the waterbody?
* Is information available from previous catchment and sanitary inspections?

**Which surface waterbody characteristics and uses of the waterbody potentially lead to hazards reaching the drinking-water offtake? Collect information on:**

* Type of surface waterbody (e.g. stream, river, lake, reservoir, channel)
* As far as available, area, depth, water volume and water retention time (i.e. dilution capacity)
* Eutrophication status of the surface waterbody
* Uses of the surface waterbody (e.g. drinking-water, irrigation of crops, recreational purposes, ritual acts, impoundments) and their patterns of abstraction under normal and drought conditions
* Location and number of drinking-water offtake points; options for switching between offtake points depending on water quality
* Changes in water quantity available, including seasonal patterns and extreme event (historical data and future scenario analysis)
* Purposes for which the waterbody is used downstream of the discharge (e.g. distance, type of use, change in the concentration of contaminants in the receiving watercourse, change in the quality of the water before its use)
* Results from screening or monitoring programmes (e.g. indicators of faecal contamination).

# **Table 14a: General inventory for catchment inspection**

| **Potential source of pollution** | **Activity present** | | **Scale** | | | | **Distance from waterbody**  **[m]** | **Slope towards waterbody** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Yes | No | Large | Small | Local | Dis-persed | Flat/undulating/ steep/very steep |
| **Agriculture (see Section 3.3)** | | | | | | | | |
| Livestock |  |  |  |  |  |  |  |  |
| Crops |  |  |  |  |  |  |  |  |
| Feedlots/intensive animal feeding/ calving/ lambing |  |  |  |  |  |  |  |  |
| Tillage/ploughing |  |  |  |  |  |  |  |  |
| Storage and application of fertilizers |  |  |  |  |  |  |  |  |
| Storage and application of pesticides |  |  |  |  |  |  |  |  |
| Storage and application of manure |  |  |  |  |  |  |  |  |
| Application of wastewater or sludge (or both)  (please also refer to Section3.5) |  |  |  |  |  |  |  |  |
| Irrigation |  |  |  |  |  |  |  |  |
| Clear-cutting |  |  |  |  |  |  |  |  |
| Drainage |  |  |  |  |  |  |  |  |
| Significant wildlife populations |  |  |  |  |  |  |  |  |
| Other (please specify) |  |  |  |  |  |  |  |  |
| **Aquaculture (see Section 3.4)** | | | | | | | | |
| Fish ponds |  |  |  |  |  |  |  |  |
| Integrated aquaculture systems |  |  |  |  |  |  |  |  |
| Flow-through systems |  |  |  |  |  |  |  |  |
| Recirculating aquaculture systems |  |  |  |  |  |  |  |  |
| Cage culture systems |  |  |  |  |  |  |  |  |
| Other (please specify) |  |  |  |  |  |  |  |  |
| **Settlements, wastewater and stormwater (see Section 3.5)** | | | | | | | | |
| On-site sanitation (improved) |  |  |  |  |  |  |  |  |
| On-site sanitation (unimproved) |  |  |  |  |  |  |  |  |
| Off-site sanitation (combined wastewater/ surface run-off) |  |  |  |  |  |  |  |  |
| Off-site sanitation (separate, i.e. sewage only) |  |  |  |  |  |  |  |  |
| Wastewater treatment |  |  |  |  |  |  |  |  |
| Use of wastewater sludge (please also refer to respective sections for activities that sludge is applied for) |  |  |  |  |  |  |  |  |
| Wastewater from households |  |  |  |  |  |  |  |  |
| Wastewater from commercial/industrial activities |  |  |  |  |  |  |  |  |
| Wastewater from medical activities (e.g. hospitals) |  |  |  |  |  |  |  |  |
| Cemeteries |  |  |  |  |  |  |  |  |
| Construction activities releasing (potentially polluted) sediment |  |  |  |  |  |  |  |  |
| Other (please specify) |  |  |  |  |  |  |  |  |
| **Commerce, industry, mining and military (see Section 3.6)** | | | | | | | | |
| Food processing (including slaughterhouses) |  |  |  |  |  |  |  |  |
| Textiles |  |  |  |  |  |  |  |  |
| Tanneries |  |  |  |  |  |  |  |  |
| Oil/petroleum (including garages) |  |  |  |  |  |  |  |  |
| Metal processing |  |  |  |  |  |  |  |  |
| Mining |  |  |  |  |  |  |  |  |
| Military |  |  |  |  |  |  |  |  |
| Impoundments (e.g. hydroelectric power) |  |  |  |  |  |  |  |  |
| Other (please specify) |  |  |  |  |  |  |  |  |
| **Traffic (see Section 3.7)** | | | | | | | | |
| Main roads |  |  |  |  |  |  |  |  |
| Railway lines |  |  |  |  |  |  |  |  |
| Airports |  |  |  |  |  |  |  |  |
| Shipping and boat traffic |  |  |  |  |  |  |  |  |
| Pipelines (please specify content) |  |  |  |  |  |  |  |  |
| De-icing (please specify: roads, airports, aircrafts) |  |  |  |  |  |  |  |  |
| Ancillary activities (e.g. fuelling, repair workshops) |  |  |  |  |  |  |  |  |
| Other (please specify) |  |  |  |  |  |  |  |  |
| **Recreational (see Section 3.8)** | | | | | | | | |
| Cruise ships |  |  |  |  |  |  |  |  |
| Motor-boating/jet-skiing/water-skiing |  |  |  |  |  |  |  |  |
| Rowing/sailing/canoeing/touring/paddling/ rafting |  |  |  |  |  |  |  |  |
| Surfing/windsurfing |  |  |  |  |  |  |  |  |
| Bathing/swimming |  |  |  |  |  |  |  |  |
| Fishing |  |  |  |  |  |  |  |  |
| Land-based recreational activities (e.g. picnics, walking, birdwatching, quad bikes) |  |  |  |  |  |  |  |  |
| Sub-aqua diving or snorkelling |  |  |  |  |  |  |  |  |
| Infrastructure for recreation |  |  |  |  |  |  |  |  |
| Other (please specify) |  |  |  |  |  |  |  |  |

# **Table 14b: Conditions inventory for catchment inspection**

| **Potential conditions influencing pollution pathways** | **Condition present** | | **Extent** | | |
| --- | --- | --- | --- | --- | --- |
| Yes | No | Minor | Medium | Significant |
| Deforestation |  |  |  |  |  |
| Erosion |  |  |  |  |  |
| Gullying |  |  |  |  |  |
| Ditches or channels draining land |  |  |  |  |  |
| Pipe outfalls potentially carrying water of unclear origin |  |  |  |  |  |
| Surface sealing |  |  |  |  |  |
| Damage of vegetation cover |  |  |  |  |  |
| Water turbidity |  |  |  |  |  |
| Water colouring |  |  |  |  |  |
| Very low or high water level in reservoir |  |  |  |  |  |
| Cyanobacterial (algal) blooms |  |  |  |  |  |
| Other (please specify) |  |  |  |  |  |

# **Checklist 3: General checklist for documentation and visualization of information**

* Consolidate information from checklist points and summarize in a report, including data gaps to close with high priority for improving the information base
* Summarize hazards (microbial, chemical or physical) expected from activities in the catchment, and hazards identified in the surface waterbody
* Summarize amounts of hazards intentionally applied or non-intentionally released
* Summarize conditions encountered in the catchment that increase the likelihood of reaching the waterbody
* Summarize conditions observed in the waterbody that increase the likelihood of hazards reaching the drinking-water offtake point(s)
* Consider mapping spatial distribution of general land use (use geographical information systems [GIS] if possible) in relation to contamination pathways to the waterbody.

# **Checklist 4: Assessing pollution risk from agricultural activities**

**What types of agricultural activity are found in the catchment?**

* Determine the proportion of land covered by agriculture
* Compile information on types of agriculture (e.g. pasture land, arable land, irrigated or drained agriculture, horticulture and market gardening)
* Identify main crops cultivated (including changes over time)
* Compile (and, if possible, map) information on location, spatial distribution and scale of agricultural land and different cultivation types
* Identify extent to which stock have access to waterways, including location of major access points
* Determine whether manure is applied in the catchment
* Estimate livestock densities, animal species and amount of manures produced
* Characterize storage conditions and handling practices for manures
* Evaluate patterns of manure application:
  + Assess adequacy of application rates: check whether criteria are based on

1. nutrient budgets and crop uptake rates, or
2. merely the need for getting rid of manure in areas with high livestock densities or intensive livestock farming
   * Assess timing of application in relation to hydrological events and to seasonal aspects (e.g. presence or absence of vegetation cover, frozen ground)
   * Assess adequacy of spreading methods.

**Are fertilizers applied in the catchment?**

* Characterize amounts, types and products of fertilizers used
* Check composition of fertilizers (e.g. content of nitrogen and phosphorus)
* Evaluate patterns of fertilizer application (see ‘Evaluate patterns of manure application’ above in this checklist for adequacy of application rates, timing, spreading methods and irrigation practices).

**Are feedlots, dairies or other intensive animal feeding activities operated in the catchment?**

* Estimate livestock densities and animal species present in the catchment
* Determine locations of the animal feeding activities in relation to surface waterbodies
* Assess adequacy of design, construction, condition, operation and maintenance (e.g. sealing and lining of surfaces and containments, open-air or closed facilities)
* Quantify and characterize wastes generated
* Evaluate availability, storage capacity, treatment efficiency and adequacy of wastewater-treatment facilities
* Check and assess disposal practices for treated or non-treated wastewater (e.g. irrigation) (see ‘Is sewage sludge or wastewater used in the catchment?’ below)
* Check and assess disposal practices for manures (see ‘Evaluate patterns of manure application’ above).

**Is sewage sludge or wastewater used in the catchment?**

* Estimate amount and composition of sludges and treated or non-treated wastewaters
* Evaluate adequacy of sludge treatment (e.g. composting) or storage time before land application
* Evaluate patterns of land application: see checklist for manure application above for adequacy of application rates, timing, spreading methods and irrigation practices
* See also Checklist 6 on assessing pollution risk from wastewater and stormwater effluents for further information to be collected on wastewater.

**Are pesticides used in the catchment?**

* Characterize amounts, active ingredients and commercial products of pesticides
* Assess adequacy of design of, and practices at, handling and mixing sites, and whether there is indication of inadequate disposal practices of residues, surplus pesticides or drums
* Assess adequacy of siting, design, construction and condition of storage facilities
* Assess whether there are any stockpiles of obsolete and banned pesticides
* Check whether there are indications of illegal use of banned pesticides
* Check location of dip sites for livestock treatment, and assess adequacy of practices employed
* Check whether there is indication of abandoned pesticide stocks
* Assess patterns of pesticide application:
* Assess adequacy of application rates: check whether criteria are based on

1. recommendations of producer or licensing authorities
2. merely the need for getting rid of surplus pesticides, or
3. preventive spraying practice

* Assess timing of application in relation to hydrological events, seasonal aspects (e.g. presence or absence of vegetation cover, frozen ground), and crop needs
* Assess adequacy of spreading methods.

**Are irrigation and drainage practised in the catchment?**

* Determine the scale to which irrigation and drainage is practised (amount of water used and distribution)
* Compile information on irrigation and drainage techniques employed
* Assess adequacy of irrigation practices (if employed)
* Check for indications of leaching of naturally occurring substances
* Check whether acid sulfate soils occur in the catchment.

**Are ploughing, grazing or clear-cutting practised in the catchment?**

* Determine the scale and extent to which ploughing, grazing or clear-cutting is practised, and where it is practised
* Compile information on the ploughing, grazing or clear-cutting techniques employed and their timings.

# **Checklist 5: Assessing pollution risk from aquaculture and fishery activities**

**What types of aquaculture and fisheries are practised in the catchment or waterbody?**

* Compile information on the number of aquaculture operations in the catchment, on their type (pond, flow-through systems, recirculating systems, cages, integrated systems), location and size (in terms of pond area, fish production or whatever information is available)
* Are large-scale intensive aquafarms or fisheries operated in the catchment? If so, compile information on the water sources they use (e.g. surface water, groundwater, geothermal water, wastewater from other industries such as power stations), how water is exchanged (flow-through, recycling, partial recycling), which feed and feeding methods they use, and what data are available on effluent quantity, quality and discharge patterns
* Compile information on occurrence, intensity and type of fisheries in the water resource.

**Is feeding applied?**

* Characterize the feeding strategy (supplementary or basic/regular)
* Characterize the applied feed (amount, type, source, presence of any chemicals).

**Are fertilizers applied in fish ponds?**

* Characterize amounts, types, products and composition of fertilizers used (see also Checklist 4 on assessing pollution risk from agricultural activities, for further information to be collected on fertilizers).

**Is manure applied in fish ponds, and if so, how?**

* Characterize the applied manure (source, amount, composition, presence of veterinary pharmaceuticals, application patterns) (see also Checklist 4 on agriculture, for further information to be collected on manure).

**Is sewage or wastewater used in fish ponds?**

* Collect available information on the wastewater (e.g. amount; is it raw or has it undergone some treatment or ageing; is it pure domestic wastewater or might it contain commercial effluents?) (see also Checklist 6 on assessing pollution risk from wastewater and stormwater effluents, for further information to be collected on wastewater).

**Are other chemicals and drugs used in fish ponds?**

* Characterize amounts, types, active ingredients and commercial products of chemicals used.

# **Checklist 6: Assessing pollution risk from wastewater and stormwater effluents**

**Are the systems in place used, and are they sufficient?**

* Assess amount of wastewater and stormwater generated, and whether systems in place are sufficient to meet these amounts in the catchment
* Assess extent of open-air defaecation
* Compile information on scale, condition, maintenance and user acceptability of the systems
* Compile information on periods of peak loading (e.g. during festivals and other large gatherings), and assess sufficiency of the systems in peak loading situations.

**Is on-site sanitation practised in the drinking-water catchment area?**

* Assess size and proportion of population using on-site sanitation, including settlement structure, numbers and distribution of on-site sanitation systems
* Compile inventory on coverage with different types of on-site sanitation systems
* Assess whether water used for washing is collected and disposed of separately from human excreta, and where it goes.

**Are contaminants from on-site sanitation likely to reach the waterbody?**

* Assess whether seepage or overflow to the surface waterbody is likely on the basis of information on slope, distance of sanitation systems to the waterbody, population size using the systems, operation and maintenance of the systems, and whether the soil characteristics render retention or breakthrough more likely
* Check for indication of spills or overflow and whether they are likely to reach surface waters, especially in rainy seasons.

**Do the on-site systems require periodical removal of solids or sludge?**

* Identify who carries out the removal (e.g. owners, public entity, small private companies)
* Identify the criteria for definition of the removal time
* Identify amounts of solids or sludge generated, and what happens to them. If composted, is the process effective in inactivating pathogens? If spread on fields, how likely is transport into the waterbody? If disposed of, how far away is this from the waterbody and can transportation to the waterbody be affected, especially in rainy seasons or during heavy rainfall?

**Is wastewater collected and transported off-site?**

* Assess size and proportion of population connected to the system
* Determine why some properties are not connected to the system, and how such properties dispose of their wastewater and excreta
* Assess condition, capacity and maintenance of these systems. Is there a need for maintenance, upgrading or, for example, an increase in storage capacity? Is the condition, capacity and maintenance of the collection system sufficient to avoid leakage or overflow directly to the waterbody (including during the peak tourist season)?
* Identify whether stormwater collection is separated from wastewater collection. If yes, are there unintended cross-connections that might challenge the wastewater system with excessive amounts of stormwater or contaminate stormwater with wastewater?

**Is stormwater collected and channelled to the waterbody?**

* Identify and delineate urban and periurban catchments connected to the system
* Assess the connected area for topographical features (e.g. drainage areas, slopes and lengths)
* Assess potential sources of specific contamination from the drained surfaces (e.g. fuel stations, hazardous materials stored in courtyards – see also Section 3.7)
* Identify location of outfalls and of the outfalls’ discharge into the waterbody
* Identify whether upstream settling structures and retention basins are present that retain part of the load. If yes, check for sediment deposits and practices for maintenance and clearance
* Assess frequency, seasons, volumes and loads of collected stormwater reaching the waterbody. How does this amount relate to river flow?
* Assess condition of these systems. Is there a need for maintenance, upgrading or, for example, an increase in storage capacity?
* Identify whether response plans are in place for major stormwater events that cannot be retained by the system. Are plans adequate and being followed in the case of such events?

**Additional checks for combined wastewater–stormwater systems:**

* Identify what amount of rainfall triggers overflow. How frequently, in which season and with what amounts of water do overflow events occur?
* Estimate the pollution load of overflow events that occur more often than once a year
* Identify whether response plans are in place for combined sewer overflow events (e.g. for affected bathing sites and drinking-water offtakes). Are plans adequate and being followed in the case of such events?

**How does wastewater transported off-site reach the waterbody?**

* Identify the location of sewage outfalls (particularly in relation to drinking-water offtakes and recreational sites). Are they all registered, or is there indication of illegal outfalls?
* Identify whether wastewater is discharged to a treatment plant
* Gather and assess quality data for the (treated or untreated) wastewater.

**What wastewater treatment is in place and how effective is it?**

* Identify types of treatment systems in place, their location, and how much wastewater each system treats (e.g. compile data on population connected, flow and loads)
* Identify types of treatment processes in place. Are they appropriate for the quality needed in the waterbody, or is upgrading necessary? How much improvement can be achieved by adoption of better operational practices?
* Compile available quality data on influent and effluent concentrations and removal efficiencies, including an assessment of the monitoring concept (e.g. grab or composite samples, frequency, methods, and amount and reliability of data)
* Identify whether discharge standards exist and, if so, what the percentage of compliance is
* Assess effectiveness of day-to-day operation. What problems exist? Is the plant in good condition, and what improvements or upgrades are necessary to ensure surface-water quality?
* Identify the frequency of use of bypasses or overflows of untreated sewage
* Identify the amount of sludge produced, its characteristics and destination
* Identify whether the effluent is disinfected. If so, how and with what target?
* For systems combined with stormwater, how does the treatment capacity relate to the dry-weather flow; that is, how much capacity does the system have to absorb stormwater flow? Compile data on measured flows (average, minimum, maximum).

**Are contaminants from sewage sludge likely to reach the waterbody?**

* Check whether sludge is used as fertilizer, and what the related practices are (if yes, also refer to Checklist 4)
* If sludge is disposed of, check the adequacy of the site and method to avoid waterbody contamination.

**Is wastewater reuse affecting the waterbody?**

* Identify whether treated or untreated wastewater is used for irrigation, aquifer recharge, fish ponds or other purposes and, if yes, what the amounts are, and whether there is potential for run-off from these uses to reach the waterbody (also refer to Checklists 4 and 5)
* Identify whether there is indication of surcharging and flooding.

# **Checklist 7: Assessing pollution risk from commercial, industrial, mining and military activities**

**What potentially contaminating commercial, industrial, mining and military activities are present in the catchment?**

* Compile an inventory of currently operating as well as abandoned industrial and mining sites, commercial facilities and disposal areas, and military sites, including information on the scale of activities
* If an inventory of small-scale enterprise is not possible due to limited information (e.g. not registered), estimate the numbers of, for example, tanneries, slaughterhouses, and metal and car repair workshops, and the hazardous materials they typically deal with, including their wastes that could contaminate surface water through direct run-off or via sewers
* For active and former operations, compile an inventory of permits for discharging effluents to watercourses, sewers, soils or injection wells (including predisposal treatment if known)
* For active operations, compile an inventory of goods currently produced and raw materials needed for their production (including potentially hazardous degradation products, if known), amounts, and locations of storage and handling
* For former operations, compile whatever information is available to assess whether the site is likely to leach hazardous substances to a watercourse (e.g. type of former activities, materials handled and produced, time of operation, information from contaminated sites’ registers)
* Compile information on how raw materials are transported to the facility
* Compile information on storage and transport of potentially hazardous products and wastes –also refer to Section 3.7 on traffic for the transportation of hazardous substances
* Compile an inventory of current and former number, size, type, age and contents of pipelines, storage tanks, oil-containing machinery, storage ponds, lagoons and tanks for liquids, including subsurface structures
* Estimate the amount of local groundwater and surface water withdrawn by local enterprises and industries, including uses if they are known (e.g. process water and cooling water), condition of water discharged subsequently, and receiving waterbody
* Check data about past accidents (e.g. fires, explosions and spillages), and storage and handling areas, which may have left potential “hot spots” of contamination that could migrate to surface waters
* Check whether information is available on soil, sediment and (ground)water contamination in the area, particularly for persistent chemicals
* Compile information on past and ongoing soil and groundwater remediation activities at the site and in the vicinity.

**How well are the facilities and installations designed and maintained?**

* Assess scale, age, construction and technical condition of production sites, mining operations and (where possible) military bases with respect to potential surface-water impacts (e.g. pavement, roofing of storage and handling areas, collection of surface drainage and mine damage)
* For mines, analyse water quality of drainage systems, including run-off from milling sites, heaps, piles and tailing ponds, particularly for pH and metal content; check whether heaps and tailings are capped to reduce leaching
* Check existence and condition of containment structures, and monitoring of their integrity for storage, tanks, pipelines, production, and transportation of hazardous goods and materials
* Check appropriateness of materials and structures used for chemicals storage
* Identify existence and applicability of written maintenance plans for the facility
* Compile information on how raw materials are transported to the facility
* Compile information on transport of potentially hazardous products and wastes off-site from the facility
* Is wastewater generated at the site treated before its release to surface waterbodies (e.g. oil or grease separators)? (see also Checklist 6 on assessing pollution risk from wastewater and stormwater effluents)
* Are standard operating procedures (SOPs) in place for handling hazardous substances?

**Are good management practices implemented at individual facilities to protect surface-water resources?**

* Check availability and implementation of environmental management concepts (eco-audits), and potential incorporation of health aspects
* Check whether there are audits for verification of best management practices, operational precautions and closure plans
* Check whether there is accounting for materials brought in, materials processed, wastes requiring disposal and long-term closure procedures
* Check availability and implementation of waste management concepts
* Evaluate whether there is clear definition of responsibility in written form for dealing with emergency releases
* Check whether there are developments towards recycling of water and reducing water demand
* Check for indications of episodic releases that have accumulated contaminants over time in soils, sediments, basins, etc.

**Are side-effects of production processes or activities potentially relevant to contamination of surface-water resources?**

* Identify characteristics of activities at the facility such as vehicular traffic, vehicle cleaning, power production, water withdrawal or treatment, and grounds maintenance
* Check type of grounds maintenance and use of chemicals (e.g. fertilizers for lawns)
* Evaluate sanitation systems present at the premises
* Evaluate emission of substances that act as co-solvents (e.g. fuels, acids) and are likely to mobilize other hazardous chemicals in the environment
* Identify construction activities on industrial sites that may physically affect surface or subsurface drainage to the waterbody, or cause hazardous emissions
* Consider whether groundwater abstractions (e.g. in the case of construction activities) may include contaminated groundwater or lead to mobilization of contamination, affecting surface waterbodies due to subsequent discharge
* Ascertain whether water treatment operations are conducted on-site, which may result in releases of chemicals (e.g. chlorine, flocculants and pH controls)
* Check whether firefighting training is conducted
* Refer to respective sections if relevant additional activities have been identified.

# **Checklist 8: Assessing pollution risk from traffic activities**

**What information is available about traffic?**

* Compile an inventory of main types of traffic and location of main traffic routes
* Compile an inventory of substances, potentially hazardous products and wastes, and wastewater – including their amounts – currently transported via these traffic routes
* Evaluate siting, design, construction and technical condition of individual traffic routes in relation to physical, topographic and geological conditions in the surface-water drainage basin
* Check data about past accidents (e.g. fires, explosions and spillages) that may have left potential “hot spots” of contamination that can migrate to surface waters
* Check potentially conducted environmental impact assessment (EIA) documentation for traffic routes
* Check inventory of hazardous paints allowed on boats (e.g. mono-, di- and tributyltin)
* Check whether a transport risk information system (TRIS) is in place, including geological and hydrological issues; release prevention and remediation measures in combination with classification of hazardous chemicals
* Check whether wooden sleepers containing preservatives are present on railway tracks
* Check whether agrochemicals are used for maintaining roads, railway tracks, airfields and inland waterways
* Check whether mechanical maintenance measures are used alternatively
* Identify location and ownership of pipelines (e.g. substances hazardous to water such as oil, and wastewater).

**How well are the traffic routes maintained?**

* Evaluate age, construction and technical condition of traffic routes with respect to potential surface-water impacts (e.g. integrity of road surfaces, integrity of vehicles and tankers, collection of surface drainage)
* Identify existence and applicability of written maintenance plans for the facilities
* Check whether surface run-off from the traffic routes is collected and treated before release to surface waterbodies
* Check whether standard operating procedures (SOPs) are in place for transportation of substances hazardous to water
* Check location, extent, condition and integrity of storage facilities (e.g. fuel storages, storages of de-icing agents and oil storages)
* Check condition of maintenance workshops with respect to release of hazards with surface run-off
* Check existence and condition of containment structures and monitoring of their integrity for storage, tanks, pipelines, and production and transportation of materials and substances hazardous to water and human health
* Check whether there are records of the technical and environmental safety of vehicles, particularly those transporting substances hazardous to water
* Assess whether the number of disposal stations of septic tanks of boats navigating on inland watercourses is sufficient, and whether the management of these excreta-receiving stations is appropriate.

**Are good management practices implemented to protect surface-water resources?**

* Check whether there are audits for verification of best management practices and operational precautions for transportation and storage of hazardous substances
* Check whether safe handling procedures are in place for fuel storages, storages of de-icing agents, and oil storages
* Evaluate whether there is a clear definition of responsibility in written form for dealing with emergency releases
* Identify whether direct accidental spills have been reported
* Check whether septic tanks are required and in place for trains and boats
* Check what type of accident prevention measures are in place (e.g. speed limits on roads in drinking-water protection areas or catchments, regulation of working and rest times for truck drivers).

**Which maintenance and fuelling processes are relevant?**

* Check whether de-icing of surfaces and planes is conducted
* Assess management of drainage and treatment systems to avoid spills of de-icing agents into surface waterbodies
* Identify current vehicle cleaning, fuelling and grounds maintenance characteristics in the catchment
* Check for former vehicle cleaning and fuelling sites in the catchment that may still be leaching hazards to the waterbody
* Check type of grounds maintenance, use and storage of chemicals
* Identify construction activities for traffic routes that may physically affect conduits to surface water or cause contaminant emissions.

# **Checklist 9: Assessing pollution risk from recreational activities**

**What recreational activities are currently taking place?**

* Is recreational use of the waterbody or surrounding land permitted?
* What activities are encouraged and formally recognised?
* What activities are tolerated (i.e. informal activities)?
* What activities are illegal but happening anyway?
* Are permitted activities limited to certain areas, or to a maximum number of people or extent?
* During which season do activities typically take place?

Where are land-based recreational activities taking place?

* Which catchments and subcatchments are affected?
* Are the catchments directly feeding water-supply offtakes?
* Are the catchments feeder streams or headwaters rather than directly feeding offtakes?

**Where are water-based activities taking place?**

* Are direct supply reservoirs or weirs affected?
* Are only indirect supply reservoirs or weirs affected?
* Are rivers or streams used for drinking-water purposes affected upstream of the offtake?

**What infrastructure is in place for recreation and how is it operated and maintained?**

* Develop an inventory of picnic sites, tracks for walking, biking, horse riding, beaches, sanitation facilities, boat launches, marinas, restaurants, hotels and holiday houses and so on
* Assess whether their structure and maintenance indicates a likelihood of contamination of the raw water.

**How does user pressure relate to the capability of the system to withstand water-quality impacts from recreation?**

* What is the extent of activity; that is, how many visitors (and their pets, boats and so on) use the facility, what are peak times of their presence, how long do they stay (e.g. to be counted at bottle-necks for site access, such as train stations or parking lots, or at typical beaches)?
* Are quantitative indicators available, such as traffic counts on routes to a specific area (e.g. number of train tickets sold and parking lot use)?
* Are facilities, particularly for sanitation, in place and sufficiently well maintained and designed to meet the demand placed upon them?
* What is the size of restaurants and amount of garbage removed from recreational areas?
* What are the numbers for holiday houses and hotel beds, and boats available for rent or moored at marinas; and how many kilometres of walking tracks are present along the shoreline and in the catchment?
* What is the level of information for site users about protection of the waterbody, and how do users behave?