

# Pathways of Effects

Fish and Fish Habitat Protection Program

March 2024

## Pathways of Effects Descriptions

### 1- Use of Machinery on Land / Alteration of Riparian Vegetation

This pathway illustrates the chain of events that takes place in an aquatic ecosystem when works, undertakings and activities (WUAs) are conducted in the riparian zone. Common WUAs that require the use of machinery on land and/or the alteration of riparian vegetation include: grading; excavating; grubbing; vegetation clearing and maintenance; vegetation planting and seeding; stockpiling, construction, repair and maintenance of infrastructure, and the construction of access routes. If not managed, the use of machinery on land and alteration of riparian vegetation can result in the sedimentation of fish habitat, and changes to, or losses of, riparian habitat, habitat structure and cover, fish passage, and wetted area. These pressures have the potential to impair the habitat's capacity to support the life processes of fish. Sublethal effects to fish (e.g., injury, stress) and fish mortality are also possible if protection measures are not put in place.

### 2- Use of Machinery in Water

This pathway illustrates the chain of events that takes place in an aquatic ecosystem when machinery is used in water. Common works, undertakings and activities (WUAs) that require the use of machinery in water include: use of industrial equipment for dredging, channel excavation, oil and gas exploration and extraction, mining, power generation (e.g., wind, tidal, hydro), and construction, repair and maintenance of infrastructure. If not managed, the use of machinery in water can result in the sedimentation of fish habitat, and changes to, or losses of, habitat structure and cover. These pressures have the potential to impair the habitat's capacity to support the life processes of fish. Sublethal effects to fish (e.g., injury, stress) and fish mortality are also possible if protection measures are not put in place.

### 3- Placement of Materials in Water

This pathway illustrates the chain of events that takes place in an aquatic ecosystem when materials are placed in the water. Materials can be organic (e.g., logs, rocks) or human-made structures (e.g., docks, dams, culverts, pipelines, abutments, piers, wharves). If not managed, the placement of materials in water can result in the sedimentation of fish habitat, and changes to, or losses of, habitat structure and cover, fish passage, and wetted area. These pressures have the potential to impair the habitat's capacity to support the life processes of fish. Sublethal effects to fish (e.g., injury, stress) and fish mortality are also possible if protection measures are not put in place.

### 4- Removal of Materials and Aquatic Vegetation from Water

This pathway illustrates the chain of events that takes place in an aquatic ecosystem when materials are removed from the water. Materials can be organic (e.g., woody material, logs, aquatic vegetation, sediment) or human-made structures (e.g., docks, dams, culverts, pipelines, bridges, piers, wharves). If not managed, the removal of materials from the water can result in the sedimentation of fish habitat, and changes to, or

losses of, habitat structure and cover, fish passage, and wetted area. These pressures have the potential to impair the habitat's capacity to support the life processes of fish. Sublethal effects to fish (e.g., injury, stress) and fish mortality are also possible if protection measures are not put in place.

## 5- Water Level / Flow Modification

This pathway illustrates the chain of events that takes place in an aquatic ecosystem when water levels and flows are modified. Common works, undertakings and activities (WUAs) that involve modifying flows and water levels can include: dam construction and repair, water extraction, water management, irrigation, hydropower plant. If not managed, water level and flow modifications can result in the sedimentation of fish habitat, and changes to, or losses of, habitat structure and cover, fish passage, and wetted area. These pressures have the potential to impair the habitat's capacity to support the life processes of fish. Sublethal effects to fish (e.g., injury, stress) and fish mortality are also possible if protection measures are not put in place.

## 6- Water Diversion

This pathway illustrates the chain of events that takes place in an aquatic ecosystem when water is diverted. Common works, undertakings and activities (WUAs) that involve water diversion include: stream realignments, dams (power generation), mining, culverts, bridges and pipelines. If not managed, water diversion can result in the sedimentation of fish habitat, and changes to, or losses of, habitat structure and cover, fish passage, and wetted area. These pressures have the potential to impair the habitat's capacity to support the life processes of fish. Sublethal effects to fish (e.g., injury, stress) and fish mortality are also possible if protection measures are not put in place.

## 7- Dewatering

This pathway illustrates the chain of events that takes place in an aquatic ecosystem when areas containing fish habitat are dewatered. Common works, undertakings and activities (WUAs) that involve dewatering include: water extraction, mining, construction, repair and maintenance of infrastructure. If not managed, dewatering can result in the sedimentation of fish habitat, and changes to, or losses of, habitat structure and cover, fish passage, and wetted area. These pressures have the potential to impair the habitat's capacity to support the life processes of fish. Sublethal effects to fish (e.g., injury, stress) and fish mortality are also possible if protection measures are not put in place.

## 8- Detonation in or Near Water

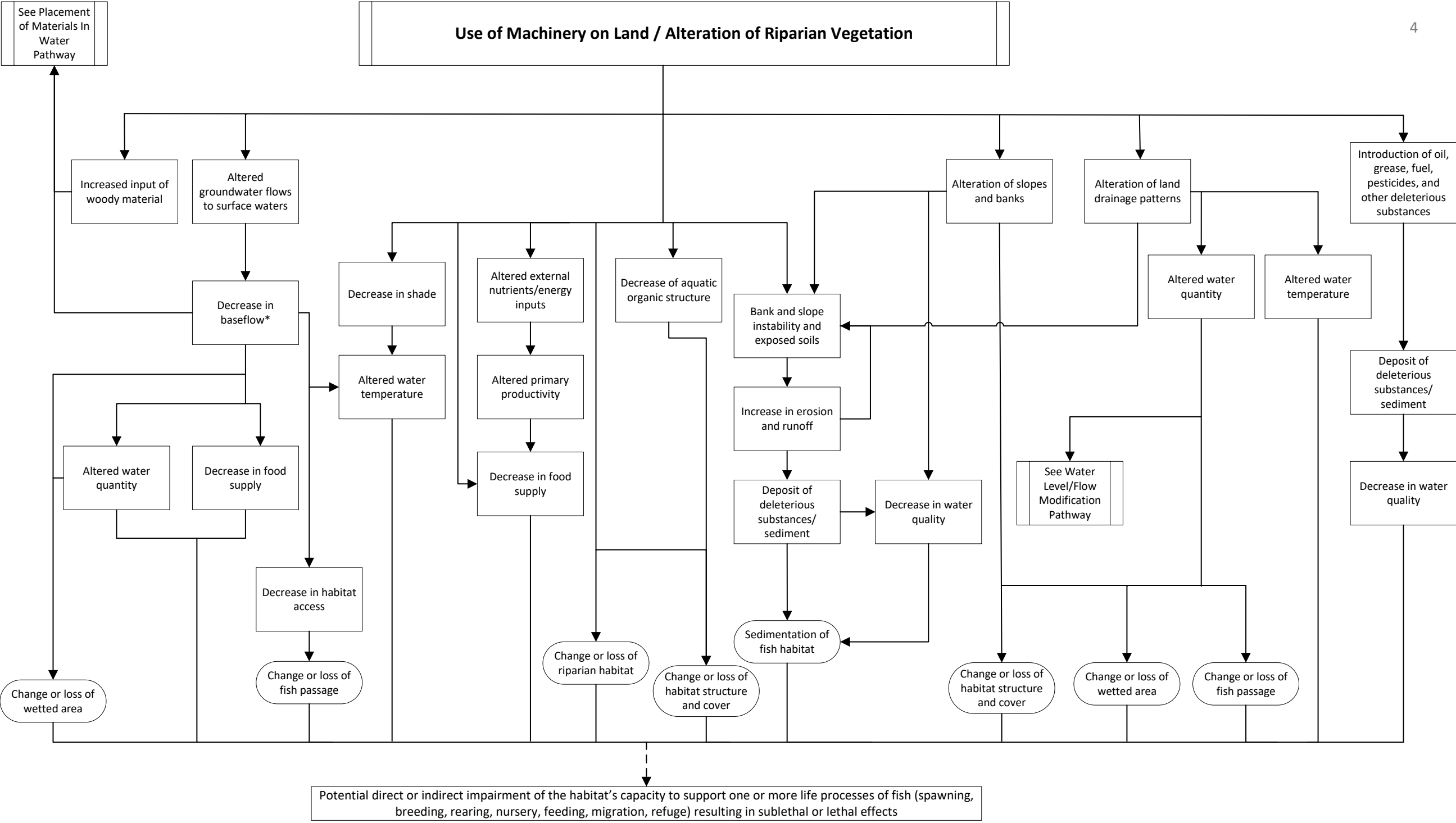
This pathway illustrates the chain of events that takes place in an aquatic ecosystem when explosives are detonated in or near water. Common works, undertakings and activities (WUAs) that involve detonating explosives include: geotechnical surveys, construction, repair and maintenance of infrastructure, road construction, pipeline installation, mines and mining exploration. If not managed, detonation in or near water can result in the sedimentation of fish habitat, and changes to, or losses of, habitat structure and cover. These pressures have the

potential to impair the habitat's capacity to support the life processes of fish. Sublethal effects to fish (e.g., injury, stress, and impaired communication, navigation and migration) and fish mortality are also possible if protection measures are not put in place.

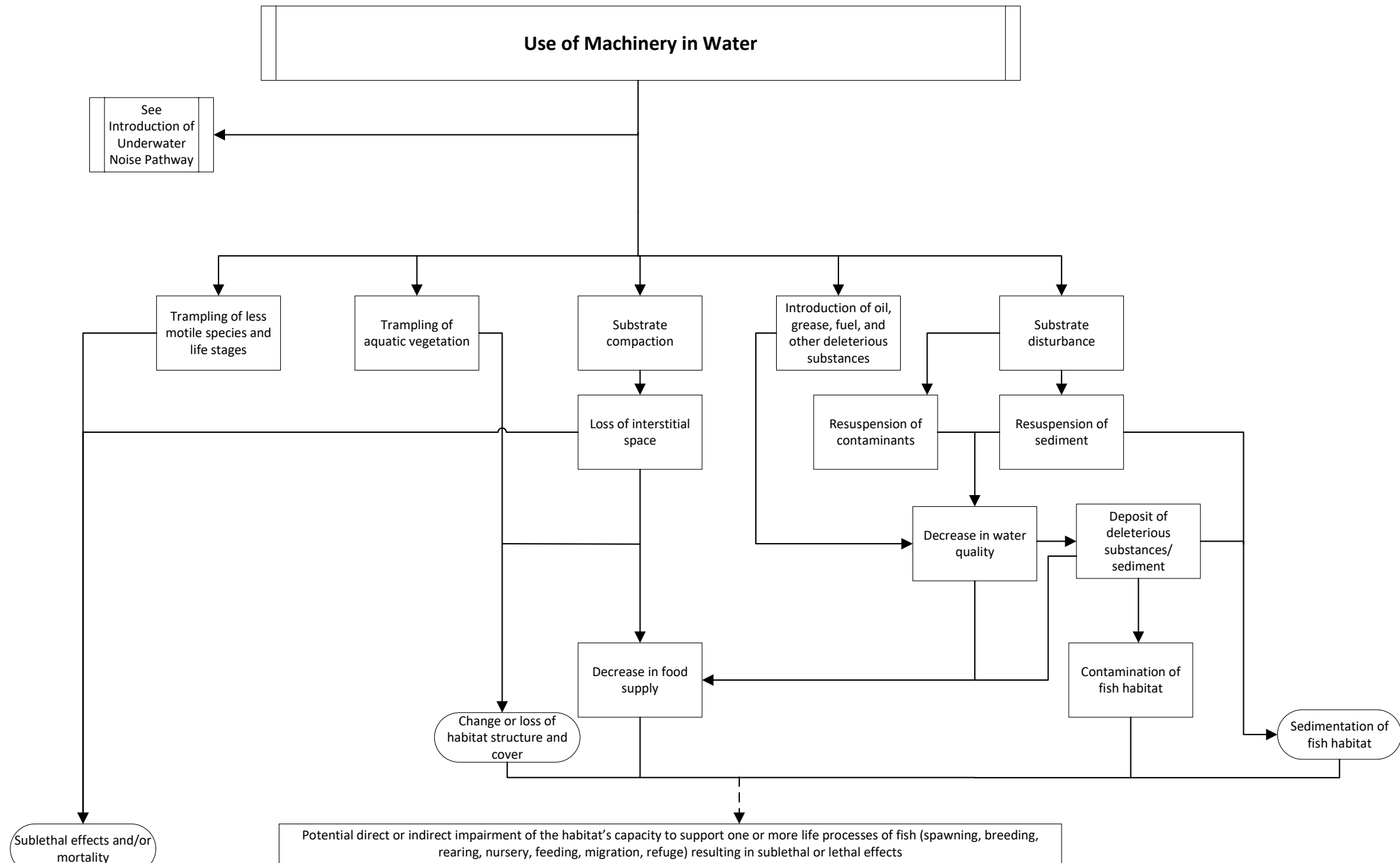
## 9- Introduction of Underwater Noise

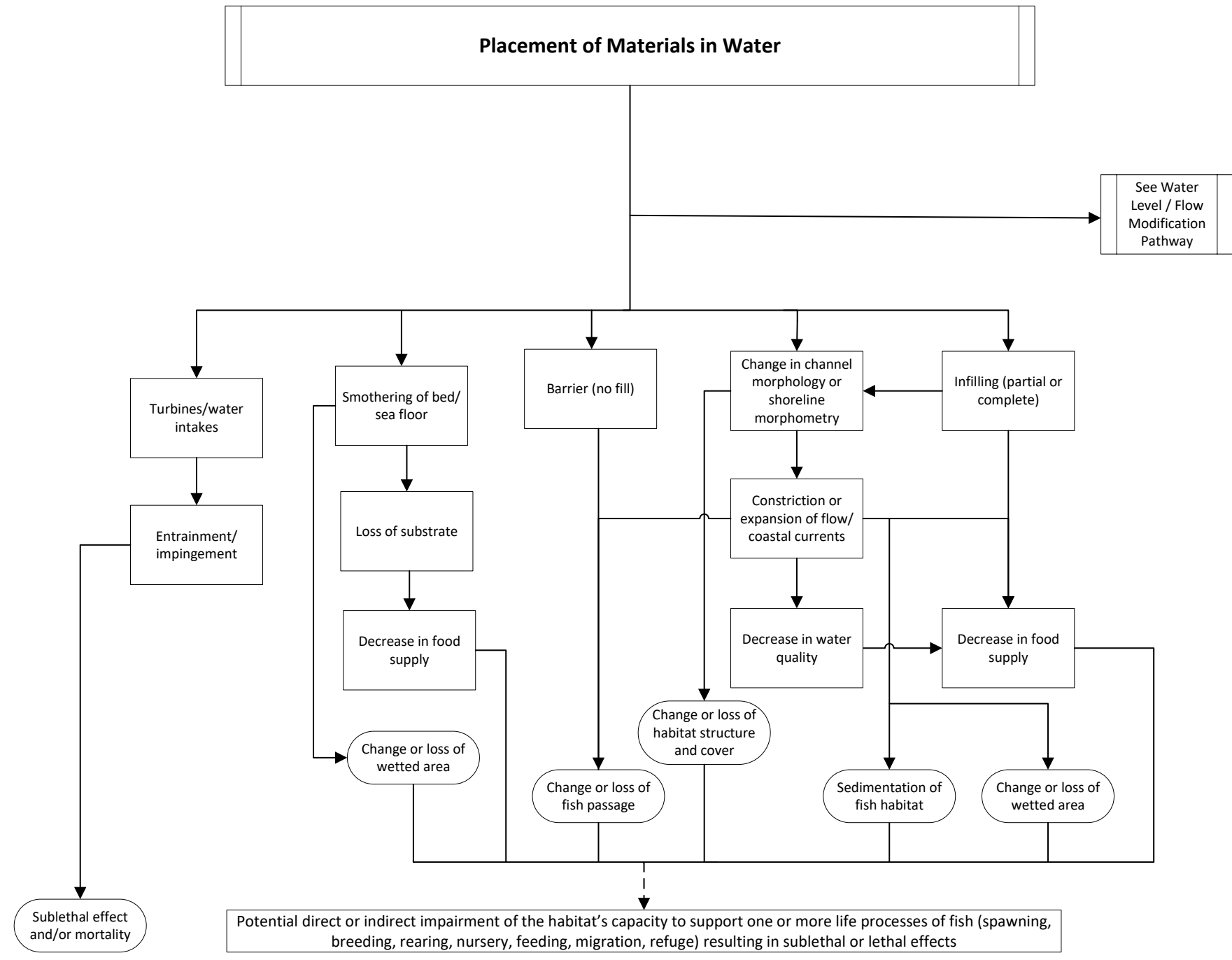
This pathway illustrates the chain of events that takes place in an aquatic ecosystem when noise is introduced. Common works, undertakings and activities (WUAs) that produce noise under water include: seismic and geotechnical surveys, pile driving, dredging, drilling, wind turbines and tidal energy turbines. Sublethal effects to fish (e.g., injury, stress, and impaired communication, navigation and migration) and fish mortality are possible if protection measures are not put in place.

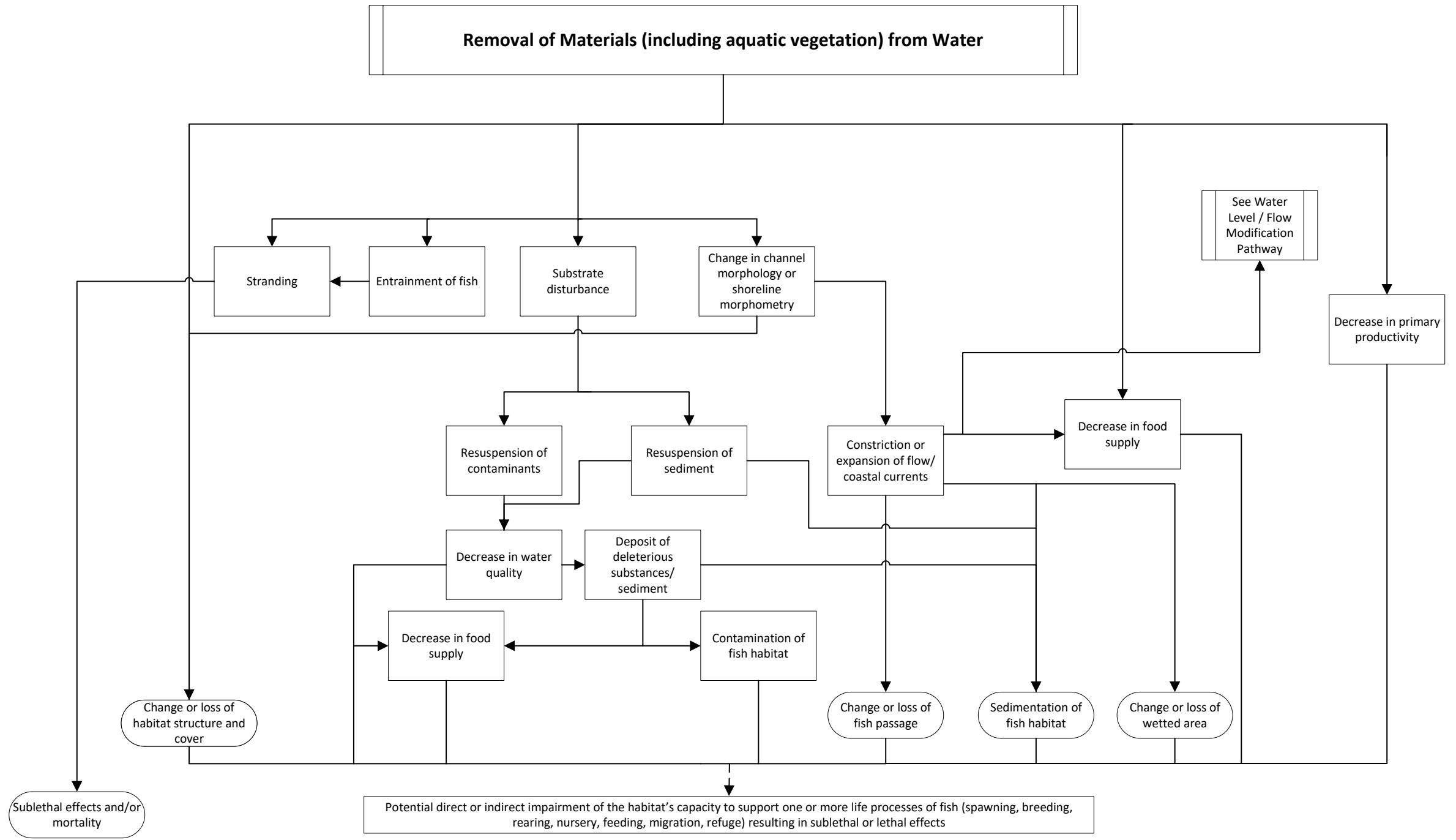
# Use of Machinery on Land / Alteration of Riparian Vegetation



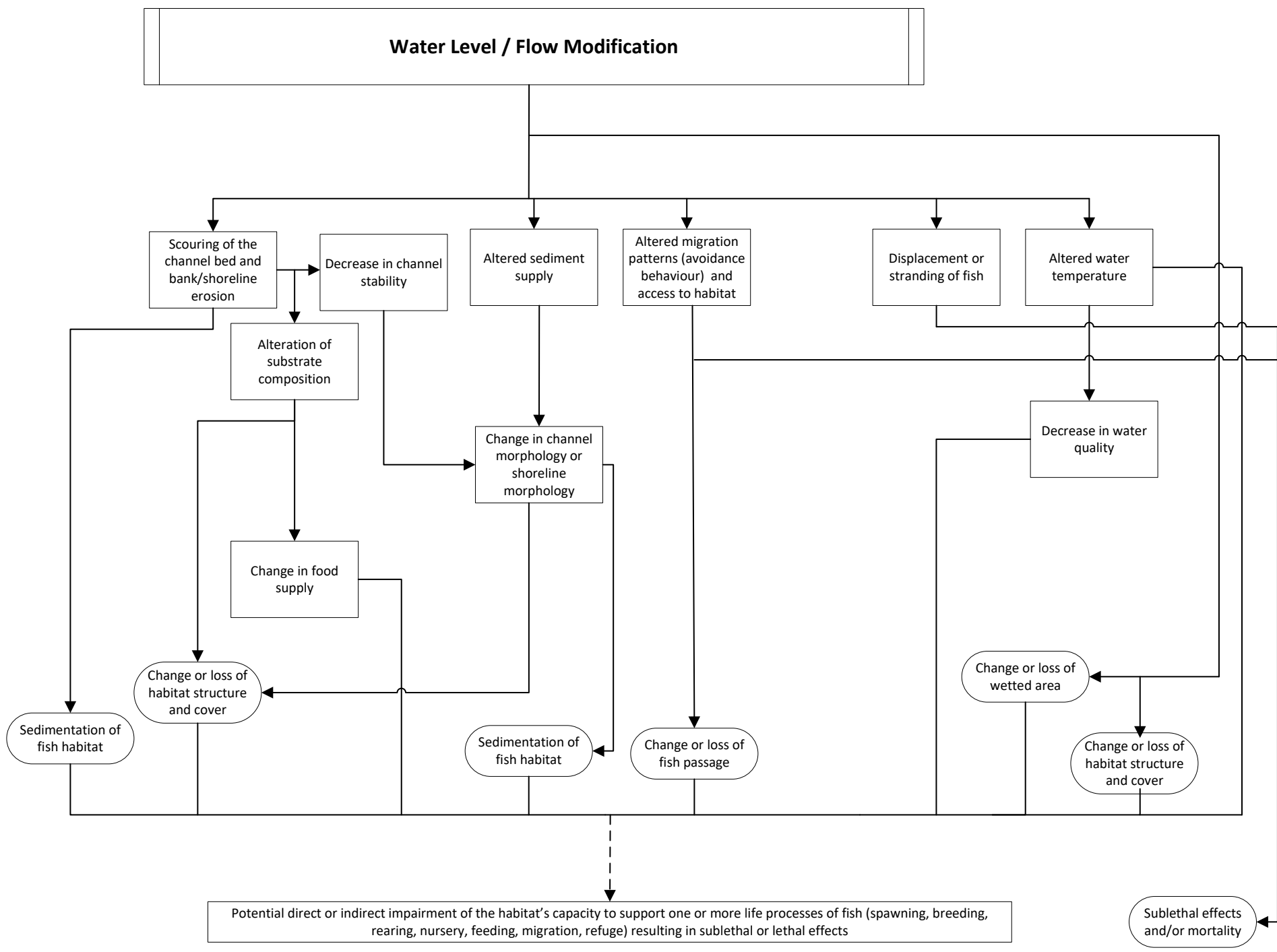
\*Potential for increase in baseflow in some cases

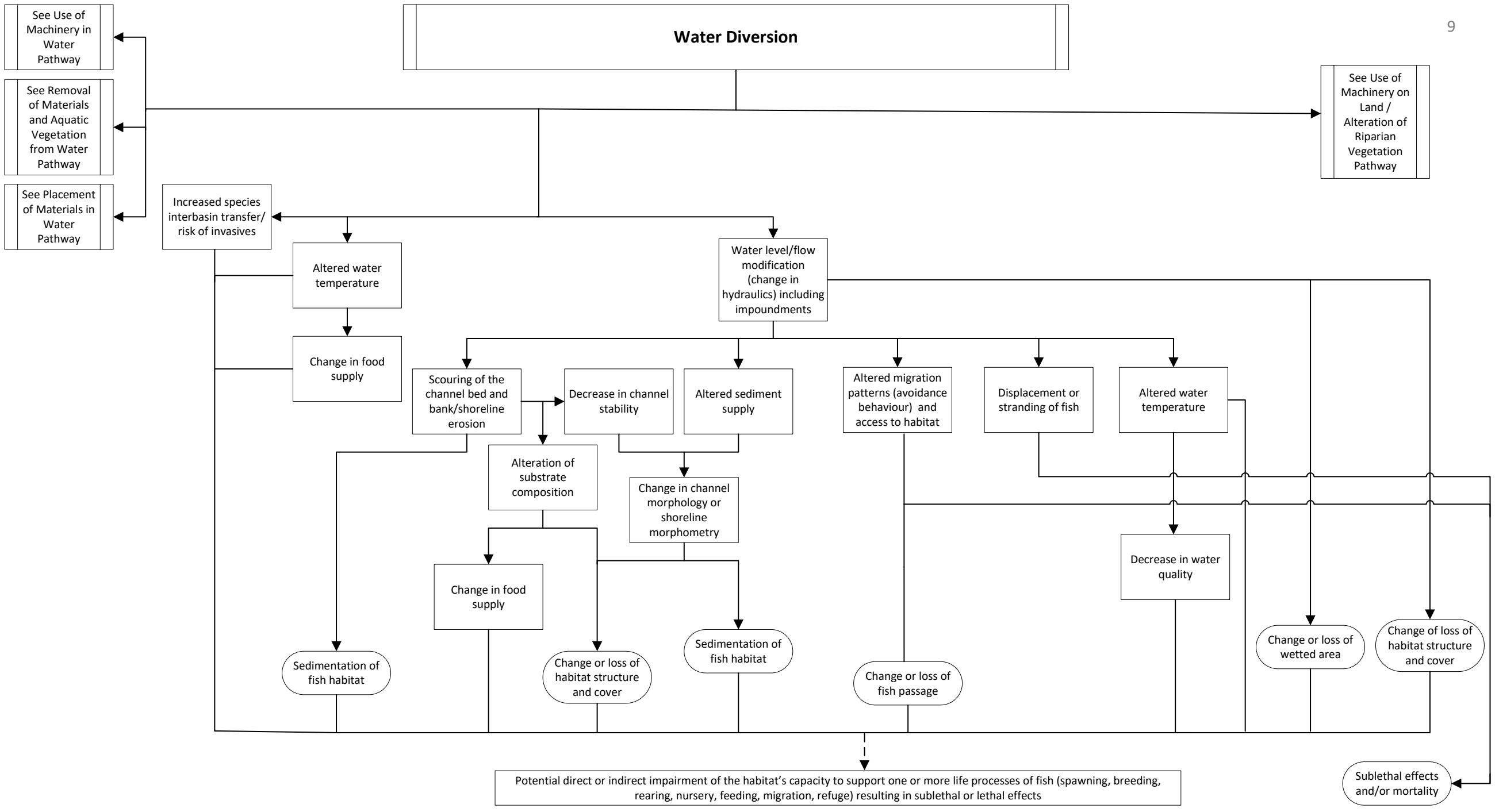












Potential direct or indirect impairment of the habitat's capacity to support one or more life processes of fish (spawning, breeding, rearing, nursery, feeding, migration, refuge) resulting in sublethal or lethal effects

Sublethal effects and/or mortality

# Dewatering

