

Environmental Impact Assessment
for the
“Plan for revitalization of Dojran Lake shoreline using nature-based solutions, for improved protection against pollution from land”

Date: 30.09.2022

CEPF Grant 109162

ASD Milieukontakt Macedonia

Enhancing Dojran Lake unique biodiversity through engagement of all stakeholders and implementation of ecosystem-based approaches

Municipality of Dojran – Dojran Lake

Grant Summary

1. Grantee organization: Milieukontakt Macedonia
2. Grant title: Enhancing Dojran Lake unique biodiversity through engagement of all stakeholders and implementation of ecosystem-based approaches
3. Grant number: CEPF-109162
4. Grant amount (US dollars): 193,359.00
5. Proposed dates of grant: July 2019 – September 2023
6. Countries or territories where project will be undertaken: The Republic of North Macedonia
7. Summary of the project: The project aim is to strengthen the governance of the catchment management zone and to achieve sustainable management, conservation, and restoration of the lake through engagement of all stakeholders and implementation of ecosystem-based approaches.
8. Date of preparation of this document: 30.09.2022
9. **Status of area to be impacted:** This section should describe the applicant's understanding of the site.

This Environmental Impact Assessment and Environmental Management Plan (EIA/EMP) is developed for the following project activity: "Plan for revitalization of Dojran Lake shoreline using nature-based solutions, for improved protection against pollution from land".

The main objective of the "Plan for revitalization of Dojran Lake shoreline using nature-based solutions, for improved protection against pollution from land" is to identify and propose appropriate nature-based solutions for revitalization of the coast of Dojran Lake with the aim to mitigate pollution and erosion, as well as floods. The proposed nature-based solutions will be implemented along Dojran Lake coastline.

Dojran Lake is a border lake divided between Republic of North Macedonia (27.2 km²) and Greece (15.9 km²). It lies at 148 m above sea level. The Greek side is part of NATURA 2000 and belongs under "Special Protected Area" based on the EU Birds Directive. The part of North Macedonia is also a protected area, protected as a natural monument.

Dojran Lake is a shallow eutrophic lake with a maximum depth of 10 m (average depth of 6.7 m). It is a tectonic lake (the smallest tectonic lake in the Republic of North Macedonia).

During the preparation of the Plan for revitalization of the coast of Lake Dojran a site visit was undertaken. The Plan reflects the current situation (state of the coastline and threats to the Lake ecosystem and potential for mitigation through coastal revitalization).

Increased pressure caused by anthropogenic pollution from land around Dojran Lake, causes poor water quality and eutrophication, which represents big threat for biodiversity in the lake.

Main sources of the pollution are:

- discharge of insufficiently treated communal water from the wastewater treatment plant in Toplec,
- discharge of untreated water polluted with nutrients from the canal which brings additional amounts of water into the lake,
- mixed sources of pollution (agricultural activities and untreated wastewater from septic tanks in parts of the urban zones and surrounding villages).

Additional problems are the lack of buffer zones in the coastal area, deposits generated from erosion that occur due to unsustainable agricultural practices, climate change and urbanization, which cause floods and huge damage to the coast and coastal infrastructure.

10. **Approach:** This section will describe proposed actions during the project. Specifically, what do you intend to do and how will you do it?

Dojran Lake has been facing different problems for several decades, such as: flooding, poor water quality and erosion.

Flooding

Until 2000, the water level in the Dojran Lake was constantly decreasing. Because of the constructed canal-system for water supply, now the water level has increased. However, nowadays high water levels (above the maximum water level) are causing problems with erosion of coastal walls and flooding of the low-lying land during heavy rains.

Poor water quality

Dojran Lake is a eutrophic, nutrient-rich lake, which supports very dense populations of plants and algae. When the algae die, a large amount of oxygen is consumed, which causes die-off of fish and other underwater life. At the same time, more nutrients are entering the lake, which means that the lake is in a state of "closed circle".

Last samples from the canal-system that supplies lake with fresh and clean water, show that the water is polluted with nutrients (large amounts of nitrogen and phosphorus).

Another large source of pollution is the insufficiently treated water which enters Dojran Lake from the Wastewater Treatment Plant "Toplec".

Large part of the land surrounding the lake (the north part of the lake) is used for agriculture. Due to conventional agricultural practices, phyto-pharmaceuticals and nutrients from fertilizers leach into the lake (through erosion of topsoil and flushing of substances).

Housing facilities that are not connected to the sewer system and use septic tanks (old and damaged) to collect wastewater, also represent a source of pollution.

Another problem is the inappropriate disposal of waste (plastic) in the lake and its surroundings, which releases harmful substances during decomposition.

Usage of tar to protect wooden piers on the port is also a source of pollution, because tar is toxic for underwater life.

Erosion

Beside erosion from agricultural activities, there is also erosion caused by the lake the lake itself and/or runoff in the more urban areas. Major erosion can be observed on large sections of the wall built along the path that stretches from the southern border with Greece to the end of Star Dojran.

There are also cases of coastal erosion visible on some gravel beaches, caused by runoff, waves, or a combination of both.

In the frame of this project a Plan for revitalization of the coast of Lake Dojran using nature-based solutions developed has been developed with the aim to improve protection against land pollution and mitigate erosion.

Nature-based solutions are used to solve wide range of problems/threats, such as pollution and erosion and are widely used for coastal protection. Nature-based solutions protect nature, people, and infrastructure from different impacts, while restoring ecosystems and providing benefits for the local biodiversity.

The Plan for revitalization of the coast of Lake Dojran gives an overview of beneficial nature-based solutions that can be used to improve the condition of freshwater ecosystems. These are:

- **Wetlands**

Wetlands act as a filtration system, removing nutrients and pollutants and sediment from the water. As the water flows into the reedbeds, it expands and passes through dense vegetation, which reduces its speed. This allows the sediment to fall to the bottom, where the plants' roots bind it and retain it in the wetland (up to 90% of the sediment). Because pollutants, such as heavy metals, are attached to soil particles, they also become trapped in the wetlands by the process of sedimentation.

Nitrogen and phosphorus are the main nutrients that flow into water bodies from agricultural land and communal wastewaters. Microorganisms and plants that live in the wetlands remove these nutrients from the water. When plants die, nutrients are recycled into the wetland itself.

There are also some pollutants that can be converted into less harmful chemical forms through the biological processes that occur in the wetlands, through longer period of exposure to the sun, and even via absorption in the wetland plants.

- **Constructed wetlands**

Traditional wastewater treatment plants are technologically complex and financially expensive. Constructed wetlands represent a good alternative, because of their simplicity in construction and operation, and the environmental and economic benefits they provide.

There are many different forms of constructed wetlands. The most commonly used in Europe are subsurface vertical or horizontal flow constructed wetlands.

Each constructed wetland consists of a septic tank, where most of the solids are removed, followed by one or more fields. The fields are coated with a waterproof layer to prevent untreated water from seeping into the surrounding soil. The fields are filled with gravel and are usually planted with common reed (*Phragmites australis*), but other local wetland plants can also be used.

Water is purified/treated through physical and chemical processes with the help of microorganisms and wetland plants. Constructed wetlands have been proven to have the capacity to remove suspended solids, organic matter, nutrients, fecal and other bacteria, heavy metals, and persistent organic pollutants.

Constructed wetlands can be used on a larger scale, such as for entire cities, but also on a smaller scale, i.e., for individual houses.

- **River diversion wetlands**

River diversion wetlands work on the same principle as constructed wetlands. The difference is, they are located in natural water bodies, either in the polluted stream or river or right next to them, connecting with a bypass. They are used only in places where the water does not have a lot of residual solids and other large waste in it, which would quickly clog the filter.

- **Natural sloping gravel shore**

Natural sloping gravel shore is a much more effective water treatment solution than concrete or stone walls. The natural coastal slope with gravel also provides a suitable habitat for the spawning of certain types of fish (for example in the Dojran Lake the whiting - *Alburnus macedonicus*)

- **Floating islands**

Floating islands are artificial floating structures planted with various plants that can withstand the constant presence of water around their roots. They are composed of 4 components: anchoring system, floating structure, planting medium and plants.

The floating structure allows the island not to sink. It can be made of materials capable of being kept afloat or in cases where floating islands need to withstand greater loads, the construction can also be made of HDPE pipes.

The anchoring system holds the floating islands in place. The system can be made in the form of an anchor placed on the bottom or a sliding platform that attached to the shore. In both cases, the anchoring system must be designed to allow the island to move with changing water levels.

In most cases, the planting substrate does not have the usual role of providing nutrients to the plants (they get them from the water), it mostly serves as a support until the seedling forms a strong root system with which it will be anchored to the floating structure. Therefore, materials that are low in nutrients are used, such as coconut fiber.

The main role of plants is to take up nutrients from the water. In addition, plants form habitats above and below water that represent home to a variety of living organisms. Among them are microorganisms, which live in the root structure of the plants, and which play a key role in the water purification. Plant roots also take up a lot of residual solids from the water, making the water clearer. If possible, it would be ideal to use native plants to plant the floating islands. In addition to water purification, the floating islands can increase biodiversity, so it is recommended to plant a wider range of different types of plants.

- **Fascines/Brush mattress**

Brush mattress/fascines represent a layer formed by living branches positioned on the banks, which are used to stabilize the coasts and protect to coasts from erosion. By covering the bank with a layer of 15 - 30 cm, an instant effect is achieved that becomes even greater when the branches start to take root, forming a thick network, underground, that joins the bank together. At the same time, the part above the ground begins to branch out new branches, making the structure thicker and thus more effective in protecting the coast from erosion. As well as protecting the coast, fascines also provide habitat for a wide variety of animals, remove nutrients and trap sediment originating further inland and are therefore useful in protecting against diffuse sources of pollution. The fascines are placed in a location where the branches will be in contact with the wet substrate but will not be completely under water. Optimally, this solution should be used on embankments with a slope of less than 35°. Bendable branches that are 2-3 years old and have a length of 1.5 to 3 m are used for the construction of the fascines. The thickness of the thicker end should be between 1 and 4 cm. The cut parts should be straight and bushy. Stakes (dead wood or live sticks) and strong biodegradable hemp are also needed.

The embankment is prepared by removing the larger waste and grading it, so that the branches can lie flat on it. Care must be taken not to compact the soil too much as this would prevent root formation. A horizontal furrow 20 - 30 cm deep is dug at the base of the embankment. The cut branches are arranged in a slightly diagonal grid with the thicker part placed in the furrow as deep as possible, and the other end pointing towards the upper part of the embankment. This is repeated until at least 80% coverage of the surface is achieved. This requires approximately 10 to 50 branches per meter of fascines. After this the stakes (60-90 cm long) must be nailed between the branches in a diamond-like pattern with a distance of 0.9-1.2 m between them. They should only be partially nailed inside before connecting to the rope. After this is done, the stakes should be further nailed in order to compress the sill firmly against the embankment. The base of the fascine is secured with a suitable technique such as a contour wall. To achieve good contact and to retain some moisture, a layer of soil is placed over the branches after their placement and watered.

- **Planted rip-rap**

Planted or vegetated contour wall is a combination of a contour wall and vegetation that is used to prevent erosion. A contour wall in itself is good for protecting embankments from erosion, but it is not an ideal solution in itself when it comes to eco-remediation. Although rocks are natural material, large rocks and stones do not provide habitats like other nature-based solutions and do not significantly improve self-purification capacities. For that reason, i.e., in order to achieve a better capacity for self-purification and provision of habitats, the contour wall is combined with vegetation. There are various methods to achieve this:

- Vegetative contour wall with willow
- Vegetative contour wall with folded stakes
- Vegetative contour wall with layers of shrubs and planted stakes
- Contour wall planted with jointed or living branches

For all the above-mentioned types of vegetative contour walls, cut branches of trees that grow quickly, love moisture, and easily grow roots (in most cases willow) are used. These cut branches can be placed in front of the stones or wedged between the stones. As with the construction of a conventional contour wall, a filtration layer is required to prevent fine soil from being pumped out from under the contour wall. This can be done by using gravel with a different fraction that will serve as a filter or with a material as a filter. Ideally, the first option should be chosen, as plants may have difficulty growing roots through the filter material.

- **Willow spiling**

Willow terraces are an ancient technique for bank stabilization. It is a combination of twigs (either live only or a combination of live and dead) and branches of trees that grow quickly and have a tendency to make roots quickly (usually willows). These branches (3 - 10 cm diameter) are buried vertically in the soil, every 30 cm. The branches are then intertwined, making a vertical wall of live cut branches. This is then turned back on the side of the mound so that the cut branches are in contact with the soil. Over time they develop roots, further stabilizing the bank and growing new branches, forming a thick rampart that traps eroded sediments and provides habitat for a variety of animals.

Although willows like moist soil, they do not grow well if they are completely submerged. Therefore, a combination of willow terraces and other solutions can be used in deeper waters.

- **Green buffer zones**

Green buffer zones are buffer zones made up of plants. They are a combination of trees, shrubs and herbaceous vegetation. It is recommended to use local plants that are already present in the environment.

Green buffer zones are located between the zone that is the source of the threat and the zone that should be protected.

In this case the green buffer zone would be placed between the land and the lake (in the coastal area). When it comes to pollution and siltation, the lake needs to be protected, and the land is the source of the mentioned threats. When it comes to flooding and coastal erosion, the roles are reversed.

Green buffer zones can be located deeper inland, close to other bodies of water, to prevent sediment and other pollutants from entering streams and rivers that then flow into the lake. Another option is to set up green buffer zones as a fence between fields, which will stop runoff at the point of discharge, which will also function as a habitat for fauna, thus increasing pest control.

In terms of pollution and sediment protection, green buffer zones function in the same way as wetlands. When it comes to protecting the coast from erosion, they function as an object that dissipates (reduces) the erosive energy of the water.

- **Renaturation of canals**

Concrete canals, like the hydro-channel that supplies additional water to Dojran Lake, have a much lower self-purification capacity than natural streams and rivers. This is the reason why projects - where rivers and streams that have been diverted into canals are being transformed back into natural ones, are becoming more common all over the world.

This would mean removing the existing concrete canal and making a natural canal, which would be made with more bends instead of a straight line, thus increasing the retention time of the water, but also including various structures, such as gravel fields, stacking of logs and larger rocks and planting plants where new ecosystems can be established. In the case where it is not possible to remove the existing concrete canal and make a natural one, certain measures can be taken to improve the current situation (for example gabions that will make the water bends bigger and provide more surface area for microorganisms that purify the water), but the improvement will not be as visible as with a complete renaturation of the canal.

- **Sustainable drainage systems**

Sustainable drainage systems are drainage solutions that provide an alternative to directly canaling rainwater through networks of pipes and sewers with the intention of quickly diverting it away from urbanized areas and roads.

They work by imitation of natural drainage regimes and aim to reduce surface water flooding, improve water quality, and increase the amenity value and biodiversity of the environment. This is achieved by reducing runoff rates, increasing water storage capacity, and reducing the transfer of pollution into the aquatic environment.

Examples of sustainable drainage systems are:

- Bio-canals - a shallow depression in a piece of land that collects and filters surface runoff, by directing polluted rainwater into the soil and vegetation.
- Permeable pavement – a type of pavement that allows normally impervious surfaces (e.g. parking lots) to become permeable and thus allow water to pass through them and seep into the ground.
- Retention basins - a depression covered with vegetation that should retain rainwater and drain it slowly.
- Rainwater storage tanks – this can be anything from a small barrel to a 30m³ (or wider) cistern. They are usually made of plastic or concrete. They are used to store rainwater when there is an excess of it, and it is used for irrigation in the dry part of the year or even for water in toilets.
- Rain gardens - a garden with natural shrubs, perennials and flowers planted in a small depression, which is used to absorb rainwater (usually directly from downspouts).

- **Sustainable/regenerative agriculture practices**

Measures for prevention represent a large part of the improvement of water quality, and thus of aquatic ecosystems. Conventional agriculture has a major negative impact on the surrounding ecosystems. If the water quality aspect is considered, conventional agricultural practices are a huge source of nutrients, pollutants and sediments leaching into water bodies.

Through implementation of such land practices, flood safety is also improved by absorbing excess water resulting in a reduction of surface water runoff. Sustainable agriculture practices encompass few techniques, such as:

- No plowing (reduced tillage) is an agricultural practice that involves no plowing or minimal tillage. This causes less erosion which means less sediment and nutrients in surface water runoff.
- Contour farming involves planting crops in man-made water breaks or furrows running across slope. This furrow must be made on level throughout. This slows down the surface runoff, allowing more of it to infiltrate in the soil and lessening its erosive power.
- Swales are trenches built on contour. They work in the same way as farming on contour, but are capable of storing more water and are usually not planted with annual crops, but perennials
- Cover cropping is a technique of sowing additional crops between the main seedlings. Its main role is, as the name suggests, to cover the soil thus reducing the chances of erosion, while at the same time improving the quality of the soil and the life in and above the soil.

The focus of the Plan for revitalization is to provide concrete solutions, that have the capacity to mitigate the major hazards that pose threat to the protected area of Dojran Lake. The Plan for revitalization proposes implementation of the following nature-based solutions:

a. Establishment of the destroyed reed belt

Dojran Lake once had a permanent reed belt around the entire lake. In addition to providing a habitat for various life forms, the reed belt acts as a green buffer zone that protects the coast from waves. This wetland can play a huge role in improving the quality of the lake water. Reed belts also provide habitat for many animals and other types of plants.

The Plan for revitalization proposes establishment of a discontinuous reed belt in the southern part of the lake, starting from the Greek border all the way up to Star Dojran. The proposed solution for establishment of reeds allows for other activities to take place, such as bathing. In most areas a 25 m gap will be left between the reeds and the coast for this reason. Openings also planned between the reed belts so that the boats could pass through them.

Another option would be to place the reeds close to shore and build docks between the reed belts to allow access to open water for recreation such as swimming and fishing. Both options can be combined depending on the specific areas.

Reeds have difficulty growing in water deeper than 0.5 m. Even in water to that depth, the plants must protrude above the water during planting. If the water is deeper than 0.5 m, underwater dikes can be made from materials already present in the lake. Planting material can be in the form of nursery-grown seedlings, cane transplants, stem cuttings or rhizome fragments. In total, about 10 hectares of new reed belt would be installed.

Cutting the reeds at the right time (taking into account bird nesting and fish spawning) and the right depth (tall enough to allow regrowth) can remove nutrients from the lake. The removed reed material can be composted, and the compost can then be used in agriculture or horticulture, or even as fodder.

In addition to reeds, other local plants can be also planted, such as *Vallisneria spiralis* and *Ceratophyllum demersum*. Planting of these plants would be easy even in water deeper larger than 0.5 m.

b. Fascines/Brush mattress to prevent coastal erosion in Kaldrma

For an approximately 10 m long stretch of severely eroded beach with a gravel slope in Kaldrma, the willow Brush mattress (Fascines) solution was chosen. First, the slope should be made stepped, in order for the willow branches to have good contact with the ground. After the branches are in place, the stakes are

partially buried, in a diamond-shaped arrangement, tied with hemp and then fully buried. A thin layer of soil will be spread over them and rained down. The branches will take root in the bank, forming a strong root system, which will protect the bank from further erosion. Depending on the desired look, once established, the willows can either be pruned back or left to grow into a tall hedge-like structure of dense trees.

c. Planted rip-rap to replace the degraded parts of the coastal wall in Star Dojran

In places where the coastal wall is seriously degraded in Star Dojran due to erosion, a vegetative rip-rap will be installed. Willow stakes will be used and will be stuck between stones in such a way that the last part of the stake will be in constant contact with water, while the upper part will stick out of the rip-rap. The willow stakes will make roots on the underside, tying the structure together while simultaneously pulling nutrients from the water. Underwater plants can be planted on the lower part of the rip-rap (the part that is permanently under water).

As for the rip-rap wall, it will be made of stones of different sizes to minimize the large gaps between them, which have been proven to be ideal habitat for some invasive animal species. The lack of voids also provides a better environment for plants to take root. The Plan proposes establishment of 820 m planted/vegetative rip-rap at the places in Star Dojran where the existing concrete coastal wall is damaged.

The contour wall would be built next to the existing degraded wall. Before building, any pieces of fallen concrete that may interfere should be removed. The same applies to any dead, upright or submerged trees or other large debris.

Depending on the desired look, once established, the willows can either be pruned back or left to grow into a tall structure like a hedge of dense trees. In the same way as with reeds, if the willows are pruned, the cut parts can be used for production of compost or even as feed for goats, thus removing the additional nutrients from the lake.

d. Re-establishment of the gravel slope on the northern shore of the lake

At the southernmost part of the lake, where there is currently a crumbling, often flooded wall, a coastal gravel slope needs to be re-established. The length of this stretch is approximately 850 m. The decayed wall, as well as the material behind it, should be removed until a suitable slope to which gravel is added is formed.

e. Improved purification of the canal water through renaturation of the canal

The hydro-canal that brings additional water in Dojran Lake represents one of the main sources of nutrient pollution for the lake. This pollution can be reduced by renaturation of the concrete canal. In order to have no impact on the treatment plant, this would be done in the last 275 m of the canal (under the ramp).

In this section, the existing concrete canal would be removed. Instead, a meandering stream would be formed using natural materials such as sand, gravel, and larger stones. Plants would be added for ecosystem diversity. Immediately after the ramp, a pool lined with larger rocks would be formed in order to spread the energy of the water as it flows over the ramp. More streams will be formed using larger rocks along the section, to slow the water down and to allow mixing with air to provide additional oxygen quantities. Through renaturation the self-purification capacity of the stream/canal will be increased.

Given the high flow (400 l/s) and the fact that water is loaded with nutrients, the relatively short section where the renaturation can be applied will not be sufficient. Therefore, establishment of floating islands at the end of the stream is proposed will further help to purify the water. The approximate area of the floating

islands should be 8,000 m². Since this is a huge and costly project, it is advisable to take previous measures to find the cause for the nutrient loads in the canal water, before building the floating islands.

f. Establishment of green buffer zone between the agricultural land and the lake

In most of the area above Nov Dojran, at least a 15 m wide green buffer zone form of reeds already exists between the agricultural land and the lake. Only in a few places the farmland needs to be pushed back and reeds or other native plants to be planted in order to have a complete buffer along the entire agricultural area.

11. **Anticipated impact:** this section will describe the impact and how this impact has been determined.

This Environmental Impact Assessment is developed for the following project activity: Nature-based solutions proposed by the expert team in the Plan for the revitalization of the coast of Lake Dojran.

Proposed nature-based solutions for coastal revitalization (establishment of the destroyed reed belt along the entire coastline; repairing of the eroded bank with fascines and a planted contour wall; re-establishment of the gravel slope on the northern shore; renaturation of the canal; and establishment of green buffer zone between the agricultural land and the lake) are expected to have minimal negative environmental impact.

According to the Law on Environment and the Decree on activities that require preparation of elaborate for environmental protection, the planned activity is not explicitly stated and defined, but could be categorized in Annex 1, XI - Infrastructure projects, point 6, Projects for construction of water transmission systems, sewage systems and flood protection systems and point 11, Coastal and land works for protection from erosion and/or regulation of surface water bodies. Depending on which nature-based solution will be selected by the Municipality of Dojran to be implemented, appropriate technical documentation will be prepared and a letter for intention for implementation of the selected activities will be submitted to Ministry of Environment and Physical Planning. If requested, an elaborate for environmental protection will be prepared.

Also, according to national Law on Environment, Strategic assessment shall be carried out on the planning documents prepared in the area of agriculture, forestry, fisheries, energy, industry, mining industry, transport, regional development, telecommunications, waste management, water management, tourism, spatial and urban planning and land use, on the National Environmental Action Plan and local environmental action plans, as well as on all strategic, planning and programme documents by which implementation of projects that are subject to environmental impact assessment are planned.

Municipality of Dojran made decision for carrying out a strategic environmental assessment for the Plan for revitalization of Dojran Lake coast and has submitted a request to Ministry of Environment and Physical Planning. The Ministry of Environment and Physical Planning has issued an approval for implementation of strategic environmental assessment procedure.

Strategic Environmental Assessment (SEA) represents the process of assessment of the impact of the plans, strategies and programs on the environment and the health of people. In addition, SEA defines measures for mitigation of all identified impacts, thus providing safeguards also during the process of planning and decision-making when plans, program and strategic documents are being developed. The SEA Report takes into consideration the impacts on all media and environmental topics, the population and health of people and the socio-economic characteristics, but from one more general aspect.

Environmental impacts are categorized into two types of activities, in the construction phase and in the operational phase. During the preparation phase and construction/installation of the nature-based solutions (establishment of the destroyed reed belt along the entire coastline; repairing the eroded bank with fascines

and a planted contour wall; re-establishment of the gravel slope on the northern shore; renaturation of the canal; and the establishment of a green buffer zone between the agricultural land and the lake), minimal negative effects on all environment media are foreseen, i.e. emissions in air, water and soil, as well as somewhat increased noise level which will be limited to the location of the project activities. The impacts will be short-term, affect locally and temporarily.

In the operative phase, negative impacts on the environment and human health are not expected.

Air emissions

Construction phase

During the phase of implementation of the planned project activities (re-establishment of the gravel slope on the northern shore; renaturation of the canal), the following impacts are expected to appear in the air:

- emission of exhaust gases from transport machinery for delivery of construction materials;
- dust generated from the transport machinery and the earth excavations, during the construction works;

The impact on air quality can be assessed as short-term, localized and with low intensity of environmental impact. In order to minimize the impacts on the air quality, it is necessary to define measures and activities to minimize the expected pollution.

Operational phase

No negative impacts on air quality are expected in the operational phase.

Water pollution

Construction phase

In the construction phase of some of above mentioned nature based solutions, such as: re-establishment of the gravel slope on the northern shore and renaturation of the canal, dust and construction waste could be generated, which could reach the lake. Pollution is also possible as a result of leakage of liquids, fats and oils from construction machinery.

Operational phase

One of proposed nature-based solutions, renaturation of the canal, will increase the self-purification capacity of the water that is polluted with nutrients, and this will affect the improvement of the water quality in the lake. Therefore, these solutions in the long term will only have a positive impact and will improve the quality of water in the lake.

Waste generation

Construction phase

Different types of waste (non-hazardous) will be generated during preparatory and construction activities:

- a small amount of removed reed - during the establishment of reed belts along the route (city beach in Nov Dojran, Star Dojran, Sretenovo, Mrdaja)
- gravel from an eroded beach in Kaldrma
- stones and concrete from a degraded wall due to erosion in Star Dojran
- concrete waste and stones during cleaning of the water supply canal

- parts of damaged underwater pillars coated with tar.

Hazardous waste could be produced, during the process of removal of the tar-coated pillars that are now occurring in the lake water. This hazardous waste needs to be collected and transported by a company licensed for hazardous waste management.

Operational phase

In the operational phase, most of the expected waste will be biodegradable waste, such as unused and damaged reeds, branches and trunks during pruning of willows, grasses, bushes, dead algae and packaging waste scattered by tourists, etc.

Soil emissions

Construction phase

In this phase, following impacts on the coast soil could be expected:

- removal of sand and gravel from eroded beaches
- non-adequate disposal of generated waste on site (rocks, concrete, parts of pillars coated with tar);
- leakage of fuels and oils from construction machinery, which could cause impacts on soil and groundwater.

The impact on soil can be assessed as short-termed, localized and with low intensity. In order to minimize the impacts on the soil, it is necessary to define and undertake measures and activities that will minimize the expected pollution.

Operational phase

During the operational phase, negative impacts on the soil and groundwater are not expected.

Noise and vibration

Construction phase

Increased noise levels will occur during clearing of the sites (rocks and other debris materials from degraded concrete wall, cleaning gravel and other materials from eroded beaches) and renaturation of water supply canal. Source of the increased noise levels will be the machinery and transport vehicles.

The noise disturbances will be short-termed and localized, thus can be characterized as insignificant impact.

The limit values for the basic indicators for environmental noise are defined in the Rulebook on limit values for noise level. According to the Rulebook on the locations of monitoring stations and measuring points, the location of project activities is in the area with 1st degree of noise protection, which includes places which are intended for tourism and recreation, areas near medical equipment and hospitals, national park areas and nature reserves.

In the area with 1st degree of noise protection, allowed noise level ranges from 50 dB during the day and evenings, and 40 dB (A) overnight.

Operational phase

In the operational phase, noise disturbances are not expected.

Biodiversity (flora and fauna)

The reed belt is a very important ecosystem of Dojran Lake, because the reeds represent a habitat for various life forms. The reed belt also represents a green buffer zone that protects the coast from waves and erosion and creates a wetland that plays a huge role in improving water quality. Reed belts are a habitat for many animals and other types of plants.

Construction phase

Impacts on the biodiversity may occur as a result of the use of construction machinery. The following impacts on the biodiversity may occur: uncontrolled removal of reeds and other coastal vegetation, noise generation, fugitive dust emissions and exhaust gases emissions.

Operational phase

Having in mind that nature-based solutions are inspired and supported by nature, no long-term negative impacts on biodiversity are expected. In contrast, it is expected that the proposed nature-based solutions will improve the local biodiversity.

Impacts on human health

Some impacts on the local population may occur during construction phase, as a result of the work of the construction machinery, increased noise, fugitive dust emission, etc. These impacts will be short-termed and localized and will be present only during the construction phase of implementation of the nature-based solutions (reparation of the eroded bank with fascines and a planted contour wall; re-establishment of the gravel slope on the northern coast and renaturation of water supply canal).

During the operational phase of the implementation of the nature-based solutions, positive impacts on the human health are expected, especially from the restoration of the coast (green tampon zone and reed belt, renaturation of water canal supply), improvement of the quality of water in lake, decreased occurrences of erosion and flood events.

12. **Mitigation measures**: Describe measures that will be taken to mitigate negative impacts.

Nature-based solutions (NbS) are inspired and supported by nature, they are cost-effective and provide simultaneous environmental, social, and economic benefits. To provide safeguard against any foreseen or unforeseen potential impacts, the following mitigation measures are proposed:

Air quality

In order to minimize any potential negative impacts on air quality during construction works, following measures are proposed:

- Avoidance of work (removal of sand, gravel, concrete, etc.) during dry periods;
- Regular maintenance and servicing of the construction machinery.

Water quality

In order to minimize any potential negative impacts on surface and groundwater during construction works, following measures are proposed:

- Disposal of construction materials, waste from excavation and other inert waste (sand, gravel, concrete parts, biodegradable waste) at appropriate places;
- Regular maintenance of vehicles and construction machinery;

- Prevention of leakage of hazardous waste (e.g. liquid waste, oils and fats from construction machinery).

Soil

Prevention or reduction of potential impacts on the soil will be achieved by applying the following measures:

- Proper planning and controlled removal of sand, gravel and top layer of soil;
- Generated waste (sand, gravel, concrete parts, biodegradable waste) should be temporary disposed on places indicated for that purpose;
- All hazardous materials such as fuels, lubricants, as well as other liquid waste should be stored in appropriate containers, placed on concrete substrates;
- In case of oil leakage from the mechanization, contaminated soil should be removed and should be treated as hazardous waste, in accordance with the bylaws for further treatment of hazardous waste.

Noise

In order to minimize any potential negative impacts of noise during the construction works, the following measures should be applied:

- Ground-construction works are recommended to be performed during the day;
- Ground-construction works are recommended to be performed outside the tourist season;
- Regular service and maintenance of the machinery;
- The motors from the construction machinery should be switched off during non-working periods.

Waste management

In order to properly manage the waste generated during the construction works, it is necessary to implement the following measures:

- Waste from clearing of the locations, should be separated and collected in special places marked for that purpose (e.g., construction debris, concrete, rocks in one place, ground, green waste in another place, etc.) in accordance with the law and bylaws for non-hazardous waste management;
- Removed reeds can be composted, and the compost can then be used in agriculture or horticulture;
- Hazardous waste - parts of damaged underwater pillars coated with tar, should be removed from location, classified as hazardous waste and treated in accordance with the laws and bylaws on hazardous waste management.

Biodiversity (flora and fauna)

Having in mind that nature-based solutions are inspired and supported by nature, the negative impacts on biodiversity are negligible.

The following mitigation measures are proposed:

- Controlled removal of reeds and other coastal vegetation (reeds are very important habitats for the biodiversity of Dojran Lake)
- Conduction of a visual monitoring by an expert (biologist) for the determination of habitats of important animal species;
- Construction work needs to be performed carefully, from the aspect of noise level, in order to prevent disturbance of the fauna;
- Usage of proper construction machinery and environmentally friendly fuels;
- Lake Dojran is a Ramsar site and an important place for birds, therefore all measures required by the Ramsar convention should be respected without exception. Prior consultation with a biologist/ecologist should be made;
- If the presence of a protected species (IUCN Red book) of animals is determined, the construction works need to be stopped and the competent body for nature protection to be informed;

13. **Actions to ensure health and safety:** Describe actions that will be taken to ensure the health and safety of workers as well as the site. Include a description of waste management and/or disposal.

A professional company needs to be hired to implement the actions related to the project activities. To avoid any safety or health hazards, the company needs to fulfill a criterion of having an operational work safety and health procedures and trained personal. The waste produced during the conduction works needs to be appropriately disposed of and actions towards reduction of the waste volume and spread should be undertaken.

14. **Monitoring and Evaluation:** This section aims to outline what steps the proponent will take to monitor and evaluate the impact of the proposed intervention.

Implementation of nature-based solutions, such as establishment of the once-destroyed reed belt; restoration of the eroded bank with fascines and a planted rip-rap wall; re-establishment of the gravel slope on the northern shore; renaturation of the canal; and establishment of green buffer zone between the agricultural land and the lake, will be well planned such as to avoid any unnecessary disturbance.

Representatives from municipality of Dojran and expert supervision will supervise and provide guidance during the construction phase.

15. **Permission of the landowner:** Please verify permission of the landowner to undertake actions on the site, and verify that you have the required permits to undertake this work.

Prior to implementation of any of the nature-based solutions proposed in the Plan for revitalization, the Municipality of Dojran, as the competent body for management of Dojran Lake, will acquire all necessary permits and will implement all relevant legal procedures. This will be done in close collaboration with the Ministry of Environment and Physical Planning.

16. **Consultation:** This section aims to outline the range of informed consultations that the grantee has had both with experts to optimize the potential for success, and with stakeholders, particularly local communities, who are potentially affected by the proposed actions. Include dates of consultations.

Prior to implementation of any of the nature-based solution, the Municipality of Dojran will timely inform the local community and organize wide consultations with all stakeholders. Residents of the settlements will be informed about the planned activities, especially the time of construction works that may affect the noise level and ambient air quality.

17. **Disclosure:** CEPF requires that safeguard documents are disclosed to affected local communities and stakeholders prior to project implementation. Please describe efforts to disclose this impact assessment and environmental management plan and provide dates.

In accordance with the national Law on environment, the project team has prepared the Decision for undertaking a Strategic Environmental Assessment on the Plan for revitalization and all other relevant documentation. In line with the regulation, Municipality of Dojran has informed the Ministry of Environment and Physical Planning (MoEPP) regarding the decision, upon which the MoEPP has approved the decision. Moreover, the Decision for SEA, all other relevant documents as well as the Plan for revitalization were publicized on the official web page of Dojran Municipality in accordance with the requirement of the national law. Through this mechanism and procedure, all safeguard documents have been timely disclosed to the affected local community and stakeholders.

Milieukontakt Macedonia is developing the SEA Report for the Plan for revitalization of Dojran Lake coast, in accordance with the response from the Ministry of Environmental and Physical Planning.

Furthermore, depending which nature-based solutions will be selected by the Municipality of Dojran to be implemented, the appropriate technical and safeguard documentation (EIA or elaborate), as well as a letter of intent for the selected activities/solutions will be prepared.

18. **Grievance mechanism:** All projects that trigger a safeguard must provide local communities and other relevant stakeholders with a means to raise a grievance with the grantee, the relevant Regional Implementation Team, the CEPF Secretariat or the World Bank.

This grievance mechanism must include, at a minimum, the following elements.

- Email and telephone contact information for the grantee organization.
- Email and telephone contact information for the CEPF Regional Implementation Team.
- Email and telephone contact information for the local World Bank office.
- The email of the CEPF Executive Director: cepfexecutive@conservation.org
- A statement describing how you will inform stakeholders of the objectives of the project and the existence of the grievance mechanism (e.g., posters, signboards, public notices, public announcements, use of local languages).
- You should include the following text, exactly, in any grievance mechanism: “We will share all grievances – and a proposed response – with the Regional Implementation Team and the CEPF Grant Director within 15 days. If the claimant is not satisfied following the response, they may submit the grievance directly to the CEPF Executive Director at cepfexecutive@conservation.org or by surface mail. If the claimant is not satisfied with the

response from the CEPF Executive Director, they may submit the grievance to the World Bank at the local World Bank office.”

Following the guidance above, describe the grievance mechanism that you will use.

The project coordinator will be the first contact person for receiving the grievances. Her details (name: Petra Pop Ristova, email: petra@mkm.mk, address: Kukushka 4A, 1000 Skopje, telephone: +389 77 835 449) along with the contact information of the grantee organization (Milieukontakt Macedonia, address: Kukushka 4A, 1000 Skopje, email: info@mkm.mk, telephone: + 380 2 2460876) the CEPF Regional Implementation Team, the Executive Director and the World Bank local office will be made available to the public and the stakeholders using the abovementioned means. The project coordinator will attempt to resolve the potential issues with the help from the project team, the partner Municipality of Dojran and if necessary, with the CEPF Regional Implementation Team. The project coordinator has the obligation to communicate all grievances with the CEPF Regional Implementation Team and the CEPF Grant Director within 15 days. In a case of failed resolve, the issue must be passed along to the CEPF and the World Bank. As suggested, the following text will be included in the grievance mechanism: “We will share all grievances – and a proposed response – with the Regional Implementation Team and the CEPF Grant Director within 15 days. If the claimant is not satisfied following the response, they may submit the grievance directly to the CEPF Executive Director at cepfexecutive@conservation.org or by surface mail. If the claimant is not satisfied with the response from the CEPF Executive Director, they may submit the grievance to the World Bank at the local World Bank office.” The proposed grievance mechanism will be made publically at the Municipality of Dojran, as agreed with the CEPF team.