

**Comments to the Environmental Impact Assessment for the Project: Restoration of the River Sateska and Rerouting of the River to its Natural Corridor<sup>1</sup> (Submitted 17/3/2021)**

Rerouting a river is a serious enterprise with a wide range of potential consequences both for people and the non-human world. Although Ohrid SOS supports the basic idea to return the River Sateska to its original path and believes the overall legacy of the project will be positive for humans and nature alike, a high-quality Environmental Impact Assessment (EIA) is an essential pre-requisite before any activity takes place.

The present document falls dramatically below the standards required. It contains very little context-specific analysis and does not come anywhere close to a satisfactory level of evaluation for water-based flora and fauna, especially during the operational phase of the project. The authors do not seem to understand that completing such an assessment requires critical thought, not just a compilation of materials from other sources.

As a result of the document's low quality, when we should be moving forward with an important project that shows excellent promise of improving the ecological conditions of South West Macedonia, we are instead forced to recommend for the EIA to be entirely rewritten with a different lead author and more complete team of experts to inform its conclusions. This is a waste of precious time.

Moreover, it is disturbing to note that this is one of the first EIAs to reach public consultation since Recommendation No. 211 (2021) of the Bern Standing Committee required the Republic of Macedonia to strengthen the process for all forms of impact assessments in legislation, which implies an urgent need for improvements in standards. It is further noteworthy that the Sateska project is occurring under the auspices of the UNDP. Far better would be expected for an organization of this stature.

An overview of its numerous weaknesses is given here:

**COPY/PASTE:** Large parts of the assessment, very likely more than 50%, are simply copied from other documents without proper referencing. Whole sections are almost word-for-word identical to other reports that were compiled for various different purposes, none of them river restoration. These include, but are presumably not limited to the following:

- [LEAP Debrca 2019-2025](#);
- The Municipality of Struga's [Strategy for Sustainable Development 2006-2011](#);
- Environmental Impact Assessments from Maneko Solutions; and
- The *Management Plan for the Natural and Cultural Heritage of the Ohrid Region 2020-2029*.

These may not even be the original sources as their contents could well have been copied blindly from elsewhere. While some of them have the same lead author as the Sateska EIA, almost none of the information has been integrated with the River Sateska context and much is simply irrelevant to

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<sup>1</sup> This is an English language version of comments that were submitted by Ohrid SOS as part of an official public consultation procedure to the Republic of Macedonia's Ministry of Environment and Physical Planning, which later claimed not to have received them. It is not a direct translation.

the restoration project. Thus, the EIA gives the appearance that genuine evaluation has been conducted when that is very clearly not the case.

**EXPERTISE AND CONSULTED LITERATURE:** The team conducting the EIA lacks relevant expertise, especially in hydrology and aquatic ecosystems. Although the document claims that experts have been consulted, this does not seem to have been very thoroughly conducted as vital aspects such as ichthyofauna and groundwater recharge are not adequately discussed. In addition, the authors show no real evidence of having studied similar projects in other places in order to understand where negative or sub-optimum environmental impacts may emerge.

The bibliography reflects the poverty of research and contains very little consulted literature beyond the project documents. References in copied sections have not been included.

**PROJECT DOCUMENTATION:** The EIA should be accompanied with the full project documentation so that oversights can be identified not only by the authors, but also by the public during the consultation process.

**ALTERNATIVES (Section 4):** In the section on alternatives, it is evident that cost is a factor in the choice of solution. Therefore, an estimation of the cost of each choice ought to be included in the EIA in order that the final selection can be adequately assessed from all perspectives.

**PROVISION OF DATA:** Key data are not provided to the reader in the EIA. This means that some of the authors' claims cannot be verified, a serious issue since most of the document has been ripped out of other sources, implying a lack of genuine analysis.

Among the data that should be available in the report are the daily flow rates along with weather, especially rainfall. This could be placed in publicly available appendixes. The graphs referred to on page 46 should be provided in the main body of the EIA too.

On the subject of page 46, although the EIA compares the temporal extent of flows between  $10\text{m}^3/\text{second}$  and  $15\text{m}^3/\text{second}$  with monthly averages (without, as already mentioned, providing the reader with the actual data), the precise frequency with which the flow rate exceeds  $15\text{m}^3/\text{second}$  ought to be stated. This information on frequency should be accompanied by details of magnitude too, not least since the Sateska can be expected to experience wide flow fluctuations.

**OUT-OF-DATE DATA:** Even the data used by the authors of the EIA are not sufficiently recent, which is problematic for parameters that are likely to affect the functioning of the river once it has been rerouted. The erosion map is from 1993 (page 69). We presume the sediment map is more recent, but it is not referenced or dated (picture 12, page 41). The forestry figures for the Municipality of Struga match those from a document produced in [2007](#). Land use percentages from the Municipality of Debrca (page 108) were made in the same year. The quantifications of sediment entering Lake Ohrid and their contribution to nutrient inflows in the section on River Sateska water quality (page

67) seem to be from research conducted by Jordanoski *et al.* twenty years ago. Even monthly flow data seems to stop at 2010 (page 46). Climate change projections source back to at least [2008](#).

**SPECIFICITY OF DATA:** Although the EIA gives the impression of having considered factors such as tree coverage, in fact there is insufficient detail for relevant conclusions to be drawn in regard to the River Sateska. For example, the report (page 111) copies forestry details from the Municipality of Struga's [Strategy for Sustainable Development 2006-2011](#), yet this widescale data offers no usable information about trees in the Sateska watershed. Therefore, it gives the illusion that this factor has been considered for Struga, when, practically speaking, it has not. This is strange because more recent, detailed and Sateska-relevant information appears to have been available to the authors of the [Lake Ohrid Watershed Management Plan](#).

Similar issues arise with climate both present and projected (page 56-58).

This is juxtaposed with ridiculous resolution on matters that will contribute to the Sateska restoration project minimally if at all, such as the capacity for live-in school students in the Municipality of Struga or the precise number of канти (за њубре) in Debrca villages (page 72). The reason for fine-level detail on these topics is, of course, because it has been cut and pasted from elsewhere.

**POTENTIAL BIAS IN DATA:** A concern relates to the period during which flow data was gathered, i.e. 1967 to 2010 (page 46). On the one hand, it is not clear why data post-2010 has been excluded. On the other, unless the trend has been considered, there is a risk that the figures from the earlier part of the data set will skew the conclusions in the climate change era. This risk increases since neither the accuracy of the data being used to inform climate change projections nor the relationship between weather conditions and flow rates seem to have been properly analyzed for accuracy by the EIA authors.

**LAND-USE CHANGE & HISTORY OF THE SATESKA:** The general conclusion appears to be that simply pushing the Sateska back to its previous corridor will be a seamless exchange of one pathway for another. Unfortunately, the difference between the current land-use and landscape compared with that of the pre-1960s has not been analyzed by the EIA. Changes have not been negligible: Large areas of wetland have since been extirpated.

While it is understandable that information about the river maybe sparse prior to the 1960s, some attempt should be made to describe its behavior during that period and to understand how that might differ in the present day. It should be remembered that we are not returning precisely the same river as the one that was artificially removed several decades ago.

**REFERENCE RIVER/DESIRED CONDITIONS:** At no point is the desired status of the River Sateska's flora, fauna, and ecotones ever described. No existing natural river is provided as a model either. At least, there is no evidence of such an approach in the EIA, which does not identify this lack of direction as a potential weakness.

The impression is therefore one of oversimplification. It seems to be expected that a healthy ecosystem will automatically spring up from the river's return. As a result, measures that could enhance the rerouting project in terms of flood mitigation and habitat restoration, particularly for wetlands and aquatic environments, are not elaborated by the EIA authors.

**CAPACITY:** To our understanding, the capacity of the natural corridor will be 15m<sup>3</sup>/second once the River Sateska has been returned to its original path. This appears to contrast with the vision put forward in the [Lake Ohrid Watershed Management Plan](#), which, as quoted in the EIA (page 24), envisaged the corridor to hold 100m<sup>3</sup>/second. An explanation should be provided for why there is such a big discrepancy, especially since the 15m<sup>3</sup>/second capacity will presumably allow 165m<sup>3</sup>/second to proceed via the old corridor in Q50-year flow events.

With many rivers, the percentage of sediment transported during high water events is extremely large in comparison to the base flow. Therefore, a diversion designed only for average flow conditions may still allow very significant volumes of pollution to proceed to Lake Ohrid. It should be detailed not only the amount of water that will travel towards the lake once the Sateska has been diverted, but also the amount of sediment.

To emphasize the importance of this, one of the key benefits that could be delivered to Lake Ohrid by the diversion of the Sateska is rehabilitation of trout spawning grounds ([Monetti et al.](#), 2020). However, this may not be achieved if these areas experience serious periodic disturbance.

**CLIMATE CRISIS:** Despite its massive relevance for understanding the various environmental impacts of re-pathing the River Sateska, large parts of the section on climate change are almost word-for-word the same as assessments conducted for [other projects](#) in other parts of Macedonia.

As a result of the cut/paste approach, the information provided is relevant by turns to the North West region or Macedonia as a whole, not the Sateska watershed. Moreover, as the conclusions are not properly sourced, including in other documents where they feature, verifying the solidity of the conclusions is more difficult than it should be.

As far as we can see, key statements and data from modelling originate with the 2008 [Second National Plan for Climate Change](#) (see Table 1 and surrounding text). Minor changes in phrasing are evidenced in some places; no changes at all in others. One of the tables (6) has been mislabelled in the EIA. It claims to be for temperature when it is in fact displaying projections for percentage changes in rainfall from the abovementioned Second National Plan ([Table 4.1.2.3](#)). The same mistake appears in an EIA by the same lead author dated January 2018 ([Table 13](#)). While it is normal to use data in more than one report, the problem is that such information is being transported thoughtlessly from EIA to EIA without genuine, context-specific assessment.

Errors aside, no analysis is made of whether this 16-year-old modelling is actually providing an accurate picture of the climate that Macedonia is experiencing at present. No comparison with actual conditions is made. Unless current climate projections are precisely the same as in 2008, nor has any attempt been made to update the predictions with data and knowledge from the intervening period.

Meanwhile, other sources which contain modelling for the Sateska region forecast increased frequency of severe rainfall in the river's watershed ([Ѓурѓевиќ, 2020](#), picture 13). These do not seem to have been discussed in the EIA and one wonders whether they have been incorporated appropriately in the project development.

**EARTHQUAKES:** On the surface, seismic activity seems to be discussed in the EIA (page 61). However, closer inspection indicates that the section is identical to the Municipality of Debrca website's [short summary of natural characteristics](#), including recommendations.

For this section to be meaningful, the authors have to explain how it is relevant to the restoration of the Sateska and precisely which measures should be put in place to ensure the integrity of the related infrastructure.

**BIODIVERSITY (SECTION 5.11.2):** The level of attention that has been paid to flora and fauna in the EIA is shockingly poor. Aside from amphibians, reptiles and riverside plants, biodiversity has been almost entirely ignored.

The most obvious oversight is fish. Even though the Sateska is in the Southeast Adriatic Drainages ecoregion, which is characterized by high piscine endemism and species richness (Hales, 2015), the EIA offers no identification of relevant fish taxa; no mitigation for disturbance; no habitat connectivity measures; no recognition of the role that fish play in riverine ecosystems; and no thought to aspects such as how to revive/secure spawning areas. This is despite the river containing relatively healthy fish populations, which may be impacted by the sediment dam, including trout ([Monetti et al., 2020](#)). Another aspect requiring assessment and mitigation regarding trout is the disturbance to spawning grounds that will be caused by periodic overflow diverted to the north of Lake Ohrid. This may reduce the benefits of the Sateska diversion if it occurs too frequently for such habitats to rehabilitate.

A similar dearth of evaluation manifests for aquatic invertebrates, despite the massive role that they can play in river processes and their own heightened rates of endemism in the Ohrid-Prespa Region. Nothing on birds or mammals is in evidence either; butterflies do not feature despite the presence of a Prime Butterfly Area where the river will newly flow; and the List of Protected Species for the Republic of Macedonia is not consulted. No attempt has been made to identify keystone species even though these may help with the restoration process. Again, this contrasts unfavorably with the space dedicated in the EIA to off-topic matters such as the precise number of people (811) working in education in the Municipality of Struga (presumably in 2007, given the similarity of the EIA's wording to the [Strategy for Sustainable Tourism](#) dated that year).

Without thinking about the kinds of species that currently live in the River Sateska and its environs; those that did inhabit it prior to its artificial routing in the 60s; or those that are likely to appear in it once it has returned to its original path, balanced recovery of the ecosystem may well take longer than would otherwise be the case. There may also be damage to rare or endemic flora and fauna that could have been predicted or mitigated. Since species themselves influence river processes (Moore, [2006](#); Boedeltje et al., [2019](#); Mason and Sanders, [2021](#); Sanders et al., [2021](#)), minimizing negative and maximizing positive impacts may depend on optimizing ecosystem recovery to ensure appropriate balance.

To this end, a far more detailed, ecosystem-oriented action plan is required with indicators that are focused on different species groups, especially between Volino and the Crn Drim. It ought to be written by members of Hydrobiological Institute—Ohrid. At present, the species which live or will live in the River Sateska are not really being thought about at all.

**REPTILES/AMPHIBIANS (page 91):** It is very positive to see some genuine research on the herpetofauna, assuming that it was not repurposed from elsewhere. The extra details about migration routes and chorotypes are welcome. The SEA would benefit from explaining why the investigation was conducted on the particular dates chosen; why periods of movement such as spring/autumn were not also monitored; and which times of day research was conducted. A description of habitats where species were found would also be useful to inform decision-making/habitat rehabilitation.

Further, greater explanation is needed on why other species categories did not receive the same attention.

**HABITATS MAP:** The inclusion of the habitats map in Picture 31 (page 80) is appreciated. However, the resolution and size are not satisfactory. Rich Fens do not seem to be represented either.

**COMPENSATION:** On page 139, the EIA lazily claims that the new river path will compensate for the majority of species that are harmed by losing the present habitat in the artificial corridor from Volino to Lake Ohrid. It does this despite not having made any attempt to study the aquatic living world of the Sateska. It does not provide any information on exactly which species will be compensated by the change and which will not.

Moreover, its conclusions do not reflect the fact that the restored river will have very different conditions to its present path. There will be significantly more meanders. Factors such as flow, depth and sediment range will be very different, which will in turn affect other parameters such as oxygenation and temperature. New barriers to movement may affect certain species.

We fully expect and hope that there will be a biodiversity gain, but it is not so simple as to say that moving the river from one place to another will seamlessly compensate those species that live in its current location. It is the job of the EIA to identify any that may lose out and put in place measures to support them if necessary.

**SEDIMENTS:** The proposal for construction of a sediment barrier (таложник) is understood. However, a healthy fluvial system requires passage of some sediment ([Wampler, 2012](#)), which is necessary for in-river habitat creation as well as the redistribution of minerals and nutrients. Such sediment may require a mix of particle sizes.

The EIA has not evaluated whether/how an appropriate sediment mix will reach the downstream portion of the River Sateska between Volino and the Crn Drim. Nor does it define any specific monitoring procedure (with carefully chosen indicators) to ascertain whether the sediments that reach the lower part of the Sateska are within desired parameters.

**UPPER RIVER:** The parts of the river above the diversion have barely been considered by the EIA, even though they are presently the most ecologically healthy ([Monetti et al., 2020](#)). Although no project work will occur in these locations, they can nonetheless expect to see some change as a result of the operational phase. Maximizing the benefit they receive will require ensuring habitat connectivity and monitoring their ecological condition carefully.

**GROUNDWATERS:** As mentioned previously, groundwaters do not seem to have been sufficiently considered by the EIA, particularly between Volino and the Crn Drim. The samples taken (page 59) do not reveal much about groundwater parameters in this area. Naturally, there will be some recharge when the Sateska returns to its original corridor and the knock-on effects need to be properly considered.

**SOILS (page 131):** The EIA appears to conclude that the operational phase of the River Sateska restoration will have no major impact on soils. Clearly, however, when a river reroutes, there will be soil movements. New materials will accrue at certain places; some soils will erode. There will be saturation of new areas, intermittent or permanent. New species will infiltrate the soil and chemical processes/cycles are likely to change.

The patterns that emerge will not precisely match those of the Sateska before it was rerouted as the ecosystem, landscape use, and the surrounding climate have changed in the interim period. Notably, wetlands in the vicinity no longer exist. The river bed may have been infiltrated with pollutants that will now be overlaid with water. It is the responsibility of the Environmental Impact Assessment to identify influences that will result from the return of the Sateska and also to advise of how to mitigate their negatives/accelerate their positives.

Recommendations for the operative phase are also necessarily different from the construction phase as rehabilitation of vegetation, particularly wetlands, is necessary to provide habitat, reduce erosion, mediate light, deliver landscape heterogeneity, enable ecological connections, and facilitate exchange between terrestrial and aquatic ecosystems.

**SEDIMENT-CAPTURING DAM:** The pool that will accumulate behind the sediment-capturing dam risks displaying low water-quality parameters as it will experience a slower water flow and accumulate eroded materials. It could, to some degree, create an ecological barrier in the middle of the Sateska if it is not managed correctly. Again, specific indicators need to be identified in the EIA to ensure that the removal of sediment is conducted frequently enough to ensure reasonable water quality. At the same time, mitigation to secure habitat connectivity must be described.

**DYNAMISM:** Rivers are particularly dynamic systems and require space for frequent adaptation in flow within parameters that are safe and acceptable for surrounding communities. There is no evidence that any thought has been given to whether/how dynamism has been incorporated into the design for the Sateska restoration.

**WETLANDS:** In order to mitigate impact from periodic high waters; ensure connectivity between terrestrial and aquatic ecosystems; improve water quality; discourage erosion; facilitate an ecological corridor along the river banks; and provide a home for birds and other animals, wetland restoration should be undertaken alongside the River Sateska once it has been returned to its original pathway.

This is especially important given the land-use changes that have occurred since the 1960s, which are likely to result in more nutrient-rich run-off from agricultural lands, not to mention pesticides, fungicides and herbicides. It would align with advice for the Natural and Cultural Heritage of the Ohrid Region World Heritage Site from the IUCN and ICOMOS (2019).

Strangely, wetlands are barely mentioned in the EIA whatsoever and the action plan is inadequate to accelerate/secure their generation. Other restoration projects have shown that such habitats do not always automatically regenerate in a healthy manner within a short period of time. Indeed, blueprints may be required from other regional wetlands to inform the restoration ([Apostolova et al.](#), 2016). Evidently, the single-sentence conclusion on page 138 that the mere presence of water will stimulate vegetation in the long-term is not adequate for optimum riverine restoration.

**EUNIS HABITAT D4.1:** The EIA claims that the Rich Fens including Eutrophic Tall-Herb Fens and Calcareous Flushes and Soaks (EUNIS D4.1) near to the River Sateska are of very low significance in terms of biodiversity. However, the [EUNIS description itself](#) states, “Rich fens are exceptionally endowed with spectacular, specialised, strictly restricted species. They are among the habitats that have undergone the most serious decline. They are essentially extinct in several regions and gravely endangered in much of central and western Europe.”

While the EIA explains that Sateska fens are somewhat overgrown with weeds, this ought not be a reason to totally discount the habitat, especially since wetlands of all forms have undergone major decline in the Republic of Macedonia. Furthermore, Rich Fens seem to be featured in [Revised Annex 1](#) from Resolution 4 (1996) of the Bern Convention too.

Since they exist to a sufficient extent to trigger classification in the Sateska vicinity, the focus of the EIA ought to be on how to ensure their healthy continuation, not to dismiss them as insignificant.

**RATIOS OF PHOSPHORUS/NITROGEN:** Other parts of the world have reported unexpected distortions to ecosystems after the ratio of phosphorus to nitrogen has changed following pollution control interventions. This has sometimes caused the empowerment of non-native species through complex pathways that would be difficult to fully predict (Gilbert, [2012](#)). Therefore, careful, regular monitoring of the species composition in the area of Lake Ohrid that has been affected by the Sateska ought to follow its return to the original corridor. The Hydrobiological Institute—Ohrid should be tasked with overseeing the monitoring.

**WATER BALANCE:** The River Sateska contributes 54% of the overland inflow to Lake Ohrid ([Monetti et al.](#), 2020). Although this amounts to a relatively small percentage of the overall water budget, it nonetheless will be a loss when the river is rerouted. The EIA should examine how/whether the



inflow reduction will influence aspects such as currents, residence time, water balance, and flow. Such a discussion can inform future management of Lake Ohrid and possibly the operation of the hydroelectric dams.

**OVERFLOW TO LAKE OHRID:** The EIA should provide more specific advice about the condition in which the overflow area, i.e. the contemporary artificial channel to Lake Ohrid, must be kept and how it is to be kept this way, including a monitoring regime. If not, there is a risk that unsuitable land uses, dumping, and pollution will occur, which will impact Lake Ohrid during high-water events.

**LAKE OHRID SEDIMENTS:** Whatever remediation work (if any) takes place near or in Lake Ohrid, care must be taken not to unnecessarily disturb sediments, as this will kick up pollutants and nutrients. True, the effect will be temporary and minor, but it is still better avoided if possible.

**MONITORING/INDICATORS:** The monitoring and indicators are not adapted for the operational phase of the river re-route, especially regarding habitats and biodiversity. The ecological composition of the river ought to be the subject of monitoring at various points throughout its length, but especially in the section from Volino to the River Crn Drim. This should be compared to desired ecological conditions elaborated by the Hydrobiological Institute—Ohrid.

Bioindicators of various species kinds may facilitate this process, not just amphibians and reptiles, but other categories such as fish and macroinvertebrates. Species should also inform monitoring at the location where the Sateska currently enters Lake Ohrid. Particularly, the composition of phytoplankton and wider in-lake flora communities should be followed carefully so that mitigation can be undertaken if unforeseen changes occur.

At the same time, the new river banks will also require regular inspection at least until they have established stability comparable to a reference healthy river. Finally, specific physical and chemical indicators should be explicitly defined by the EIA and sample locations/frequencies identified, including points downstream of the таложник, to ensure that water quality and flow are conducive to the restoration of a balanced ecosystem.

**VARIOUS:** Other oversights in this EIA include

- a lack of recognition of the cumulative impacts that can arise from forestry, agriculture and dam operation in combination with the reroute (Section 7.3);
- the dearth of recommendations for/discussion of flood mitigation beyond the details from the project documentation;
- the recognition that new opportunities for irrigation will benefit farmers (page 141) without simultaneous recognition that this might need to be monitored and controlled;
- the brevity of the discussion of impact on waters (Section 7.4), especially during the operational phase; and
- the ridiculousness of advising on aspects like workers picking mushrooms (page 138) while ignoring the entire aspect of the in-river ecosystem from Volino to the Crn Drim.

**LEGACY:** The restoration of the River Sateska is a daring project of huge potential. Monitoring and documenting the process is therefore of great value for any future river recovery that might be undertaken elsewhere in Macedonia and the Balkans. If studied and followed properly, there is an opportunity for the local development of highly specific knowledge that can be leveraged elsewhere. This can only be achieved if the Sateska is deeply assessed and monitored both pre- and post-return to its original corridor.

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