Expert Evaluation of the Environmental Report concerning the Slovenian hydropower plant Hrastje-Mota on the Mura River – with a focus on the impacts on fish species listed in the European Habitats Directive

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1 Summary and Conclusions

Evaluation of the Environmental Report (ER) assessment of the Hrastje-Mota hydropower plant´s impact on the Natura 2000 area on the Mura River in Slovenia (SI3000215) and its species reveals major deficits, misconceptions and legal conflicts.

The Environmental Report (ER):

- **is characterized by large gaps and weaknesses concerning data and predictions that are too significant to allow finalization.**

- **understimates or denies likely transboundary effects on key species in Natura 2000 sites along the Mura River in Austria (SAC AT2213000), Croatia (SAC HR2000364) and Hungary (SAC HUBF20043 & HUB20044).**

- **wholly ignores assessment of the cumulative effects of the energy exploitation plan for the entire Mura River in Slovenia with up to 8 HPPs as required under SEA Directive 2001/42/EC. This includes potential transboundary effects on European Habitat Directive species as well as planned restoration efforts of migratory species such as sturgeons (*Acipenser* spp.).**

- **clearly underestimates impacts of the project on 8 of 12 key species, all of which are listed in the European Habitat Directive; and, clearly underestimates the conflicts that these impacts have with the Slovenian Natura 2000 management plan.**

- **ignores the conflict with EU funded restoration measures, which have been implemented in recent years in Natura 2000 sites on the Mura in Austria and Slovenia.**

- **proposes measures, which are grossly inadequate to mitigate foreseen negative effects on European Habitats Directive listed species and their habitats.**

- **does not properly or sufficiently describe and assess the functionality of the planned bypass channel and associated measures to accommodate fish passage for resident and migratory species; it fully ignores downstream migration, which would lead to significant mortality in a majority of the species present.**

- **neglects appropriate assessment of downstream effects of the planned dam.**

- **fails to assess potential impacts on European Habitat Directive species, such as *Hucho hucho*, *Barbus sp.*, *Rutilus virgo* and *Acipenser* spp.**

- **inadequately assesses the consequences of proposed sediment flushing and changed sediment regime on key species.**

2 Aim of this Report

2.1 Main goal

The primary aim of this critical analysis is to evaluate statements of the **environmental report** (*Okoljsko poročilo za DPN za HE Hrastje-Mota na Muri; prepared by VGB Maribor d.o.o., št. proj. 3421/13, October 2016, supplemented in April 2017, Maribor*) and **Appropriate Assessment for Natura 2000** [*Dodatek za varovana območja - Presoja sprejemljivosti DPN HE Hrastje-Mota na Muri na varovana (Natura 2000 in zavarovana) območja; prepared by VGB Maribor d.o.o. and CKFF, št. proj. 3421/13-D, October 2016, supplemented in April 2017, Maribor*] on the planned Hrastje-Mota hydropower plant project on the Mura River in Slovenia. The analysis focuses on assessing statements and conclusions concerning impacts to fish species listed in Annex II, IV or V of the European Habitats Directive (92/43/EEC) and found to occur in the Natura 2000 area SI3000215 or AT2213000 (in Austria) or other potentially affected Natura 2000 areas on the Mura River in Croatia (SAC HR2000364) and Hungary (SAC HUBF20043) and (SAC HUB20044).

2.2 Synergy with additional Legislation

The report also considers potential legal synergy or overlap between the European Habitats Directive (EHD) and the EU Water Framework Directive (WFD) limited to the potential implementation of the Exemption Clause (WFD Article 4.7) or Articles 6(3) & 6(4) of the EHD. The report will also consider additional requirements understood under SEA Directive 2001/42/EC.

3 Primary Documentation and Legislation

The primary documentation supplied to the author, and used as a basis of this analysis is listed below. Analysis and statements are further based on scientific or technical literature listed under references at the end of this report, as well as fish monitoring data (GZÜV) from the Austrian Fish Database (Sasano et al 2009).

Appropriate Assessment for Natura 2000 – Dodatek za varovana območja - Presoja sprejemljivosti DPN HE Hrastje-Mota na Muri na varovana (Natura 2000 in zavarovana) območja; prepared by VGB Maribor d.o.o. and CKFF, št. proj. 3421/13-D, October 2016, supplemented in April 2017, Maribor.

Environmental Report – Okoljsko poročilo za DPN za HE Hrastje-Mota na Muri; prepared by VGB Maribor d.o.o., št. proj. 3421/13, October 2016, supplemented in April 2017, Maribor.

ESG 15 (2006) – Managementplan Natura 2000 – Steierische Grenzmur mit Gamlitzbach und Gnasbach. Amt der Steiermärkischen Landesregierung, Fachabteilung 13C Naturschutz, Karmeliterplatz 2, A-8010 Graz.

(EHD) EUROPEAN HABITATS DIRECTIVE – Council Directive 92/43/EEC – adopted 21 May 1992 - http://ec.europa.eu/environment/nature/legislation/habitatsdirective/index_en.htm.

(HN_2016) HYDROPOWER AND NATURA 2000 – Good Practice Guide – Revised Draft September 2016 – prepared for the European Union with the assistance of N2K GROUP EEIG – Ecosystems LTD, Brussels and Beleco, Czech Republic. 85 pp.

Gewässerzustandsüberwachung in Österreich gemäß GZÜV, BGBl.479/2006 i.d.g.F; BMLFUW IV/3 Nationale und internationale Wasserwirtschaft; Amt der Steiermärkischen Landesregierung; Abt. 15 Energie, Wohnbau, Technik; Referat Gewässeraufsicht und Gewässerschutz.

LINKS BETEWEEN THE WATER FRAMEWORK DIRECTIVE (WFD 2000/60/EC) AND NATURE DIRECTIVES (Birds Directive 2009/147/EC and Habitats Directive 92/43(EEC) – Frequently Asked Questions – December 2011 – prepared by the Directorate-General for Environment of the European Commission. 34 pp.

Podgornik S., Jenič A., Pliberšek K., Govedič M., Čarf M., Cokan B., Ramšak L. 2015. HE Hrastje Mota: Ihtiološke raziskave reke Mure. Poročilo o projektni nalogi. Zavod za ribištvo Slovenije. Spodnje Gameljne. 235 s.

PUN 2000 – Program upravljanja območij Natura 2000 / Management Plan for SAC Sl3000215

Susano B, Schotzko N, Haunschmid R, Jagsch A (2009). Die Fischdatenbank Austria (FDA) Östserreichs Fischerei 62, 12-23.

SUSTAINABLE HYDROPOWER DEVELOPMENT IN THE DANUBE BASIN – GUIDING

PRINCIPLES – International Commission for the Protection of the Danube River – 40 pp (https://www.icpdr.org/flowpaper/viewer/default/files/nodes/documents/icpdr_hydropower_final.pdf).

4 Brief Description of the Study Area

The project area lies completely in the upper portion of the Natura 2000 area (SAC) Mura SI3000215, which covers approximately 10.000 ha. of lowland river landscape from Gornja Radgona (Radkersberg) to the Croatian border (Fig. 1). The Austrian SAC AT2213000 lies adjacent to SI3000215 upstream covering just over 2000 ha. Downstream of the Croatian border the Mura flows along the border region of Slovenia and Croatia and SAC SI3000215 transitions into SAC HR2000364 in Croatia, and further on into SAC HUBF20043 and SAC HUB20044 in Hungary, which reaches to the mouth with the Drava River. Where the Mura meets the Drava, the Croatian SAC HR5000014 and Hungarian SAC HUDD20054 of the upper Drava begins. Downstream of these areas, the river Drava continues to flow freely and is assigned with additional SAC protection areas and various parks to the confluence with the Danube. **This network of protection areas along the longest free-flowing lowland river system in Europe forms the headwaters of, and contributes significantly to, the planned Transboundary UNESCO Biosphere Reserve "Mura-Drava-Danube between Austria, Slovenia, Croatia, Hungary and Serbia** (http://www.amazon-of-europe.com).

The primary value of SAC SI3000215 is that it is a large complex river system with all corresponding habitat types, some natural dynamics and a mosaic of different habitat types of a complete lowland river system (http://natura2000.eea.europa.eu) forming an integral part of the free flowing Mura-Drava-Danube river system and connected Natura 2000 sites in neighboring countries. The protection area has a management plan complete with conservation objectives for 12 fish species exists (http://www.natura2000.si/index.php?id=330&L=1). For the adjoining SAC AT2213000 in Austria, a total of 14 Habitat Directive fish species are listed. Management objectives include raising the groundwater level, conserving the near-natural flow sections, restoring some river reaches, planting woody riparian vegetation and prohibiting water extraction (ESG 15 2006). Some of these measures have already been promoted with EU-funded renaturation measures carried out in the framework of

EU-financed projects (e.g. LIFE06 NAT/SI/000066, 2006-2011, € 1.9 Million; INTERREG IIIA, 2002-2008, € 3.8 Million) and the most recent 5 km long river bed restoration project (ETZ DRA-MUR-CI, 2009-2013 €3.5 Million, see www.dramurici.eu).

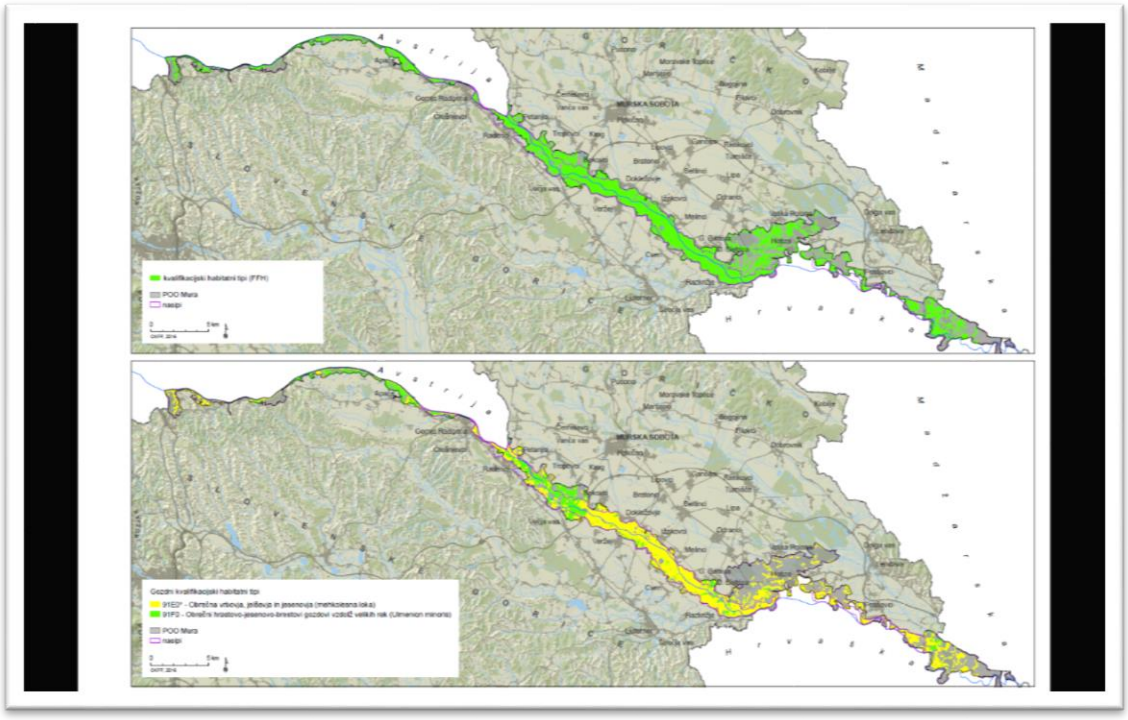

Figure 1. SAC SI3000215 on the Mura River from Gornja Radgona to the Croatian border. The Natura 2000 area covers over 10,000 hectares of lowland river landscape.

5 Brief Description of the Project

The proposed project (shown as three different variants) is a low-head (ca. 9-10 m) run-of-the-river hydropower plant near the village of Hrastje-Mota, Slovenia ca. 6 km southeast of the Austrian-Slovenian border (Fig 2). The three variants differing in minor dimensions concerning the exact placement of the weir, the length of the reservoir and the corresponding length of the planned fish bypass channel. **In all variants the uppermost head of the reservoir will reach back to approximately the Austrian border and thus potentially affect conservation goals of SAC AT2213000.** The ER variant I is stated as the preferred variant, with a proposed fish bypass channel of approximately 6 km in length with the fish passage entry some 4-500 meters below the weir and the exit in the head of the reservoir. It is not planned to have the fish bypass connect with several tributaries that now enter Mura in the project area, but rather, to route them along the reservoir to enter the Mura below the dam. It is proposed that sediment management will involve water level draw down or flushing (see 8.1 & 8.2). Below the dam, it is proposed to lower (dredge) the river bed several

meters deep, across a river stretch a bit more than two kilometers long.

Figure 2. Variant 1 of the proposed hydroelectric power plant Hrastje-Mota on the uppermost Slovenia Mura. This variant depicts a 6.17 km long fish bypass channel with a yet-to-be defined discharge.

6 Deficits of the Impact Assessment on the Natura 2000 Area and its Species

The Natura 2000 protection area of the Slovenian Mura River (SI3000215) is associated with 12 qualifying fish species, each with defined conservation objectives according to the site management plan (PUN 2000). There are additional species listed in the EHD that should have also been evaluated in the ER for potential impacts (e.g *Acipenser ruthenus*, *Acipenser nuvidentris*, *Rutilus virgo*, *Barbus* sp. & *Hucho hucho*), but this report will primarily discuss those species listed both in the management plan and in the ER. Using the original nomenclature these are: 1) *Aspius aspius* (1130), 2) *Cobitis taenia* (1149), 3) *Gobio albipinnatus* (1124), 4) *Gobio kessleri* (2511), 5) *Gobio uranoscopus* (1122),

6) *Gymnocephalus schraetzer* (1157), 7) *Misgurnus fossilis* (1145), 8) *Pelecus cultratus* (2522), 9)

Umbra krameri (2011). 10) *Zingel streber* (1160), 11) *Zingel zingel* (1159), 12) *Rhodeus sericeus amarus* (1134). Due to changes in taxonomic usage, assignment or systematics, some nomenclatural changes are noted below. For each species, there are between 3 and 7 specific conservation objectives associated with the designation and management of SI3000215. For most species, at least one of these objectives is associated with a yet-to-be determined parameter, such as the size of the population. For all species, conserving the size of the habitat is an explicit management objective. For several species, specific restoration measures make up the primary conservation objectives.

6.1 – 1130 *Aspius aspius* (Linneaus 1758.) – Asp (slov. Bolen)

– Listed in appendix II & V in the EHD. The Asp is a large river piscivore that requires fast flowing habitats for spawning and undergoes various kinds of population specific or life-stage specific migrations sometimes reaching well over 100 km in distance (Frederich, 2003; Schiemer & Waidbacher 1992). Although they occur in reservoirs, in such situations they are considered an obligatory tributary spawner (Říhad et al 2013 and ref. therein). In the Danube, Asp are reported to utilize or require lateral connectivity between the main river channel and backwater habitats (Schiemer & Spindler 1989). This could be of particular importance in understanding both the required conservation measures in regulated rivers as well as the impacts of hydropower development.

The species was recorded in low numbers throughout SI3000215 (Pogornik *et al* 2015). **Asp were also recorded in SAC AT2213000 (Zauner *et al* 2000) and in recent years with some regularity during routine monitoring in AT2213000 (GZÜV)**. The species was also recorded along the border with SAC HR2000364 (Pogornik *et al* 2015). The population status for Asp under Art 17 is not listed for any European member (as of 31.07.2017). All catches of Asp in SI3000215 revealed strong differences between spring and fall, even for the lowermost sites where the highest densities were found (Pogornik et al 2015). **It should be assumed that migration is significant through the study area, agreeing with Říhad et al (2013) reporting movements well over 100 km**. While the size of the population and habitat remains to be determined, as well as the recording of spawning grounds, management objectives for SI3000215 include conserving the size of the species habitat, conserving species-specific habitat structures and processes with respect to passage, water volume, natural hydrology and "bays" (presumably meaning backwater or oxbow habitats).

It is not entirely clear how the environmental report (ER) can determine that the population

size and habitat structures can be maintained for a species for which these characteristics remain to be determined. The ER speculates about the nearest spawning habitat as well as habitat for young fish existing in a renaturation area in Mele, but there is no citation to support this claim. If there is no adequate juvenile habitat in the immediate project area the appearance of this species both in SI3000215 as well as AT2213000 may be dependent on longer distance migration. The ER states that if a constant water level is maintained (see 8.1 & 8.2), that no significant loss of habitat will occur. It is also not clear why an increase in Asp habitat is predicted. Further, an increase in prey (e.g. bleak) is predicted, but this and other potential prey species are already quite abundant and thus obviously not currently a limiting factor for Asp in general, or specifically in SI3000215 or AT2213000. **Thus, no positive effect can occur due to increased prey, when prey abundance is not the cause of a species scarcity.** For other predictions concerning passage, conservation of natural hydrology and sediment transport see 8.1 & 8.2.

In summary, while this species appears to be in a poor status in the project area, in contrast to statements in ER, none of the proposed project variants can offer any improvement to present conditions and more likely will deteriorate present conditions and hinder prospects for achieving management goals for the species overall in SI3000215 as well as AT2213000.

Key deficits of ER: The prediction that the population size and habitat for can be maintained or even increased is totally inappropriate due to data deficiency. Potential transboundary effects of the project on the population of this species in Natura 2000 sites on the Mura in Austria, Croatia and Hungary have not been explicitly assessed (see section 7).

6.2 – 1130 *Cobitis elongatoides* Bacescu & Maier 1969 – Danubian spined loach (slov. navadna nežica)

– The genus is subject to taxonomic changes potentially relevant for conservation due to evolutionary complexity and hybridization (see Bohlen & Ráb 2001) but for the purposes of this report, we will assume that all members of the genus are listed in Annex II of the EHD (Mrakovičić et al 2008) and that the management goals of SI3000215, though originally listed for *C. taenia*, apply to *C. elongatoides*, as *C. taenia* is no longer listed to occur in the Danube basin (Kottelat & Freyhof 2007).

The species is found in a wide variety of habitats but requires relatively fine sediments and aquatic vegetation for spawning. The species is presently found in the study area predominately in tributary

or backwater habitats. Similar to the Asp, the conservation objectives of SI3000215 call for habitat size to be conserved but neither this value nor the size of the population (which should be determined) is officially registered. Furthermore, management objectives for the Danubian spined loach in SI3000215 call for the conservation of species-specific habitat structures and processes including riparian vegetation. However, **the ER predicts that some riparian habitats will disappear, which is a clear conflict with the conservation objectives of SI3000215**. This is also corroborated by the long term data of **Mustafić et al (2003) recording significant habitat loss for the species along the Drava River in Croatia due to hydropower development.** The ER, however, predicts that some backwater habitats will be created within the fish bypass channel. This prediction cannot be assessed, as the fish bypass channel plan lacks sufficient detail to determine if such habitats can or will be created (see also 8.1 & 8.2). Thus, it is not possible to determine with certainty if this prediction can or will be realized. It is not planned to connect the existing tributaries with the fish bypass channel and thus **by design, connectivity (also a conservation objective) among habitats within the floodplain will not be maintained. As conserving passage connectivity is also a management goal of the protection area there is an additional conflict.** The establishment of a reservoir with riparian dams will eliminate present riparian vegetation and alter with a significant level of unpredictability the lateral exchange between both ground- surface water between the main channel and the floodplain. The prediction that habitat for the species will be created in the reservoir is not clear, although fine sediments will accumulate, they must be accompanied by relatively stable water levels (see 8.1 & 8.2) and vegetation. Such stability cannot be provided in such a reservoir due to both the necessity of drawdown during high water and the general need to periodically remove (or flush) accumulated sediments.

The ER neglects to assess impacts for the Danubian stone loach in the downstream area of the project, whereby the riverbed will be dredged and lowered, and gravel will be added. Below the dam, with certainty, river flow velocity will be as high as now and sediments will be correspondingly coarse, at least in the main channel. **This will further isolate riparian habitats and likely result in a lowering of the water table in the riparian zone with certain reduction of habitat for this species.**

In summary, while the current status of the species in the project area is not dependent on the habitat conditions in the main channel, it is not possible to predict the maintenance of habitat size, population size nor habitat structures based on the level of planning provided. Rather, the

prediction of habitat loss in the ER is underestimated as effects downstream of the dam have been neglected. There is additional uncertainty in other potential habitat areas due to the lack of detail and or plausibility (see 8.1. & 8.2) connected with the fish bypass channel.

Key deficits of ER: Prediction of the creation of new habitats for Danubian spined loach in the bypass channel and reservoir are inappropriate and not warranted based on the level of planning provided and false assumptions. Impacts of the project on the species are underestimated due to lack of assessment in the downstream area of the project.

6.3 – 1124 *Romanogobio vladykovi* (Fang, 1943) – Danube whitefin gudgeon – (slov. beloplavuti globoček)

– formally part of *R. albinnatus* (see Naeska 2001, Kottealt & Freyhof 2007). We assume this is a synonym for *Gobio alpinnatus* (Lukasch, 1933) in this region, appearing in Appendix II of the EHD with a habitat size in SI3000215 of 490 ha (PUN 2000). The species is generally dependent or at least found in higher abundance in free-flowing as opposed to dammed river reaches, but is also recorded in reservoirs (*e.g.* in the Drau in Austria, Honsig-Erlenburg et al 1997) and prefers sandy bottom habitat. Povž et al (2005) reported that it was not common in the main stream of the Mura and Drava rivers but rather in its tributaries. In the Bulgarian Danube it was also only found in side channels (Pehlivanov *et al* 2009). **Podgornik et al (2015) reports the species throughout SI3000215 and represents the largest distribution area in Slovenia contained within a Natura 2000 area (see Fig. 76 in Podgornik *et al*. 2015) with the highest densities along natural shoreline habitats. The ER states that the natural morphology of the river with regard to habitat requirements of this species will be maintained. This does not make sense as there will be significant habitat loss in the reservoir, especially the first few 4.5 km where flow velocities will decrease significantly and fine sedimentation increase rapidly with decreasing distance to the weir.** Additionally, valuable point bars, which are not rip-rapped, will be transformed to more uniform and steep banks throughout the reservoir length. Thus, despite widespread occurrence of the species, negative impact on the ecological potential of the species in the project area is expected. **The species also has been sporadically reported between 1999 and 2016 in routine monitoring in AT2213000 (GZÜV) with a high of 51 individuals (31.10.2010; Radkersburg FDA_ID 7389).** This indicates that the species is perhaps more abundant than believed, as optimal sampling conditions may indeed produce higher catches. Thus, a combination of false assumptions have led to an underestimation of the negative impacts of this species both in the project area as well in transboundary protection areas.

Key deficits of ER: Predictions concerning the impact on Danube whitefin gudeon are inappropriate and based on false assumptions. Impacts of the project on the species are underestimated due to lack of assessment in the downstream area of the project. Potential transboundary effects of the project on this species in Natura 2000 sites on the Mura in Austria, Croatia and Hungary have not been explicitly assessed (see Section 7).

6.4 – 1122 *Romanogobio uranoscopus* (Agassiz, 1828) – stone gudgeon – (slov. zvezdogled)

– This species is strongly rheophilic and explicitly requires relatively fast flowing flow velocity for spawning and adult habitat use. However, young require access to lower flow velocities. As for all three gudgeons in the research area, the species is listed in Annex II of the EHD. Thus, this species is particularly vulnerable to damming and **the ER predicts a significant loss of 35 ha in habitat (Variant 1) and designates this as significant (i.e. > 5%) loss for the SAC SI3000215**. Like *R. vladykovi*, **the distribution area in SI3000215 is the largest area in Slovenia found in a Natura 2000 area. The ER prediction is in clear conflict with the explicit goals of the management objectives of protection area SI3000215. *R. uranoscopus* is reported with increasing regularity in monitoring of AT2213000,** appearing in the last 4 samples between 2014 and 2016 (between 3 and 11 individuals), whereas only 4 individuals were recorded between 1991 and 2013 (GZÜV). It is likely that recent EU-funded habitat improvement measures in AT2213000 (INTERREG IIIA – *Maßnahmen Unteres Murtal*) promoted the apparent growth of the species in the area. We assume for management purposes that this represents the same population as in the project area and thus **the prediction of large habitat loss in the ER for SI3000215 will also negatively affect the species in AT2213000.** While Slovenia, with a larger distribution area reports the species under Art 17 (http://bd.eionet.europa.eu/article17/reports2012) in favorable condition, **Austria reports it as unfavourable (U2), with AT2213000 being one of the very last habitats in the country where this species is regularly recorded, thus making SAC AT 2213000 a priority habitat for this species in Austria (Woschitz 2016).**

Key deficits of ER: Transboundary effects of the project on the stone gudgeon in Natura 2000 sites on the Mura in Austria, Croatia and Hungary have not been explicitly assessed. This deficit appears to be particularly meaningful for SAC AT2213000 in Austria as the habitat is one of the very last places where the species is regularly recorded.

6.5 – 2511 *Romanogobio kessleri* (Dybowski, 1862) – sand gudgeon – (slov. keslerjev globoček)

– listed in Annex II of the EBD, the species also requires fast-flowing water and a variety of substrates to complete its life-cycle. Like *R. uranoscopus*, the ER predicts a significant loss of habitat if Var 1 plans are carried out. **The ER however, also reports a non-significant effect on the species in relation to the management goal of maintaining natural sediment transport and hydromorphology. This prediction is not possible under any of the variants proposed. Again, the predictions of the ER are in conflict with the management goals for this species in SI3000215. This habitat loss will also negatively affect the ecological potential and stability of the species in AT2213000.** Like *R. uranoscopus*, *R. kessleri* has been recorded in AT2213000 with up to 24 individuals in regular monitoring (GZÜV) – Under Art 17 Slovenia reports a favorable status for the species as a whole, but the official status in **Austria is currently listed as data deficient**.

Key deficits of ER: Conclusions concerning the maintenance of sediment transport and hydromorphology related to management goals of sand gudgeon are inappropriate and based on false assumptions. Impacts of the project on the species are underestimated due to lack of assessment of the impacts in the downstream area of the project. Further, transboundary effects of the project on the species in Natura 2000 sites on the Mura in Austria, Croatia and Hungary have not been explicitly assessed (see Section 7).

6.6 1145 *Misgurnus fossilis* (Linnaeus 1758) – weather loach (slov. činklja)

– listed in Annex II of the EHD. Even more so than the Danubian spined loach, this species is not dependent on specific habitat conditions of the main channel, but rather floodplain habitats, with a mud bottom and vegetation. Schiemer & Spindler (1989) reported the species present in only disconnected habitats and Harvtich *et al*. (2008) report a strong dependence on substrate with vegetation. Černý et al (2003) reported the complete loss of weather loach following the construction of the Gabčíkovo hydropower scheme in 1992 in a Slovakian flood plain. Like the previous species, the maintenance of habitat structures, in this case namely oxbows, is a management objective for **SI3000215** whereby a habitat size (190 ha) is named but no population size. **The ER predicts the elimination of several habitats directly in the project area, which is in direct conflict with these management goals.** Due to the raising of the water table directly in the reservoir area, the ER predicts, a "possible" increase in habitat area. While a rise in riparian water level in the reservoir area is predictable, this does not necessarily lead to an increase in weather loach habitat as such habitats

develop only over long periods of time, and require periodic connectivity to maintain meta-population stability. **While such potential connectivity is also predicted by the ER, this cannot be insured with certainty. Again, the ER neglects to elaborate on the certain drop in groundwater level that will occur just downstream of the dam.** The argumentation in the ER that movement of fine sediments downstream of the proposed dam will be sufficient to maintain weather loach habitat downstream of the dam conflicts with standard knowledge of scouring below such dam facilities as well as the planned deepening of the main channel. While the ER proposes a number of measures to move sediments through the project area all such measures involve disturbances at regular intervals, which are in stark contrast to, or undermine the ecological function of natural bed-load transport. **In summary, "potential" (meaning potentially but not definitely predicted by the ER) increases in some habitat along the reservoir reach are canceled out by almost certain loss or reduction of habitats downstream of the hydropower plant.** An additional conservation goal with respect to this species is the restoration of oxbow habitats. Although the ER mentions oxbows in connection with the fish bypass channel, it is not clear how such habitats can be maintained (see also discussion on *Umbra* 6.9). **Such restoration measures will likely if not certainly become more difficult to implement if a hydropower scheme is developed due to constraints in reconnecting the main channel with the floodplain as well as constraints in managing groundwater levels. Under Art. 17 Slovenia additionally gives this species an unfavourable status (U1), increasing its responsibility to carry out already determined conservation measures.** The species was not recorded in routine monitoring in AT2213000 making the Slovenian population even more important regionally as well as an importance source for potential recolonization in AT2213000.

Key deficits of ER: Predictions of possible increase in habitats for weather loach in the reservoir are highly speculative and based on questionable assumptions. Impacts of the project on the species are underestimated due to neglecting standard knowledge and inappropriate assessment in the downstream area of the project. Potential transboundary effects on the species in Natura 2000 sites on the Mura in Austria, Croatia and Hungary have not been explicitly assessed (see Section 7).

6.7 – 1157 *Gymnocephalus schraetzer* (Linneaus, 1758) – Yellow pope – (slov. smrkež)

– listed in both Annex II & V of the EHD, the species was not captured in the Slovenian Mura during the surveys of Podgornik *et al*. (2015) and has additionally not been recorded by routine monitoring (GZÜV) in AT2213000 between 1998 and 2016. This may be a result of its nocturnal behavior, and

thus these results may not reflect the actual status of the species in the area. Figure 150 (page 183) in Podgornik *et al*. (2015) does show the Mura as the largest habitat for the species, and only one of two habitats in all of Slovenia. **The ER not only predicts no impact on this species but even speculates improvement. Considering the status of the information – data deficient – this prediction is clearly not warranted. The reasons for the lack of capture of the Yellow pope in surveys in this region of the Mura are unknown.**

Key deficits of ER: Prediction of no impact or even improvement of habitat conditions for Yellow pope is inappropriate and not warranted due to data deficiency. Transboundary effects of the project on this species in Natura 2000 sites on the Mura in Austria, Croatia and Hungary have not been explicitly assessed.

6.8 – 2522 *Pelecus cultratus* (Linneaus, 1758) – Sichel – (slov. sabljarka)

– listed in Annex II of the EHD (Balzar 2004), this species is found in both lakes and large reservoirs in addition to larger rivers, however, a clear decline of this species has nonetheless been documented with hydropower development [Ratschan 2016 and ref. therein, Kottelat & Freyhof 2007, Minin 2005 (cited from Górski et al 2010)] and this may be the result of reduced lateral connectivity (Górski et al 2010) or sedimentation, as implied by Ratschan (2016). The ER states that the species was not caught in Podgornik *et al*. (2015) but then "later" captured? It is not clear what this statement means. The species was not previously recorded in AT2213000 until 2009 (Ratschan 2016). **According to Podgornik *et al*. (2015), SI3000215 represents the only water body in Slovenia harboring this species, thus making it a priority species conveying a very high legal responsibility under the Habitats Directive to achieve a good ecological status or at least maintain the current population without degradation.** The large-scale ecological conditions required by sichel in river systems remain somewhat a mystery (Ratschan, 2016**). Thus, the conclusions of the ER, that no habitat will be lost (or even speculation that conditions for the species could be improved) must be categorized as purely speculative** and highly questionable. Additionally, the curious episodic occurrence of the species underlies a relatively long-distance migration potential, **with potential importance for the long-term stability of populations throughout the Mura River including transboundary Natura 2000 sites.**

Key deficits of ER: Predictions that no habitat will be lost or even that conditions for sichel could be improved by the project is purely speculative and inappropriate due to known facts as

well as data deficiency. Transboundary effects on this species in Natura 2000 sites on the Mura in Austria, Croatia and Hungary have not been explicitly assessed and are very likely, due to the migratory behavior of the species.

6.9 – 2011 *Umbra krameri* Waldbaum, 1792 – European mudminnow – (slov. velika senčica)

– listed as globally vulnerable by the ICUN (Freyhof, 2011) and in Appendix II of the EHD and strictly protected under the Bern convention (Appendix II)(Marić *et al*. 2017). The species has very specific habitat demands being restricted to mostly isolated and densely vegetated floodplain habitats, such as oxbows and shallow lakes (Wanzenböck 1995, Bănărescu & Bănăduc 2007, Pekárik, *et al.* 2014) – **umbra are very sensitive to changes in floodplain dynamics as well as competition from invasive species** (Takács *et al.* 2015). The species did not occur in the immediate project area but was recorded in the mid to lower sections of **SI3000215, representing the only significant distribution area of the species in Slovenia.** Under Art. 17, Slovenia reports an unfavorable status (U1). The ER reports no influence whatsoever on this species. **However, a specific conservation objective for *Umbra krameri* in SI3000215 is to restore oxbows and other standing and slow velocity habitats for the species. Thus, any level of hydropower development in SI3000215 would hinder or perhaps prohibit the achievement of this conservation objective at least in the project area including areas downstream affected by scouring or reservoir flushing.** Populations of European mudminnow in the Mura/Drava region appear to represent a distinct genetic unit within the range of the species (Pekárik *et al*. 2014, but see also Takács *et al.* 2015) and the strongest levels of gene flow throughout the species' entire range currently occur between the Mura and Drava rivers making these populations key for the long-term preservation of the species' genetic variability across a transboundary region.

Key deficits of ER: Conclusion that there will be no impacts on the European mudminnow is inappropriate due to lack of assessment of impacts on downstream populations as well as potential negative impacts preventing the achievement of the conservation objectives for this species in the project area. Potential transboundary effects on this species in Natura 2000 sites on the Mura in Austria, Croatia and Hungary due to changes in sediment transport have not been explicitly assessed (see Section 7).

6.10 – 1159 *Zingel zingel* (Linnaeus, 1758) – zingel – (slov. čep)

– listed in both Annex's II and V of the EHD, the zingel inhabits large fast-flowing rivers. **In Slovenia**, the Mura River contains the larger of two habitats reportedly inhabited by zingel in the country and **the only habitat within a Natural 2000 area** (ZZSR 2015). Zingel occur throughout the Slovenian Mura including the project area, but were reportedly only caught near the shorelines.This specific habitat use is assumed to be the result of adequate flow velocities**. The ER states that these shoreline habitats will no longer be suitable for zingel following any of the three project variants**. However, the ER speculates that due to slower flow velocities in the main channel the population could even increase. This speculation is difficult to follow and is based primarily on the fact that some adequate flow velocities will be available in the middle of the channel. However, flow velocity is only one habitat parameter and a number of significant changes to the substrate and substrate dynamics will nonetheless occur and have negative effects on these habitats. Zingel are reported to live in the heads of such reservoirs, and the species overall is not as sensitive to such developments as the streber, but the overall expectation must remain – **there will be a significant loss of habitat for this species in the project area including just downstream of the dam. Likewise, it should be assumed that this will also degrade the probability of maintaining stable populations of the species in AT2213000. The species is regularly recorded in AT2213000 but Austria reports an unfavourable status (U2) at the national level. For Slovenia, ongoing hydropower development on the Sava (e.g. at Brežice and Mokric) is resulting in a reduced range for this species.**

Key deficits of ER: Prediction that populations of zingel in the reservoir could increase is highly speculative and not warranted when the impacts on habitat conditions are properly evaluated.Impacts on the species are further underestimated due to lack of assessment of influence on this species in the downstream area of the project. Transboundary effects on this species in Natura 2000 sites on the Mura in Austria, Croatia and Hungary have not been explicitly assessed and at least for the Austrian SAC AT2213000 are highly likely.

6.11 – 1160 *Zingel streber* (Siebold, 1863) – streber – (slov. upiravec)

– listed in Annex II of the EHD, the streber is a bottom-dwelling specialist found in relatively fast flow velocities and a stony substrate. **The ER predicts a clear loss of habitat for this species.** Nevertheless, **statements in the ER relating to a non-significant impact** on water flow velocity,

sediment transport and natural gravel bank dynamics in relation **to streber habitat are completely inappropriate**. Stating that the annual sediment load passing the dam will remain is not relevant for predicting ecological impacts, as timing and dynamics of this sediment transport will be wholly unnatural and result in frequent disturbance. **Thus, in contrast to the ER prediction, the streber will clearly loose habitat throughout the length of the project area, making a significant reduction (> 5%) for SI3000215 – resulting in conflicts with multiple conservation objectives for this species.** Streber were not only caught throughout the Slovenian Mura in low numbers (Podgornik *et al*. 2015) but also regularly caught across the last 15 years in AT2213000 (GZÜV).
The likelihood that population reductions in the project area negatively affect the species occurrence in AT2213000 is high. As the species has an unfavorable status (U2) in Austria and Slovenia (U1) under Art 17, further deterioration should be avoided. Ongoing hydropower development on the Sava (e.g. at Brežice and Mokric) is resulting in a further reduced range for this species in Slovenia. **This is especially relevant, as the occupied habitat for streber in the Mura River represents the largest habitat reach for this species in a Natura 2000 area in Slovenia.**

Key deficits of ER: The conclusion of non-significant impact on key habitat conditions for streber in the reservoir is completely wrong. Impacts of the project on the species are also underestimated due to lack of assessment of the impacts on this species in the downstream area of the project. Furthermore, transboundary effects of the project on the species in Natura 2000 sites on the Mura in Austria, Croatia and Hungary have not been explicitly assessed, and especially for the Austrian SAC AT2213000 are likely.

6.12 – 1134 *Rhodeus amarus* (Bloch, 1782) – Bitterling – (slov. pezdirk)

– the bitterling is not listed in the EHD and shows a relatively wide distribution and is even considered invasive, as it expands its range both west across France as well as far into Eastern Europe. It is discussed here because species specific conservation objectives are listed in the management plan for SI3000215. The species is primarily found in various still water habitats and requires vegetation and bivalves to complete its life-cycle. The ER predicts new habitats in the reservoir under Var 1, but this cannot be guaranteed as there must not only be sufficient vegetation but also sustainable bivalve populations, which cannot be assured due to drawdowns, flushing or other forms of necessary sediment removal. Riverine bivalves are particularly sensitive to any changes in the fish fauna and are declining in many rivers in the region (Lopes-Lima *et al*. 2017; Honsig-Erlengurg 2016). Thus, conservation of the species in SI3000215 will more depend on maintaining still water habitats in the

floodplain rather than expectations in the main channel with or without hydropower development.

Key deficits of ER: The conclusion that new habitats will be created for bitterling in the reservoir is speculative and not appropriate considering the key habitat needs of this species. Impacts of the project on the species are further underestimated due to lack of assessment of the impacts in the downstream area of the project.

7 Transboundary Effects

The ER reports that SAC SI3000215 borders on 4 additional protection areas: AT2213000 (Austria), HR2000364 (Croatia), and HUBF30043 & HUBF20044 (Hungary). The ER reports that the individuals and populations of some species share these protection areas, but does not provide information on which species. The ER reports that unimpeded passage of fish and other organisms will be provided with the bypass channel, but this is overstated and is virtually impossible (see 8.1). Some level of increased mortality is unavoidable at all such facilities. **The ER incorrectly states that there can only be significant effects if there is remote influence. This is incorrect: Habitat degradation as well as reduced free passage in the project area can negatively affect the viability of species in neighboring habitats due to the well-known ripple effects of habitat fragmentation on the viability of meta-populations (Hanski & Ovaskainen 2000, Fahring 2003, Hanski 2005). This is especially likely for several species such as *Aspius aspius* (6.1), several species of *Romanogobio* (see 6.3 – 6.6), *Zingel zingel* (6.10), and *Zingel streber* (6.11) in consideration of SAC AT2213000 in Austria**. Due to potential long-distance migration considerations, **transboundary effects are either likely, or at least with the available information impossible to exclude for *Pelecus cultratus* (6.9)** for both AT2213000 upstream in Austria and also for downstream areas in Croatia and Hungary. As a disturbance in the bed-load dynamics is predicted, leading to changes in downstream sedimentation regimes, **it is furthermore impossible to exclude negative impacts on flood plain specialists such as *Umbra krameri* (6.9) and *Misgurnus fossilis* (6.6) in Croatia and Hungary.**

8 Plausibility of Fish Passage and Sediment Management

8.1 Fish passage

As noted, the proposed project foresees an over 6 km long fish bypass channel. The functionality of such a bypass is highly dependent on a number of characteristics and operating regimes that are insufficiently described to properly evaluate. Namely, the average discharge, the seasonal dynamics of the discharge, the nature of the structures within the channel, the management of sedimentation, the discharge during regular reservoir drawdowns or during flooding events, etc. Furthermore, the fish entrance is a bit far (400-500 meters) below the dam (although correctly located in an outside bend of the river channel). **This would undoubtedly lead to some level of inefficiency or**

percentage failure with respect to flow attraction – not all individuals seeking upstream migration will find the structure. The upstream entrance (or fish exit) may not be sufficiently far enough upstream to avoid artificial water level changes, which could leave fish stranded in proposed backwater or oxbow habitats. **The ER also completely ignores downstream migration.** Downstream migrating fish can be injured or killed through a variety of mechanisms while attempting to pass even relatively low-head hydropower facilities (Turnpenny 1998)(pgs, 173-203 in Clay 1995). **Thus, there will be a level of mortality associated with most species attempting downstream migration at such a weir and these levels can be quite significant.** Hadderingh & Bakker (1998) reported values reaching as high as 50% but highly dependent on species, individual size and flows. Schwimm *et al*. (2017) reported 74% reduction in survival of downstream migrating salmonids in a Danish stream and even where some technical accommodations were made, Calles *et al.* (2012) reported a range of 10 to 67% mortality for salmon, trout and eel. Precise research for most of the species present is unavailable, and expected or realized mortalities are highly variable depending on not only biological or hydrological factors but also the head of the facility and the turbine design. But, the **ER clearly ignores a significant source of additional injury and mortality** for species that are mostly already classified as having an unfavorable status. This source of mortality will also likely affect the colonization and dispersal ability of Annex II species within other reaches of SAC Sl3000215 but also the adjoining protection areas in **Austria (SAC AT2213000), Croatia (SAC HR2000364) and Hungary (SAC HUBF20043). Even with the best intentions, it is expected that a fish pass facility of this nature will lead to increased mortality or hindered migration both in an upstream and downstream direction. Additional conflicts or compromises with respect to**

the conservation objectives of the SAC Sl3000215 as well as speculated mitigation functions (e.g. creation of backwater habitats) are to be expected.

8.2 Sediment Management

To a large degree, the proposed Hrastje-Mote hydropower facility is a conventional run-of-the river plan not unlike many other facilities on the Mura (e.g. in Austria). As such, fine sediments will accumulate on the reservoir bottom at flow velocities beginning at about 0.5 m/s, but especially at 0.3 m/s or less, which corresponds to at least 4 km of reservoir. Aside from the clear negative ecological impact, these sediments also cause operational or flooding problems, especially for the Hrastje-Mote site, with even less gradient than the Austrian Mura (Harb *et al*. 2015). Thus it is imperative to flush the fine sediments and this is proposed in the ER. Under Variant 1, a number of proposals (section 5.7 of the ER) are made to deal with sedimentation as well as the overall disturbance of bed-load transport inherent in all such projects. These proposals involve controlled sediment flushing, transport or deposition of sediment downstream of the dam (such as through channel widening), and the transport and input of gravel (from the reservoir) below the dam. Except for the simple flushing (5-25 days/year) there is insufficient detail concerning exactly where sediments or gravel will come from to evaluate all potential impacts. However, it is important to recognize that flushing does not reduce the immediate negative ecological effects of reservoir sedimentation, which begins to occur immediately following the closing of the dam. Periodic flushing only means that fine sediments do not accumulate to meters of thickness in the middle of the reservoir before being flushed (but they nonetheless accumulate along riparian areas, for example). The flushing, then disturbs or wholly eliminates the fauna that has settled on the bottom of the reservoir, despite sedimentation. This is important to understand, as this negative dynamic also negates most positive predictions or speculation concerning positive aspects of reservoir habitat, for species that are supposedly adaptable to such habitats. **No species is adapted to flushing or drawdowns. Thus, where project developers propose mitigation measures concerning sediment or habitats within a project area, such habitats, even if temporarily functional, are disrupted or even become major death traps for aquatic organisms during necessary drawdowns or flushings.** The cited video, shows such an event, where a somewhat functional riparian habitat within a run-of-the-river project area on the Austrian Mura, turns into a death trap when reservoir levels are lowered due to flood conditions (https://www.youtube.com/watch?v=jysV43-2bwk). Further, due to the unpredictability of high water events, the seasonal timing of flushing cannot be controlled, and thus in different years, whole year classes of different species can be affected and specific spawning times

or rearing times of target species cannot be accommodated for. Additionally, there is a chain of over 30 power plants on the Austrian Mura and during high flows (now routinely by yearly floods) the spillway gates of this entire chain must be opened – when this occurs, a power plant just across the border in Slovenia must do the same to avoid severe damage to the surrounding landscape. **Such operation, while necessary to protect various features of the surrounding landscape also has strong negative ecological consequences for the ichthyo-fauna just downstream of the weir (e.g. Grimardias *et al.* 2017)**. Aside from these acute problems, downstream river reaches are highly prone to **river-bed colmation** (Graham AA 1990, Davies-Colley *et al*. 1992, Graham 1990), considered an important indicator of river substratum quality (Hauer 2015). **These changes lead directly to dramatic decreases in the density of the macrozoobenthic community (e.g. Graf *et al*. 2015). In summary, it will not be possible to maintain stable communities of fish, invertebrates or aquatic vegetation in much of the proposed reservoir. Thus, both for the**

reservoir area and immediately downstream significant reductions in the food base are to be predicted with negative consequences not only for fish species, but also terrestrial EHD species targeted with management plans along the floodplain and associated habitats, including transboundary protection areas. The ER proposal to transport gravel from the reservoir to below the dam lacks detail, and thus it is not known from where the developers plan to dredge the gravel, and what habitats within SAC Sl3000215 would be affected by such dredging. Further, the deposition of gravel below the dam, while perhaps foreseen with good intentions, contradicts the project plans for the lowering (through dredging) of the river bed below the dam. **The proposed river channel widening will also promote the deposition of large masses of fine sediments along the sides of the channel, which can block tributary mouths, oxbows or other riparian habitats in the immediate floodplain below the project area. Thus, specific management measures for floodplain species within SAC Sl3000215 will be hindered or rendered impossible.**

9 Potential Legal Conflicts of the Proposed Project and EU legislation

The management of surface waters in Europe is regulated by the Council Directive 2000/60/EEC or Water Framework Directive (WFD) together with national laws. A principle goal of the WFD are to achieve a good ecological status of surface waters and the no-deterioration clause (Art. 4) plays a prominent role in setting the tone and purpose of the legislation. Specific habitat and species protection is regulated by the European Bird and Habitats Directives (EHD).

The backbone of these protection directives is the establishment of Natura 2000 sites designed to protect specific designated habitat types (Art.1) or designated species of common interest (Art. 2). Both the WFD (Art. 4.7) and EHD (Art. 6(3) & 6(4) contain exemption clauses allowing for some deviation from rules or objectives. However, hurdles are extensive for a project requiring exemptions for both the WFD and EHD, especially when a number of species of high national or regional interest are involved, as is clearly the case with SAC Sl3000215 as well as transboundary SACs in Austria, Croatia and Hungary.

9.1 Potential Conflicts with the European Habitats Directive (92/43/EEC).

The proposed project is in clear conflict with a number of explicit conservation goals and general purposes of the designated SAC Sl30000215. Some of these conflicts are described in the ER itself, while others are summarized predominately in 6.1 through 6.12 and at times conflict significantly with the predictions of the ER. Moreover, the ER has left out some significant issues of degradation, which could lead to additional long-term degradation of the SAC, namely regarding downstream effects, bed-load management and downstream migration (see 8.1 & 8.2). Additionally, the ER lacks species specific potential effects on additional SACs namely the adjacent AT2213000 in Austria, the downstream sites HR2000364 in Croatia and HUBF20043 in Hungary, areas which have received EU funds for restoration measures that have promoted improvements that would be undermined by such a project. This is in conflict with the inclusion of assessing the transboundary effects on Art. 6(3) of the EHB (HN_2016). Additionally, considering the international value of the Mura SAC SI30000215 and its central role in preserving one of the longest free-flowing lowland river habitats in Europe, it would seem that this SAC is a priority habitat containing as well priority species. Above the Austrian border, the Mura is listed as priority habitat under the WFD.

9.2 Potential Conflicts with the EU Directive 2000/60/EC - Water Framework Directive (WFD).

If Art 4.7 WFD should be applied to the project Hrastje-Mota both the stipulations of this clause as well as those of EHD 6(3) & 6(4) must be fulfilled. Furthermore, under Art 4.7 such an exemption must not be in conflict with other EU legislation, for example Directive 2007/60/EC (Flood Directive). Exceptional in this case, is not only the existence of AT2213000 adjacent to the head of the reservoir, but also the fact that the reservoir would reach back to the Austria/Slovenian border. While hydrologic conditions during normal river discharges will most likely not change beyond the Austrian border, this may not be true for riparian flooding during exceptional high water events. **The**

ER neglects assessment of such potential impacts from floods at the Austrian border.

9.3 Potential Conflicts with SEA Directive 2001/42/EC – Strategic Environmental Assessment.

The ER that has been assessed in this report is a fundamental element of a strategic environmental assessment, as understood under SEA Directive 2001/42/EC for public planning and programs that may involve environmental impacts, especially, for example, relevant to the European Habitat Directives both within a state and considering transboundary effects (Art. 7). **The proposed project Hrastje-Mota has been repeatedly revealed in the media together with 7 additional hydropower plants on the Slovenian Mura River.** Thus this public plan of energy development is not limited to the Hrastje-Mota project but rather appears to involve substantial exploitation of the entire Mura River in Slovenia, involving potential environmental impacts on the entire SAC SI30000215, its habitats and its key species. **The limitation of this ER to the Hrastje-Mota project appears to conflict strongly with the spirit of SEA Directive 2001/42/EC in scoping the extent of potential environmental impacts both within Slovenia as well as internationally in the form of transboundary effects and adjacent SAC in Austria, Croatia and Hungary.** The clear deficit of the ER in not explicitly assessing species-specific transboundary effects for qualifying species in bordering protection areas has been repeatedly mentioned in this report. **Needless to say, the potential impacts on species or habitats discussed in the ER and critique of the ER in this report would be greatly magnified by the full realization of the publicized hydropower exploitation plan, to the point which the plan would conflict with the very creation of SAC SI30000215 as well as adjacent SACs in Austria, Croatia and Hungary. Further, additional species of transboundary interest, not mentioned in this report, would clearly become relevant from the more extensive and publicly advertised plan of 7 additional power plants. Notably, this would have clear implications for planned restoration of such species as sturgeons (Acipenser spp.) as outlined by the Danube Sturgeon Task Force (Sandu *et al*. 2013).**

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