Project Water Bodies Without Borders (EstLat 66)

Description of water bodies in the project area

Activity T1. Compilation of existing data and identification of gaps

REPORT

February 2020

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Abbreviations

BQE – Biological Quality element

EE – Estonia

EU – European Union

EstModel – Estonian software for modeling nutrient loads

GIS – Geographic information systems

HMWB – Heavily modified water body

HPP – Hydropower plant

LB – Lake basin

LV - Latvia

QE – Quality Element

RB – River basin

RBD – River Basin District

TWB – Transboundary water body

WB – Water body

WBWB – project "*Water Bodies Without Borders*"

Introduction

Water is the most important natural resource on our planet and the quality of water should be a concern for all of us. According to Water Framework Directive 2000/60/EC [1] requirements, all European countries should ensure achievement of at least good ecological status in their waters. Gauja/Koiva and Salaca/Salatsi river basins are shared between two countries - Latvia and Estonia, forming transboundary water bodies (rivers and lakes). It is essential for both countries to contribute to assessment of ecological status of transboundary water bodies jointly.

Ecological status and typology has been a subject for cooperation between Estonia and Latvia already in the project "Towards joint management of the transboundary Gauja/Koiva river basin district" (Gauja/Koiva project) in 2011—2013. However, in both countries changes have been made in ecological status assessment and typology field since.

Latvia has gone through re-delineation of water bodies and the total count of water bodies will be higher for the 3rd cycle of River Basin Management Plans for period 2022—2027. Ecological quality assessment has been improved by increasing amount of quality elements that are used in quality assessment and by improving precision of water body boundaries. On Estonian side changes have been made in water body delineation and pressure assessment too, resulting in many differences comparing to previous Gauja/Koiva project results and 2nd cycle River Basin Management Plans for period 2016—2021. Estonia has also changed the typology of water bodies in 3rd cycle of River Basin Management Plans by including importance of water bodies for fish in the water body type assessment.

Additionally, the European Commission has indicated that both Member States should cooperate on water body delineation, developing harmonised methodologies for delineation, and efforts on harmonisation of status assessment should continue [2].

To ensure effective and harmonized water body management in both countries, initially work was started on water body delineation process and harmonization of common transboundary rivers (solving spatial information issues). Revised and harmonized ecological quality assessment for rivers and lakes has been done. This information will form basis for sustainable cooperation between the countries in the implementation of joint river basin management plans and common actions to improve water quality in the future.

This document will describe the delineation of transboundary water bodies, harmonized status of the water bodies, and characterize transboundary water bodies in the project area.

[1] Water Framework Directive (2000) "Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy.

[2] International Cooperation under the Water Framework Directive (2000/60/EC). Factsheets for International River Basins (2019). Comission staff working document.

1. Designation of the project area

The project area includes Gauja/Koiva and Salaca/Salatsi transboundary river basins that are located in the territories of Gauja River Basin District (RBD) in Latvia and in three RBDs in Estonia - Koiva, West Estonia and East Estonia. Additionally, water bodies that are part of Gauja RBD in Latvia or part of Koiva RBD in Estonia but belong to other river basins, is a subject of WBWB project. This approach would secure consideration of anthropogenic pressures in all of the Latvian-Estonian border area when devising solutions suitable for meeting the environmental objectives (see Figure 1.1).

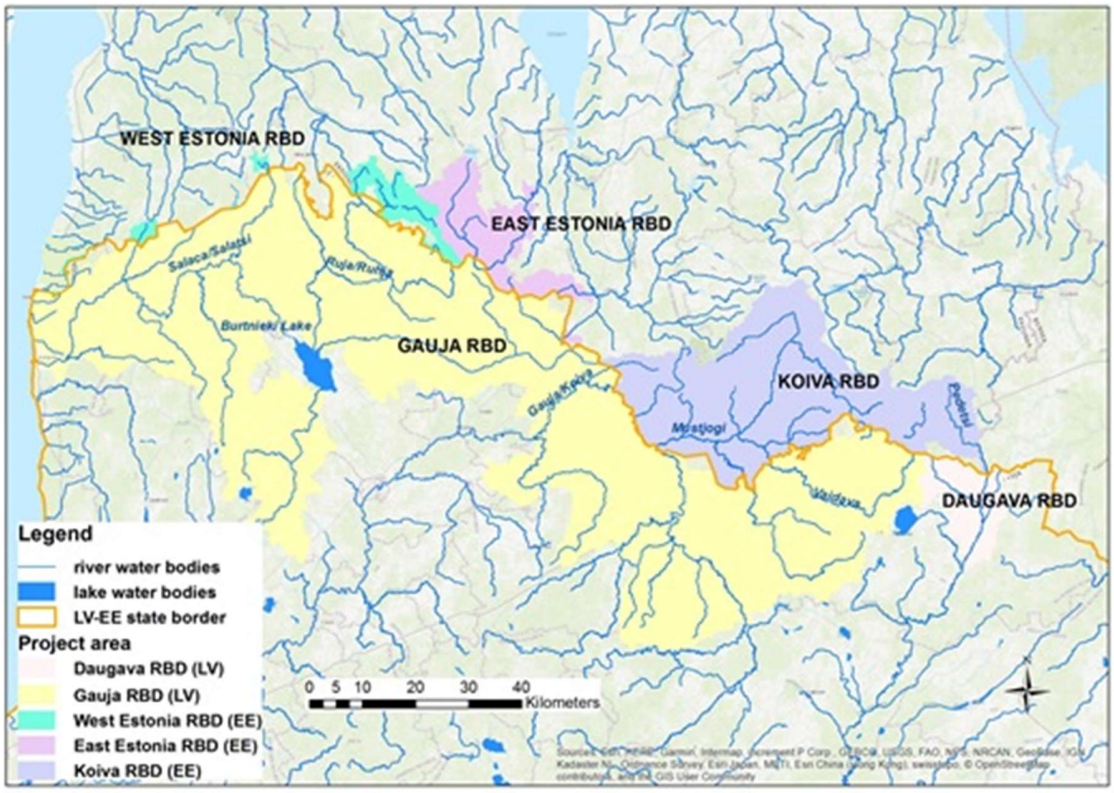

Figure 1. River Basin Districts within WBWB project area.

Latvian side of the project territory includes part of Gauja river basin with direct transboundary water bodies and their tributaries that are impacting water quality for transboundary water bodies. The rest of Gauja river basin will be assessed and described during elaboration of Gauja river basin district management plan (not included in activities of this project).

In project area there are in total 109 water bodies, 63 water bodies on Latvian side (52 river water bodies, 11 lake water bodies) and 46 water bodies on Estonian side (37 river water bodies, 9 lake water bodies). There are 18 transboundary water bodies identified in the project area - 17 river water bodies and 1 lake water body (Table 1).

On Latvian side of the project territory there are 10 water bodies and on Estonian side of the project territory there are 7 water bodies that are not a part of Salaca/Salatsi and

Gauja/Koiva river basins. On Latvian side those are transboundary water bodies, or water bodies that are located very to the border. These rivers mainly flow from Latvia to Estonia, but in some cases in the opposite direction (for example, Pedele/Pedeli flows from Estonia to Latvia and then again back to Estonia). Koiva RBD in Estonia includes water body Pedetsi that belongs to Daugava RB. Transboundary water bodies (TWBs) of West Estonia RBD (2 WBs of Pedeli/Pedele River and 3 WBs of Ohne /Omulupe River), in Latvia are included in Gauja RBD, but hydrologically are a part of Peipus Lake Basin (LB). These WBs are included in the analysis of this report, in order to strenghthen and improve the international cooperation between both countries, however, the assessment was prepared by project experts outside of this project.

Table 1. Transboundary water bodies

Transboundary code	Transboundary name	WB new short name
EELV1010	Atse/Acupīte_1	Atse
EELV1001	Gauja_8/Koiva_1	Koiva
EELV2002	Lätеteperä/Akaviņa	Lätеperä
EELV1015	Pedeli_1/Pedele_1	Pedeli_1
LVEE1016	Pedele_2/Pedeli_2	Pedeli_2
EELV2001	Pedetsi/Pededze_1	Pedetsi
LVEE1003	Peļļupīte/Peeli	Peeli
EELV1004	Peetri/Melnupe_2	Peetri
EELV1011	Penuoja/Kolkupīte	Penuja
EELV1012	Puupe/Pužupe	Puupe
LVEE1005	Pērļupīte/Pärlijõgi_1	Pärlijõgi_1
EELV1013	Raamatu/Ramata	Raamatu
EELV1014	Ruhja/Rūja_1	Ruhja
EELV1006	Ujuste/Kaičupe	Ujuste
EELV1007	Vaidva_1/Vaidava_1	Vaidva_1
LVEE1008	Vaidava_2/Vaidva_2	Vaidva_2
EELV1017	Õhne_2/Omuļupe	Õhne_2
EELV1009	Murati järv/Muratu Ezers	Murati järv

1.1. Basic information on International river basins/sub-basins shared by Latvia and Estonia

River Basin Districts concerned: Gauja/Koiva, East Estonia, West Estonia, Daugava.

Key sub-basins in International River Basins (RB): Gauja/Koiva, Salaca/Salatsi.

Table 2. Size of the total catchment area and national shares for each international river basin / sub-basin (km^2, %), indicative division by country and respective RBD.

International River Basin / Sub-Basin District	Gauja / Koiva		Salaca/ Salatsi		Daugava	
	km^2	%	km^2	%	km^2	%
Total area:	8900		3570		87900	
Latvia						
Gauja RBD	2119	23.8	2810	78.7		
Daugava RBD					204	0.2
Estonia						
Koiva RBD	1155	13.0			131	<0.2
West Estonia RBD			161	4.5		
East Estonia RBD			330			

Project territory covers mainly water bodies from Gauja/Koiva and Salaca/Salatsi hydrological river basins (Table 2), with a few exceptions. Koiva RBD in Estonia includes water body Pedetsi that belongs to Daugava RB. Salaca RB in Latvia includes rivers that discharge directly into the Gulf of Riga. Transboundary water bodies (TWBs) of West Estonia RBD (2 WBs of Pedeli/Pedele River and 3 WBs of Ohne /Omulupe River), in Latvia are included in Gauja RBD, but hydrologically are a part of Peipus Lake Basin (LB).

1.2. Land use

Land use in water bodies has direct impact on the water quality. Land use is indicative of pressures present in the water body, an integral part of the pressure assessment. Determination of anthropogenic pressures is necessary to define measures for improvement of ecological status.

In total 4718 km^2 of WBWB project area is forest land (64,3 % of the project territory), 2266 km^2 are agricultural lands (30, 9 % of the project territory), 179 km^2 are wetlands (2,4% of the project territory) and other land use types account for 173 km^2 (2,4 % of the project territory), Figure 2.

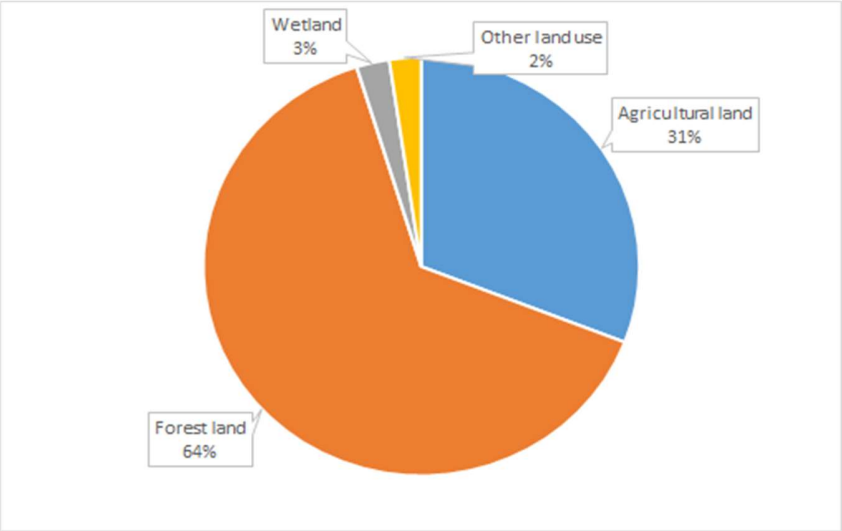

Figure 2. Main land use types in the project territory.

In Estonia agricultural lands cover 473 km^2 (25,8%) of the project territory (Figure 3). Forest in Estonia covers 1144, km^2 (67,9%) of the project territory. Wetlands cover 18 km^2 (0,81 %) of the Estonian project territory. Other land use types account for 44 km^2 (5,4%) of the Estonian project area.

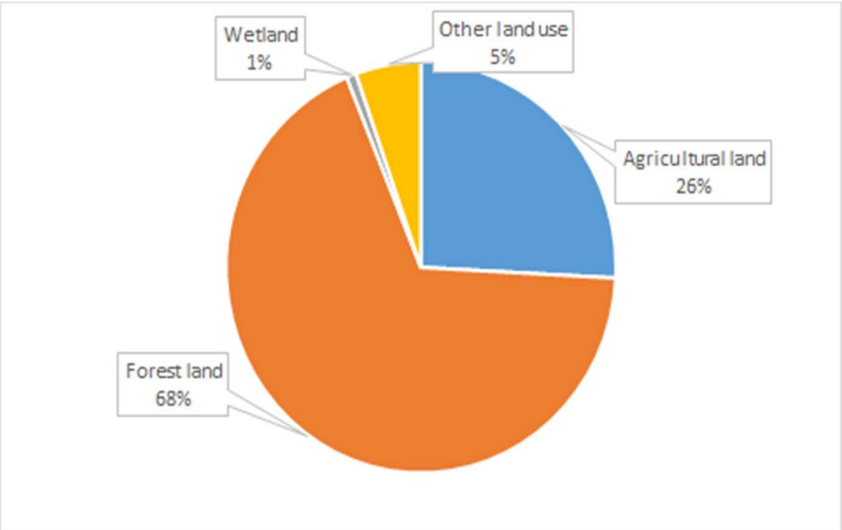

Figure 3. Main land use types in the project territory in Estonia.

In Latvia forest covers 3574 km^2 (63,1%) of the Latvian project territory (Figure 4). Agricultural lands in Latvia cover 1793 km^2 (31,7%) of the project territory. Wetlands

cover 161 km^2 (2,85%) of the Latvian project territory. Other land use types account for 129 km^2 (2,3%) of the Latvian project territory.

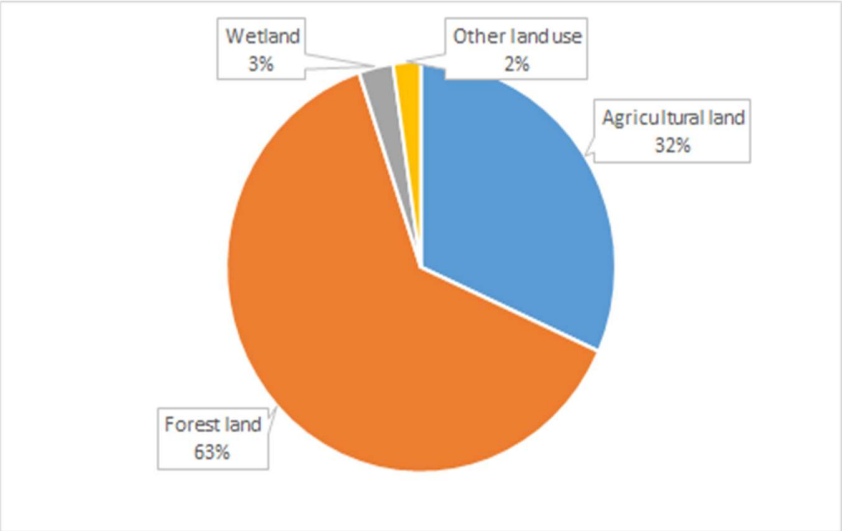

Figure 4. Main land use types in the project territory in Latvia.

1.2. Gap analysis for delineated water bodies

In **Latvia** delineation of water bodies was conducted in 2004. Pressures and ecological status assessment results revealed instances of inconsistent impacts of pressures on a water body level, leading to situations where single ecological status could not be determined for a whole water body. Therefore, in 2017 re-delineation of water bodies was started.

In **Estonia** delineation of water bodies was started in 2005. In 2009 National water regulation confirmed 750 surface water bodies. Ten years of status assessment development, pressure-impact analyses, monitoring and intercalibration revealed a need for improvements and change in some water body characteristics, *e.g.* type, length, catchment *etc*. Re-delineation was started in 2017 and work is in progress.

Re-delineation process continued in both countries during the WBWB project in order to ensure the ecological status assessment in all of the transboundary water bodies - 8 in the Gauja/Koiva RB, 5 in the Salaca/Salatsi RB, 2 in the Daugava RB and 3 in Peipus RB.

According to European Commission document "International Coordination Regarding the EU WFD and Water Resources Management in the Gauja/Koiva River Basin District" it is assessed that "an analysis of the GIS data shows the size of the Latvian shared water body is shorter than the Estonian water body delineated for the same river" (Figure 5 - water body G231, Gauja, in Latvia (pictured in brown) and Estonia (pictured in grey).

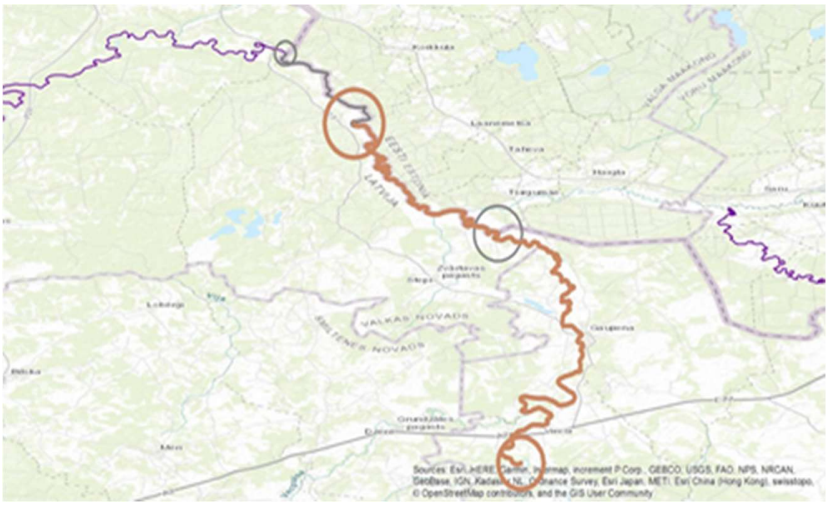

Figure 5. Map 1. Assessment if delineation of surface water body has taken place as indicated in WISE (Source: WISE electronic reports 2016).

In accordance with GIS data analysis results laid out here, the following activities were carried out within the project:

Latvia

- *Size correction of existing transboundary water bodies*. Correction works have been done taking into account national water body boundaries. Thus the size of WB G231 (Gauja_7) was decreased and from the Mustjogi River (right bank tributary, EE) the next water body G274 (Gauja_8) was delineated. Delineation of water body G336 (Pedele_1) led to reduction of its length and increase in length for water body EE WB 1012100_2 (Pedeli). The size of water body G319 (Acupīte_1) was increased in accordance with delineated EE WB 1154000_1 (Atse).
- *Delineation of new transboundary water bodies.* In order to cover gaps in transboundary water quality, new transboundary WBs have been delineated: D533 (Virgulica River), G332 (Peļupīte/Peeli River), G329 (Kaičupe/Ujuste River), G330 (Omuļupe/Ohne River), G331 (Kolkupīte/Penuja River), G333 (Pužupe/Puzupe River).

Estonia

- *Size correction of existing transboundary water bodies.* Five national water bodies: 1152600_1 (Ikla); 1158400_1 (Kolga_1); 1152300_1 (Loode); 1012600_1 (Piiri); 1152500_1 (Treimani) have been identified with a catchment area in Latvia > 10%, and for which information on loads will be exchanged in the future. Kolga water body was divided into two water bodies - 1158400_1 (Kolga_1) and 1158400_2 (Kolga_2), based on the location of a dam and the border of a salmon river. The 1153700_1 (Vanausse) water body was added to 1153600_1 (Ruhja) water body.

- *Delineation of new transboundary water bodies.* A new part of the water body was delineated, which was classified as part of the transboundary body - 1159704_1 (Läteteperä / Akaviņa). Tributaries of Peeli's water body were divided into two separate water bodies - 1158100_1 (Peeli) and 1158200_1 (Pähni).

1.3. Spatial information

An essential part of ensuring that assigned borders of water bodies are not dependent on administrative borders between countries and represent the natural hydrological borders, is by harmonisation of spatial information. Initially, two main problems related to spatial information were identified by creating the first joint map of Latvian and Estonian project territories (Figure 6):

1. *errors* – borders of transboundary water bodies not matching between the countries;
2. *gaps* – empty spaces along the Latvian – Estonian border, these were either a result of the errors, or parts of catchment areas without transboundary water bodies, as a result not belonging to water bodies of either country.

Another issue with spatial information were minor offsets of borders of WB's after converting data from both countries to united coordinate system, as different coordinate systems are in use in Latvia and Estonia.

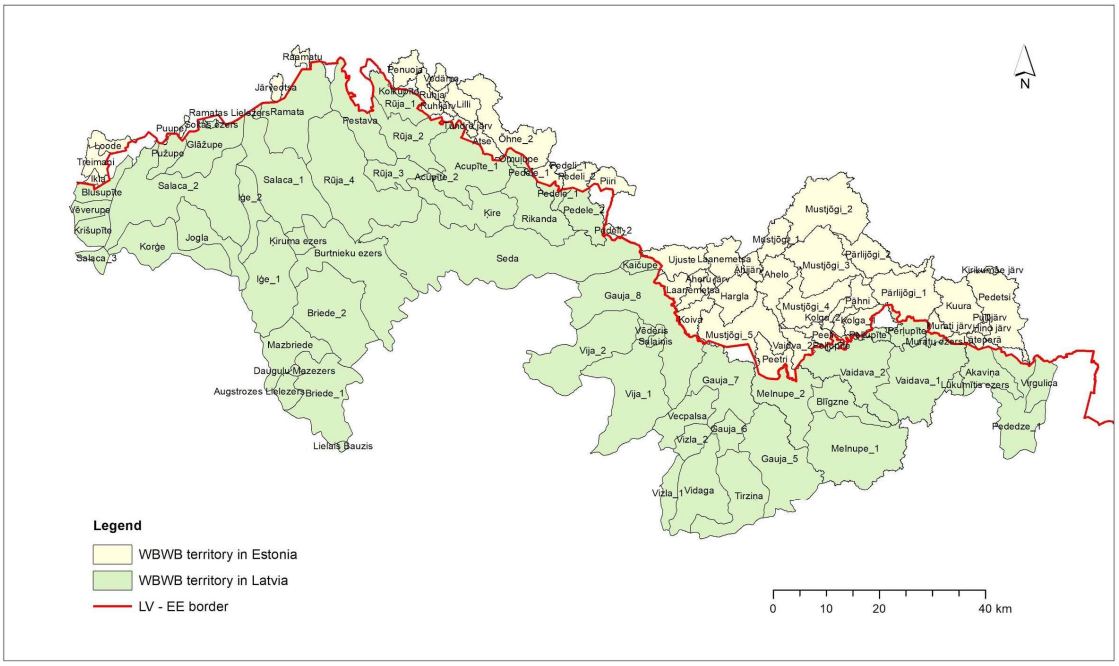

Figure 6. WBWB project territory in Estonia and Latvia before harmonisation of spatial information.

Borders of each water body in the project territory were reviewed (Figures 7, 8 and 9), and errors were corrected using digital elevation model (DEM), generated from LiDAR data (where available) and topographic elevation information on Latvian side. The same method was applied for joining *gaps* to certain water bodies. Water bodies with corrected boundaries in the project territorry are shown in Figure 10. In order to create a joint water body layer for both countries, addittional seven water bodies were identified outside the project territorry for correction of borders (Figure 11). These are water bodies that are not transboundary, but their catchment area is located in both Latvia and Estonia.

Precision in assignment of water body borders is essential in many ways. Precise borders will allow for correct determination of water body area, therefore for correct determination of other important information, e.g. administrative areas, land use, point sources of pollution etc., within the water body territory. This information is essential in economic analysis and creation of action plans to improve ecological status.

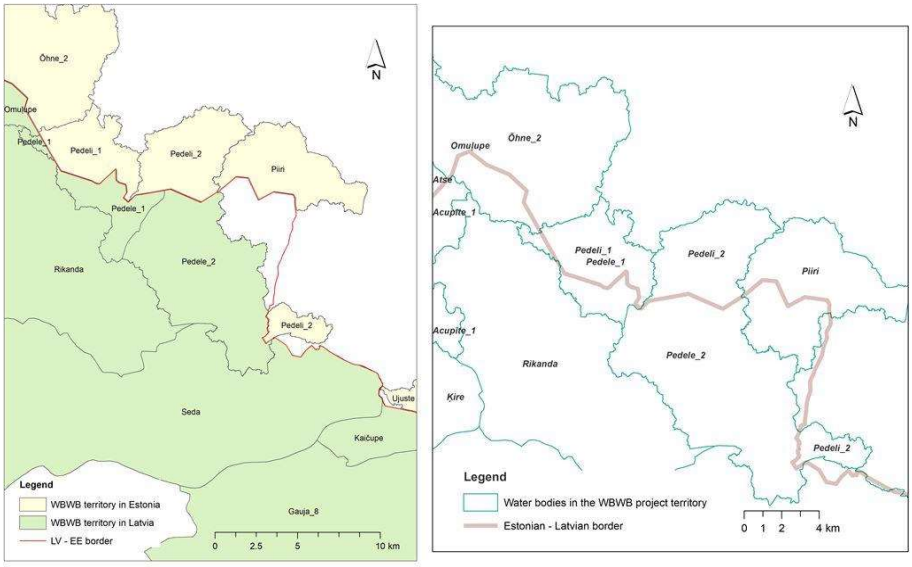

Figure 7. Borders of transboundary WBs Pedeli_1 / Pedele_1 and Pedeli_2 / Pedele_2 not matching initially (left) and after corrections have been made (right).

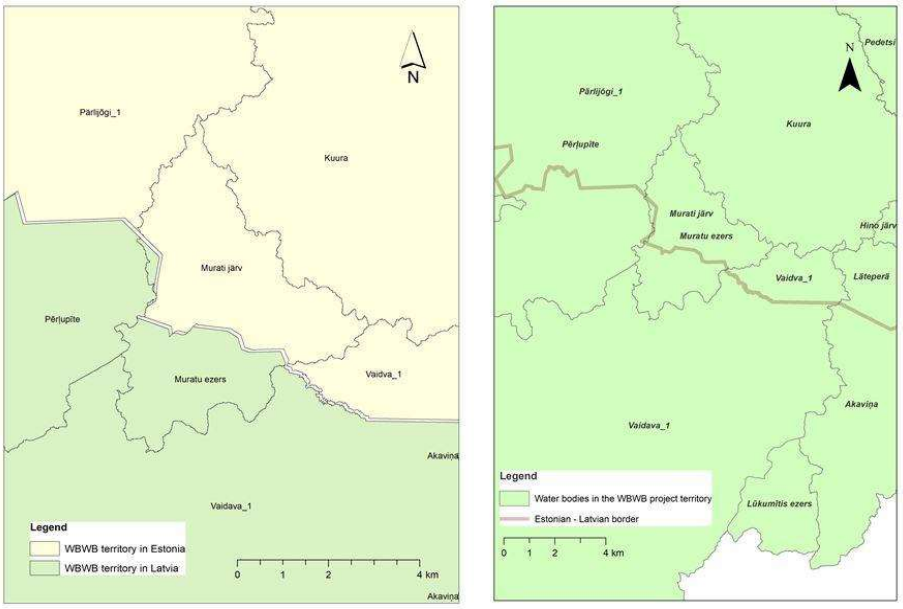

Figure 8. Transboundary WB of Murati lake (Muratu ezers / Murati jaarv) with offset of borders (left) and after correction of errors (right).

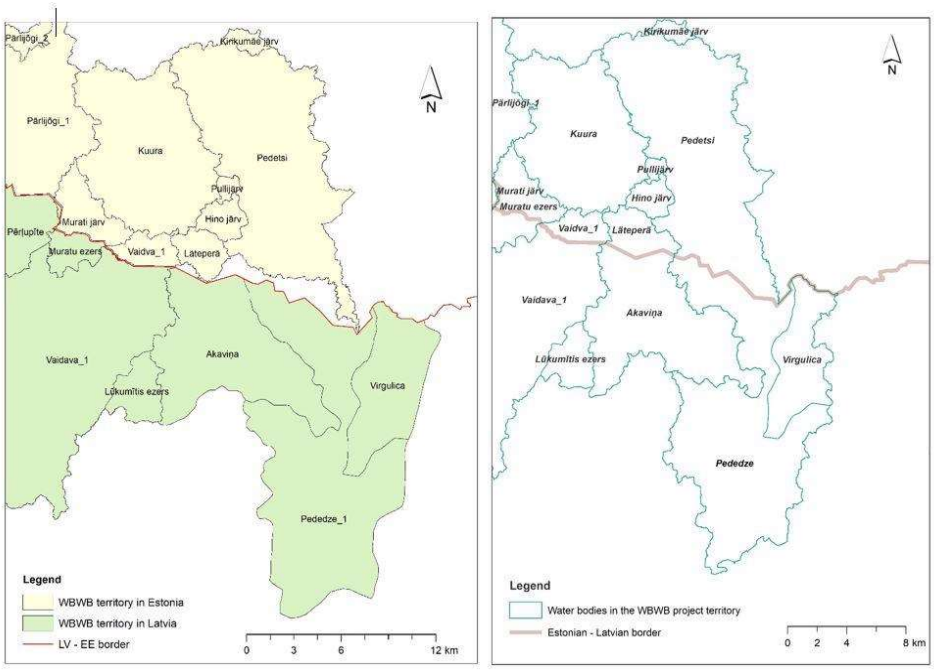

Figure 9. Large gaps Akaviņa / Latepera and Pededze / Pedetsi transboundary water bodies (right) and joint water bodies after correction of borders (left).

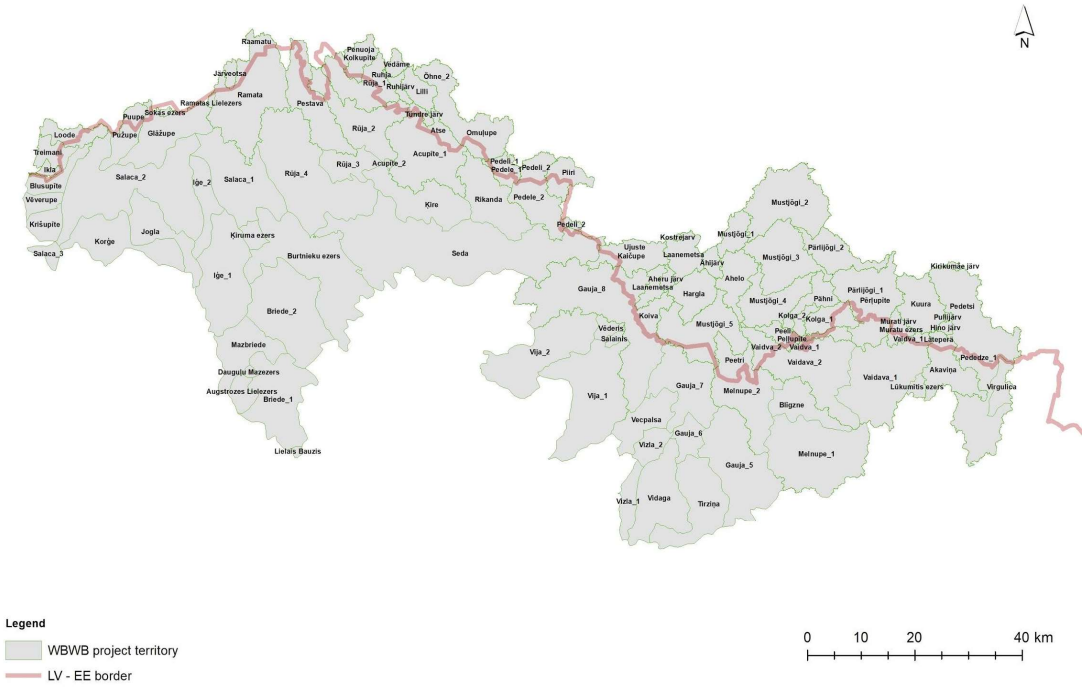

Figure 10. WBWB project territory with joint water bodies after correction of water body borders between countries.

Figure 11. Identified additional seven water bodies outside of the project territory, essential for creation of joint Latvian - Estonian WB layer.

2. Status assessment of water bodies

General principles for status assessment in both countries - Estonia and Latvia - are in compliance with Water Framework Directive (2000/60/EC)[1] article 8 (Monitoring of surface water status…) and Annex V (status, classifications, quality elements *etc.* are described). Information for river basin specific pollutants and chemical status are in compliance with Priority substances directive (2013/39/EC)[2] and stated also in the national regulation of each country.

2.1. Status assessment principles in Estonia

General principles for status assessment in Estonia are in compliance with Water Framework Directive (2000/60/EC) [1] article 8 (Monitoring of surface water status…) and Annex V (status, classifications, quality elements etc. are described). Most important information to assess the ecological status of a surface water body is stated in the national water regulation Ministry of Environment no 44 ("*Pinnaveekogumite moodustamise kord ja nende pinnaveekogumite nimestik, mille seisundiklass tuleb määrata, pinnaveekogumite seisundiklassid ja seisundiklassidele vastavad kvaliteedinäitajate väärtused ning seisundiklasside määramise kord*"). Information for river basin specific pollutants and chemical status are in compliance with Priority substances directive (2013/39/EC)[2] and stated in the national regulation Ministry of Environment no 77 ("*Prioriteetsete ainete ja prioriteetsete ohtlike ainete nimistu, prioriteetsete ainete, prioriteetsete ohtlike ainete ja teatavate muude saasteainete keskkonna kvaliteedi piirväärtused ning nende kohaldamise meetodid, vesikonnaspetsiifiliste saasteainete keskkonna kvaliteedi piirväärtused, ainete jälgimisnimekiri*").

In Estonia, there are 7 types of river water bodies and 8 types of lake water bodies (Table 3). In Koiva/Gauja river basin types 1A, 1B, 2B, 3B and lake types II, III and V are represented.

[1] Water Framework Directive (2000) "Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy.

[2] Directive 2013/39/EU of the European Parliament and of the Council of 12 August 2013 amending Directives 2000/60/EC and 2008/105/EC as regards priority substances in the field of water policy.

Table 3. Estonian river and lake types.

River types in Estonia		
1A, 1A-KaVo, 1B,1B-KaVo, 2A, 2B, 3A, 3B, 4B		
Explanation of river type codes:		
Catchment area	Water type	Importance as fish habitat
1 – 10–100 km^2 **2** – 100–1000 km^2 **3** – 1000–10,000 km^2 **4** – over 10,000 km^2	**A** – dark water, humic **B** – bright water, low organic matter	**KaVo** – natural conditions do not allow development of stable fish community
Lake types in Estonia		
Type I – water mirror area under 10km^2, high water hardness, >240 HCO3 - mg/l, electrical conductivity >400 µS/cm, low chloride content up to 25 mg/l, no stratification, no importance in regards to water colour.		
Type II – shallow lakes, water mirror area under 10 km^2, medium water hardness, 80 - 240 HCO3 - mg/l, electric conductivity 165 - 400 µS/cm, low chloride content up to 25 mg/l, no stratification, no importance in regards to water colour.		
Type III – deep lakes, water mirror area under 10km^2, medium water hardness, 80 - 240 HCO3- mg/l, electrical conductivity 165 - 400 µS/cm, low chloride content up to 25 mg/l, stratified, no importance in regards to water colour.		
Type IV – water mirror area under 10km^2, soft water, <80 HCO3- mg/l, electric conductivity <165 µS/cm, low chloride content up to 25 mg/l, no stratification, dark water colour.		
Type V – water mirror area under 10km2, soft water, <80 HCO3- mg/l, electric conductivity <165 µS/cm, low chloride content up to 25 mg/l, no stratification, light water colour.		
Type VI – Lake Võrtsjärv		
Type VII – Lake Peipsi		
Type VIII – coastal lakes		

Status assessment is divided into three sections: ecological status + chemical status = overall status (Table 4). Ecological status is assessed by biological quality elements, physical-chemical quality elements (incl. river basin specific pollutants) and by

hydromorphology (as a quality element). Chemical status is assessed by 45 priority hazardous substances (in water, sediment, biota). Quality elements system (QE-s and BQE-s) is used all over the European Union countries. Every member state has own normatives and indices by water type and region.

Ecological and overall status has 5 quality classes: high (blue), good (green), moderate (yellow), poor (orange) and bad (red). Chemical status has only two status classes: good (red/pink) and bad (blue). The main principle in assessment is one-out-all-out principle, which means that the worst quality element will determine the status. For example, if fish are poor and all other quality elements are good or even in high status, then ecological status is still poor and so is overall status (when chemical status is good). The target for majority of water bodies is to achieve or to maintain at least good environmental status latest by 2027 regarding to WFD article 4 ("Environmental objectives").

In ecological assessment the biological quality elements (BQE) in Estonian **rivers** status assessment are: phytoplankton (in very large rivers), phytobenthos, macroinvertebrates, macrophytes and fish. Supportive quality elements (QE) are: physical-chemical, river basin specific pollutants and hydromorphology. BQE-s used In **lakes** are: phytoplankton, phytobenthos, macroinvertebrates, macrophytes and fish. Supportive QE-s are: physical-chemical, river basin specific pollutants, and hydromorphology. Zooplankton in lakes is monitored but not used in status assessment according to WFD. In WBWB project are no coastal sea water bodies, therefore no description of principles is given.

Estonia has altogether 644 river water bodies. Many are monitored in 6 year cycle (except continuously monitored river water bodies), details are given in the project document "Joint monitoring program for Koiva/Gauja and Salatsi/Salaca river basin". Estonia has 90 lake water bodies and within 6 year period all lakes are monitored at least once (more in case of continuous monitoring).

Status is given even if water body is not monitored. Then EstModel modelling results from 2011 (Ntot and Ptot values for rivers), dams inventory work for fish quality (longitudinally passable info) and hydromorphology report results are used to determine the status. This combination allows to give water body confidence level 1 (0 - no data, 1 - low confidence, 2 - medium confidence, 3 - high confidence). Confidence level criteria has been specified by Commission and allows to evaluate the status information more efficiently and compare it between the countries. Status information of transboundary water bodies in WBWB project area before harmonizing procedure has been given in Table 3. Among those 18 bodies 15 have good overall status (83%), two have moderate status (Pedeli_2 and Vaidava_2) and one has poor status (Pärlijõgi_1) due to dams. Chemical status for most waterbodies has never been determined. Chemical status of Gauja_8/Koiva_1, Pedele_2/Pedeli_2, and Murati järv/Muratu Ezers was monitored in 2012 as part of a project Towards Joint Management of the Transboundary Gauja/Koiva River Basin District (Kalvane I. and Veidemane K. (eds.), 2013). Polybromdiphenylethers (PBDEs) in fish tissue exceeded ecological quality limits in Gauja_8/Koiva_1 and Murati järv/Muratu Ezers. PBDEs were not monitored in fish from Pedele_2/Pedeli_2.

Table 4. Transboundary surface water bodies and statuses in 2018 before harmonizing.

Code	Name	IC type in EE	Local type	Ecological status/ monitoring year/ not good element	Con-fidence level	Hydro-morp-hology 2019	Chemical status/ monitoring year/ not good element	Overal l status
1154000_1	Atse	R-C6	1B-KaVo	never	1		Unknown	
1154200_1	Koiva	R-C5	3B	never	1		2012 G/K* PBDE	
1159704_1	Läteperä		1A	never	1		Unknown	
1012100_1	Pedeli_1	R-C6	1B-KaVo	never	1		Unknown	
1012100_2	Pedeli_2	R-C6	2B	2012 G/K fish	2		2012 G/K	
1159700_1	Pedetsi	R-C6	1A	2017	3		Unknown	
1158100_1	Peeli	R-C6	1B	never	1		Unknown	
1158700_1	Peetri	R-C6	2B	2012 G/K	2		Unknown	
1153200_1	Penuoja	R-C6	1B-KaVo	never	1		Unknown	
1152700_1	Puupe		1A-KaVo	never	1		Unknown	
1155700_1	Pärlijõgi_1		1A	2012 G/K fish	2		Unknown	
1153000_1	Raamatu	R-C6	1B-KaVo	never	1		Unknown	
1153600_1	Ruhja	R-C6	1B-KaVo	2017	3		Unknown	
1154300_1	Ujuste		1B-KaVo	2012 G/K*	2		Unknown	
1158000_1	Vaidava_1	R-C4	2B	2010	1		Unknown	

Code	Name	IC type in EE	Local type	Ecological status/ monitoring year/ not good element	Con-fidence level	Hydro-morp-hology 2019	Chemical status/ monitoring year/ not good element	Overal l status
1158000_2	Vaidava_2		2B	2017 fish	3		Unknown	
1013700_2	Õhne_2	R-C4	2B	2018	3		Unknown	
2155900_1	Murati järv	L-CB1	II	2017	3		2012 G/K PBDE	

*G/K ─ Kalvane I. and Veidemane K. (eds.). 2013. Final report on assessment of the quality status of the transboundary water bodies (coastal, lakes, rivers) in Gauja/Koiva river basin district.

2.2. Status assessment principles in Latvia

Latvia has not developed unified status assessment system. In general, there are three independent systems: ecological quality (biological, physico-chemical and hydromorphological quality), chemical quality (45 priority hazardous substances in water, sediments, biota) and quality of priority fish waters (salmonid and cyprinid, not all WBs belong in these categories). Water quality standards for priority substances and priority fish waters are available in Cabinet regulations No. 118 "Regulations Regarding the Quality of Surface Waters and Groundwaters". Physico-chemical quality standards have not gained official status yet and are based on the results of the project "Implementation of the Water Framework Directive 2000/60/EC in Latvia" (2004).

The overall assessment of the quality of water bodies is based on physico-chemical and biological parameters, where the assessment of biological quality elements are most important. If biological quality is good, then poor physico-chemical quality can downgrade overall quality to moderate. Hydromorphology can downgrade biological quality only from high to good, but there are only few such cases.

The methodology for the evaluation of biological quality elements covers almost all the biological quality elements required by Water Framework Directive 2000/60/EC. At the moment only phythobentos is notincorporated into methodology, however unofficially assessment is done using Estonian method. Biological quality elements used in Latvian rivers are: phytoplankton (in very large rivers with catchment > 10000 km^2), macroinvertebrates, macrophytes and fish. Biological quality elements used in lakes are: phytoplankton, macroinvertebrates, macrophytes and fish.

There are some exceptions regarding use of biological quality elements:

- Macrophytes and phytoplankton are not part of total quality assessment in dystrophic (humic) lakes,
- Macroinvertebrates are not used in small rivers with catchment area below 100 km^2.

In Latvia there are 6 types of river water bodies and 10 types of lake water bodies (Tables 5 and 6). Latvian river and lake typology are described in Cabinet Regulations No. 858 "Regulations Regarding the Characterisation of the Types, Classification, Quality Criteria of Surface Water Bodies and the Procedures for Determination of Anthropogenic Loads". For monitoring purpose also and lake type L4.1 (very shallow brownwater (> 80 Pt-Co) lakes with low conductivity (< 165 mkS/cm) and pH <6) and L8.1 (shallow brownwater (> 80 Pt-Co) lakes with low conductivity (< 165 mkS/cm) and pH <6) are used, but they are unofficial and are not included in national legislation. Gauja/Koiva river basin district is represented by all 6 river types and lake types L1, L2, L3, L4, L4.1, L5, L6, L7, L8, L8.1. It must be taken into account, that only rivers with catchment area > 10 km^2 and lakes with water surface area > 50 ha are considered to be separate water bodies. No lakes, belonging to L10 type, are included in surface monitoring network, because them are too small.

Table 5. River typology in Latvia.

Type	Catchment area	Slope	Type description
R1	Small (< 100 km2)	Large (> 1.0 m/km)	Small ritral-type river
R2	Small (< 100 km2)	Small (< 1 m/km)	Small potamal-type river
R3	Medium large (100-1000 km2)	Large (> 1.0 m/km)	Medium ritral-type river
R4	Medium large (100-1000 km2)	Small (< 1 m/km)	Medium potamal-type river
R5	Large (> 1000 km2)	Large (> 1.0 m/km)	Large ritral-type river
R6	Large (> 1000 km2)	Small (< 1 m/km)	Large potamal-type river

Table 6. Lake typology in Latvia.

Type	Average depth	Water hardness	Water color
L1	Very shallow (< 2 m)	Hard-water (> 165 mkS/cm)	Oligohumous (< 80 Pt-Co)
L2	Very shallow (< 2 m)	Hard-water (> 165 mkS/cm)	Polyhumous (> 80 Pt-Co)
L3	Very shallow (< 2 m)	Soft-water (< 165 mkS/cm)	Oligohumous (< 80 Pt-Co)
L4	Very shallow (< 2 m)	Soft-water (< 165 mkS/cm)	Polyhumous (> 80 Pt-Co)
L5	Shallow (2-9 m)	Hard-water (> 165 mkS/cm)	Oligohumous (< 80 Pt-Co)
L6	Shallow (2-9 m)	Hard-water (> 165 mkS/cm)	Polyhumous (> 80 Pt-Co)
L7	Shallow (2-9 m)	Soft-water (< 165 mkS/cm)	Oligohumous (< 80 Pt-Co)
L8	Shallow (2-9 m)	Soft-water (< 165 mkS/cm)	Polyhumous (> 80 Pt-Co)

Type	Average depth	Water hardness	Water color
L9	Deep (> 9 m)	Hard-water (> 165 mkS/cm)	Oligohumous (< 80 Pt-Co)
L10	Deep (> 9 m)	Soft-water (< 165 mkS/cm)	Oligohumous (< 80 Pt-Co)

After large-scale water body re-delineation in 2017/2019, Latvia now has 762 water bodies. Monitoring data are available only for 463 of them. Ecological status assessment was also carried out for rivers and lakes without any monitoring data. For that purpose was used water body grouping and data from older projects (for example, project "*Towards joint management of the transboundary Gauja/Koiva river basin district*"). Grouping was based on water typology, hydromorphology, land use on different scales, data from the most similar monitored WB and other parameters.

From all transboundary water bodies in this project, 4 of them are never monitored. Most of rivers belong to good ecological quality class and the only lake (Murati lake) is of good ecological quality (Table 7). Moderate quality mostly is associated with hydromorphological alterations (Vaidava_1, Vaidava_2, Pedele_2) and nutrient runoff from agricultural land (Pužupe, Melnupe_2).

Table 7. Transboundary surface water bodies and ecological status in 2018

Code	**Name**	**IC type**	**National type**	**Ecological status monitoring year**	**HYMO**	**Chemical status**
G319	Acupīte_1	R-C4	R4	2018	2	Unknown
D565	Akaviņa	R-C6	R1	G/K* 2012	2	Unknown
G274	Gauja_8	R-C5	R6	2017	2	Unknown
G329	Kaičupe	R-C6	R1	G/K 2011	3	Unknown
G331	Kolkupīte	R-C6	R2	G/K* 2012	1	Unknown
G233	Melnupe_2	R-C4	R4	2016	1	Unknown
G330	Omuļupe	R-C4	R4	Never	4	Unknown
D450	Pededze_1	R-C4	R3	2007	2	Unknown
G336	Pedele_1	R-C6	R2	Never	2	Unknown
G317	Pedele_2	R-C6	R3	2018	4	Unknown

Code	Name	IC type	National type	Ecological status monitoring year	HYMO	Chemical status
G332	Peļļupīte	R-C6	R1	Never	1	Unknown
G237	Pērļupīte	R-C6	R1	2016	2	Unknown
G333	Pužupe	R-C6	R2	G/K* 2012	3	Unknown
G307SP	Ramata	R-C6	R4	2018	4	Unknown
G314	Rūja_1	R-C4	R3	G/K* 2012	1	Unknown
G334	Vaidava_1	R-C4	R3	Never	2	Unknown
G235	Vaidava_2	R-C4	R3	2016	4	Unknown
E205	Muratu ezers	L-CB1	L6	2017	2	Unknown

*G/K- Gauja/Koiva project

2.3. Harmonized status for transboundary water bodies

Most of these water bodies had the same ecological status class (14) before harmonization. Some transboundary water bodies (Peetri/Melnupe_2, Pērļupīte/Pärlijõgi_1, Vaidva_1/Vaidava_1) had different ecological statuses (Tables 4 and 7). These differences are mainly caused by biological quality element (BQE) fish - water bodies have obstacles/dams or hydropower plant dams. All the obstacles are lowering the fish status by causing pressure in fish migration and free movement along the river. From monitoring results both countries have clear understanding that BQE fish is under severe impacts. Latvia considers benthic macroinvertebrates also to be a sensitive indicator that allows to detect hydromorphological alterations.

Chemical status of most water bodies (15) in both countries had never been monitored. The available data on three water bodies originates from a previous international project *Towards Joint Management of the Transboundary Gauja/Koiva River Basin District* (Kalvane I. and Veidemane K. (eds.), 2013). Estonia has adopted these data into national status assessment but Latvia has not, only using them as supporting information, because hydrochemical elements was sampled only in summer.

Therefore, there is a need to harmonize the ecological statuses of three water bodies and chemical statuses of three other water bodies to support (international) water management, monitoring planning, and for reporting tasks for European Commission.

2.3.1. Main principles for status harmonizing process

In the status harmonization process the status assessment of both countries was considered. The monitoring results were given higher confidence level than the modelling results. Results after harmonization are presented in table 8.

Table 8. Transboundary surface water bodies and statuses after harmonizing.

No.	Common code	Common name	Common Ecological Status	Not good BQE, reason	Common Chemical Status	Not good CQE, reason
1	EELV1010	Atse/Acupīte_1	Good			
2	EELV1001	Gauja_8/Koiva_1	Good		Bad	Polybromdiphenylethers (PBDEs)
3	EELV2002	Läteperä/Akaviņa	Good			
4	EELV1015	Pedeli_1/Pedele_1	Good			
5	LVEE1016	Pedele_2/Pedeli_2	Moderate	Fish (HPP-s)*	Good	
6	EELV2001	Pedetsi/Pededze_1	Good			
7	LVEE1003	Peļļupīte/Peeli	Good			
8	EELV1004	Peetri/Melnupe_2	Moderate	Macroinvertebrates, agricultural pressure		
9	EELV1011	Penuoja/Kolkupīte	Good			
10	EELV1012	Puupe/Pužupe	Good			
11	LVEE1005	Pērļupīte/Pärlijõgi_1	Good/ Poor**			
12	EELV1013	Raamatu/Ramata	Good			
13	EELV1014	Ruhja/Rūja_1	Good			

No.	Common code	Common name	Common Ecological Status	Not good BQE, reason	Common Chemical Status	Not good CQE, reason
14	EELV1006	Ujuste/Kaiču pe	Good			
15	EELV1007	Vaidva_1/Va idava_1	Moderate	Fish, macroinvert ebrates (HPP-s)*		
16	LVEE1008	Vaidava_2/V aidva_2	Moderate	Fish (HPP-s)*		
17	EELV1017	Õhne_2/Omu ļupe	Good			
1	EELV1009	Murati järv/Muratu Ezers	Good		Bad	Polybromdiphe nylethers (PBDEs)

*HPP – hydro power plant

** Status difference between countries because fish are in poor status in the waterbody due to dams, but the water body is very small on Latvian side, therefore fish as a quality element are not considered in status assessment.

3. Characteristics of transboundary water bodies in project area

The Water Framework Directive (WFD) introduces the principle that water management planning should be based on natural, not administrative boundaries. The Member States of the European Union must coordinate the management of international river basin districts within their territory, including the assessment of the quality of transboundary rivers and lakes by neighboring countries.

In project area there are 18 transboundary water bodies (Figure 12) :

- 17 transboundary river water bodies (one of them is a heavily modified water body);

- 1 transboundary lake water body.

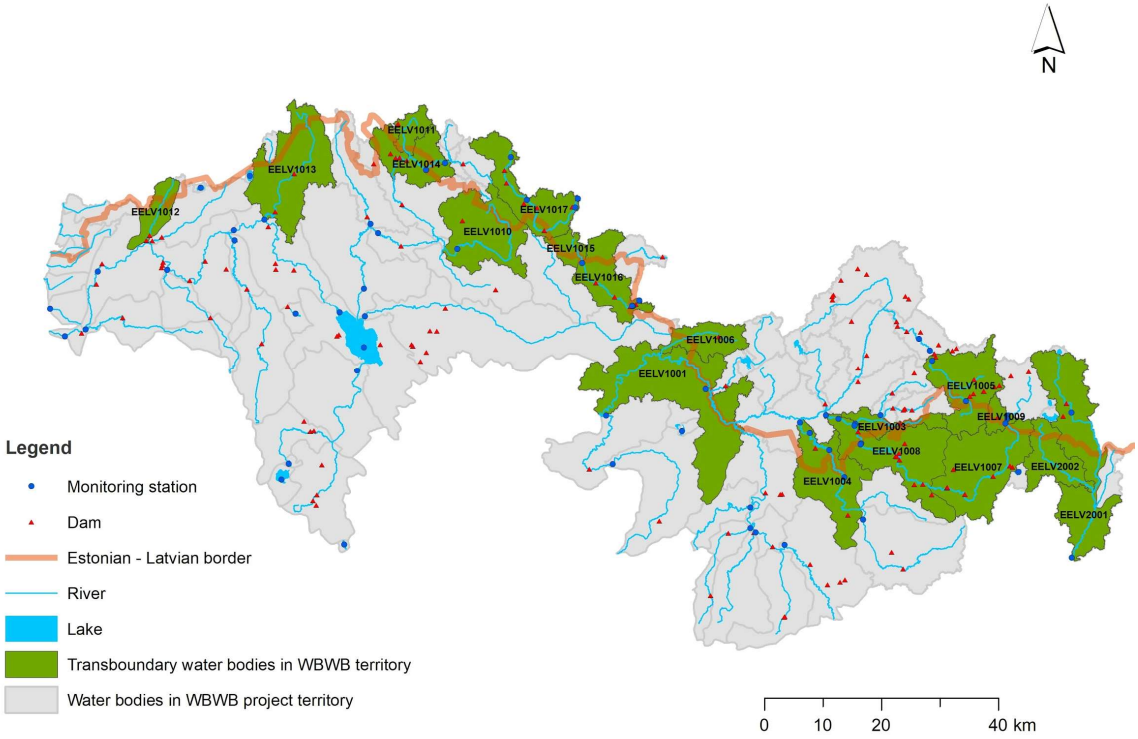

Figure 12. Estonian – Latvian transboundary water bodies.

Common description and information about status and pressures for transboundary water bodies will be of high importance during the next reporting of 3rd cycle River basin management plans.

3.1. Transboundary river water bodies

3.1.1. Water body Gauja_8/Koiva_1 (EELV1001)

Latvian part

New water body Gauja, from tributary Mustjogi River to tributary Vija, new national code G274. It previously belonged to the Gauja water bodies G225 and G231. The upper part and part of the middle of the water body flows along the Latvian – Estonian border. Water body area in Latvia is 253.46 km^2. The catchment area is 2944.03 km^2. Length of the water body is 60.8 km and slope – 0.18 m/km. According to Latvian typology, this water body belongs to type R6. The river bed is natural. There are several oxbow lakes in floodplain. The water body area is covered mostly in forests – 64.3% and agricultural lands – 34.1%. Urban areas are scarce and anthropogenic pressure is minimal. There is an existing monitoring station "Gauja, downstream Kāršupīte". The ecological quality is good. The water body is located in the specially protected nature territory "Ziemeļgauja".

Estonian part

An existing water body Koiva_1 (1154200_1) (Figure 13). It is a natural water body. Catchment area in Estonia is 50.5 km^2. Length of the water body is 24.7 km. According to Estonian typology, this water body belongs to type V3B. Catchment area consists of 79.2% forest land and 19% agricultural land. Urban areas are small and anthropogenic load is moderate. There is no monitoring station on the water body. Ecological quality is good. The water body is located in the "Koiva-Mustjõe landscape conservation area".

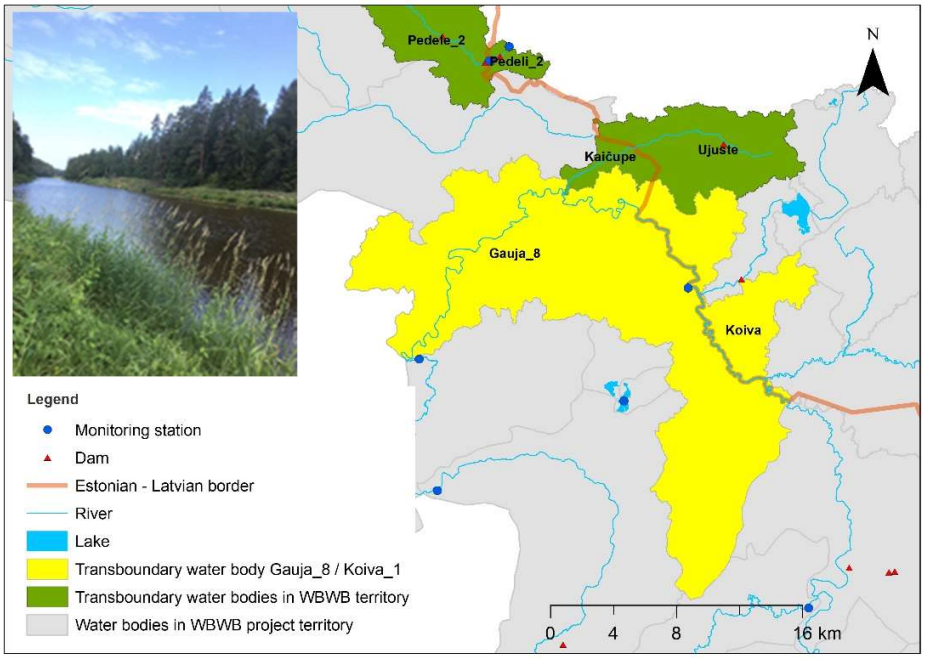

Figure 13. Transboundary water body Gauja_8 / Koiva. In photo - Gauja, 1 km from Vija mouth, Latvia (2018).

3.1.2. Water body Peetri/Melnupe_2 (EELV1004)

Latvian part

River WB Melnupe (G233), from tributary Blīgzne to Latvian-Estonian border (Figure 14). In comparison to previous water body boundary, River Blīgzne is separated from the water body. Area of water body is 104.31 km^2. Total catchment area in Latvia is 239.34 km^2. Length of the water body is 21.6 km, slope – 0.59 m/km. Water body belongs to type R4. It is naturally meandering with oxbow lakes, however there are also some straightened sections. The water body area is covered in forests – 57.6%, agricultural lands – 38.1% and bogs – 3.6%. There is a small impact of livestock farming and also Trapene wastewater treatment plant. Existing monitoring station "Melnupe, Latvia – Estonian" border. The ecological quality is moderate.

Estonian part

Water body Peetri (1158700_1), from Latvian – Estonian border to Mustjõgi. The catchment area in Estonia is 39.2 km^2. Length of the water body is 24.9 km. Water body belongs to type V2B. The catchment area is mostly covered in forest (74.6%). Share of agricultural land is 23.5%. Water body has been monitored during Est-Lat IR project "Towards joint management of the transboundary Gauja/Koiva river basin district" in 2012. The ecological status is good. Water body is located in 3 protected areas: Peetri river landscape conservation area, Peetri river limited-conservation area and Koiva-Mustjõe landscape conservation area.

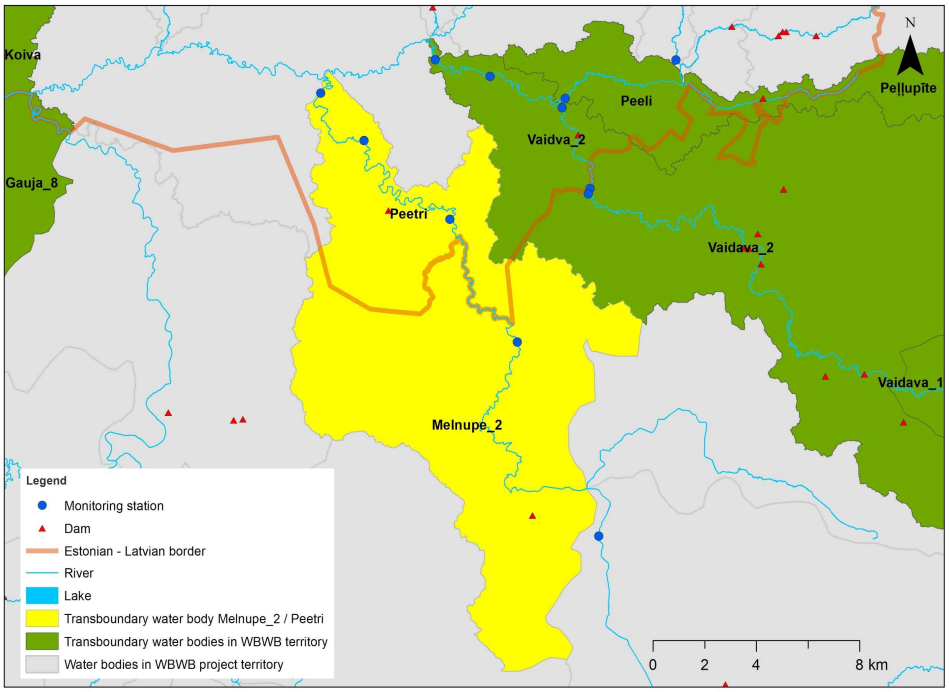

Figure 14. Transboundary water body Peetri / Melnupe_2.

3.1.3. Water body Vaidva_1/Vaidava_1 *(EELV1007)*

Latvian part

New water body Vaidava_1 (G334), from Murati lake (transboundary water body) to tributary Bēteru steram (Figure 15). The upper part of the water body flows along the Latvian – Estonian border. Water body area is 172.5 km^2. The catchment area is 267.2 km^2. Length of the water body is 40.2 km and slope – 1.1 m/km. Water body type is R3. The water body area is covered mostly in forests – 62.3% and also agricultural lands – 35.5%. Middle part of this water body is straightened. The water body has remnants of several old obstacles, but the main effect of river continuity is from the barriers in the downstream water body. There are no significant anthropogenic nutrient load sources in water body area. Ecological quality is likely to be moderate due to several barriers obstructing it.

Estonian part

New water body Vaidava_1 (1158000_1), part from Murati lake and running along Estonian-Latvian border. The catchment area in Estonia is 8.5 km^2. Length of the water body is 3.7 km. Water body type is V2B. Most of the catchment area is covered in forest 92.6%. There is no monitoring stations, but ecological quality is likely to be good.

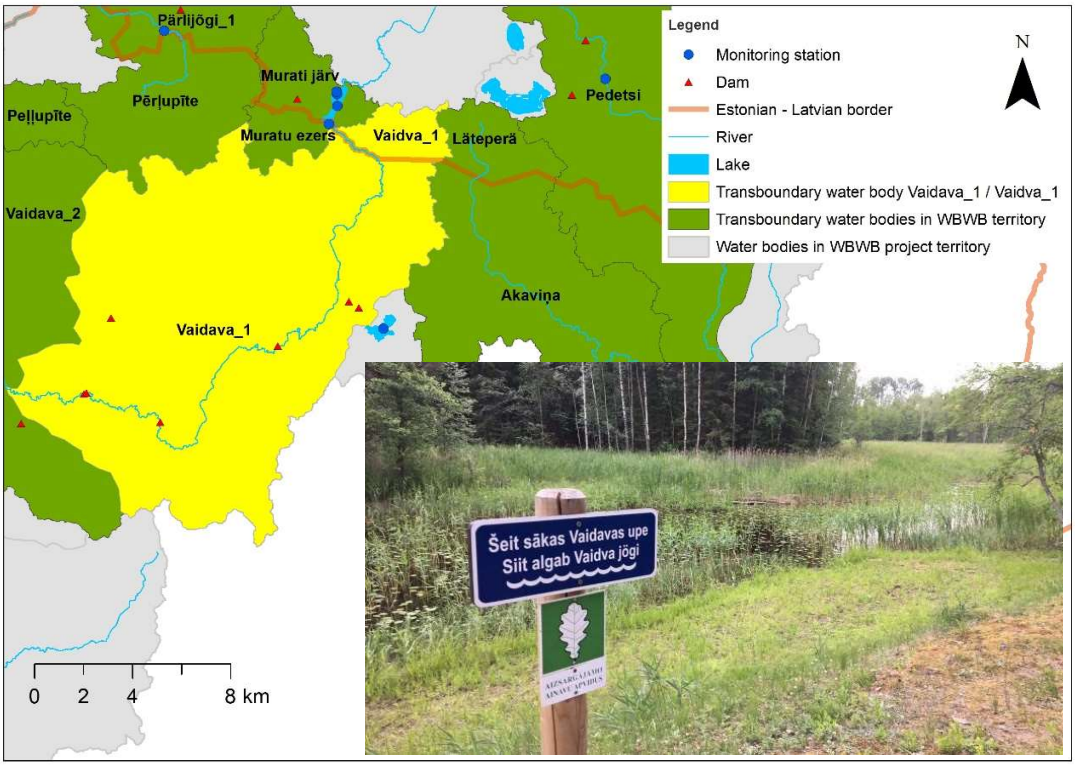

Figure 15. Transboundary water body Vaidava_1 / Vaidva_1. In photo – Vaidava / Vaidva river at the source (2019).

3.1.4. Water body Vaidava_2/Vaidva_2 *(LVEE1008)*

Latvian part

An existing water body Vaidava (G235), from tributary Bēteru stream to Latvian – Estonian border (Figure 17). Water body area is 146.26 km^2. The total catchment area is 413.46 km^2. Length of the water body is 29.5 km and slope – 1.77 m/km. This part of the river can be described as an excellent example of fast-flowing rithral river (national type R3). The water body area is covered with forests – 56%, agricultural lands – 42.1% and urban areas 1.2%. On the river there is Grūbe HPP, one of the most environmentally friendly HPPs in Latvia. River upstream and downstream Grūbe HPP can be seen in Figure 16. There is also Karva HPP, with a history of complaints about HPP operating during low-flow periods. Karva HPP has a fish pass, but it's efficacy has not been studied. There are other hydromorphologic changes in the water body and a potential impact from Ape village and other smaller village wastewater treatment plants. Existing monitoring station - "Vaidava, Latvia – Estonian border". Ecological quality is moderate. General physico - chemical quality is good (2016), but biological quality elements are affected by hydromorphological modifications. Part of the water body is located in the specially protected natural territory "Veclaicene".

Figure 16. Vaidava, upstream of Grūbe HPP (2018) and Vaidava, downstream Grūbe HPP (2018).

Estonian part

An existing water body Vaidva_2 (1158000_2) from Latvian-Estonian border to Mustjõgi (Figure 17). The catchment area in Estonia is 25.7 km^2. Length of the water body is 14.9 km. Water body belongs to type V2B. The catchment area is covered in forests – 61.6%, agricultural lands – 35.4%. On the river there is Vastse-Roosa HPP (Figure 17). In 2013 confirmation from dams inventory situation was assessed as good as fishpass was constructed, but in later years (2014─2017) it has not worked effectively because of the massive water overflow and damaged dam facilities.

There are 3 existing monitoring stations on the water body. The ecological status is moderate. The not good quality element is fish.

Water body is located in three protected areas: Vaidva river limited-conservation area, Mõisamõtsa conservation area and Koiva-Mustjõe landscape conservation area.

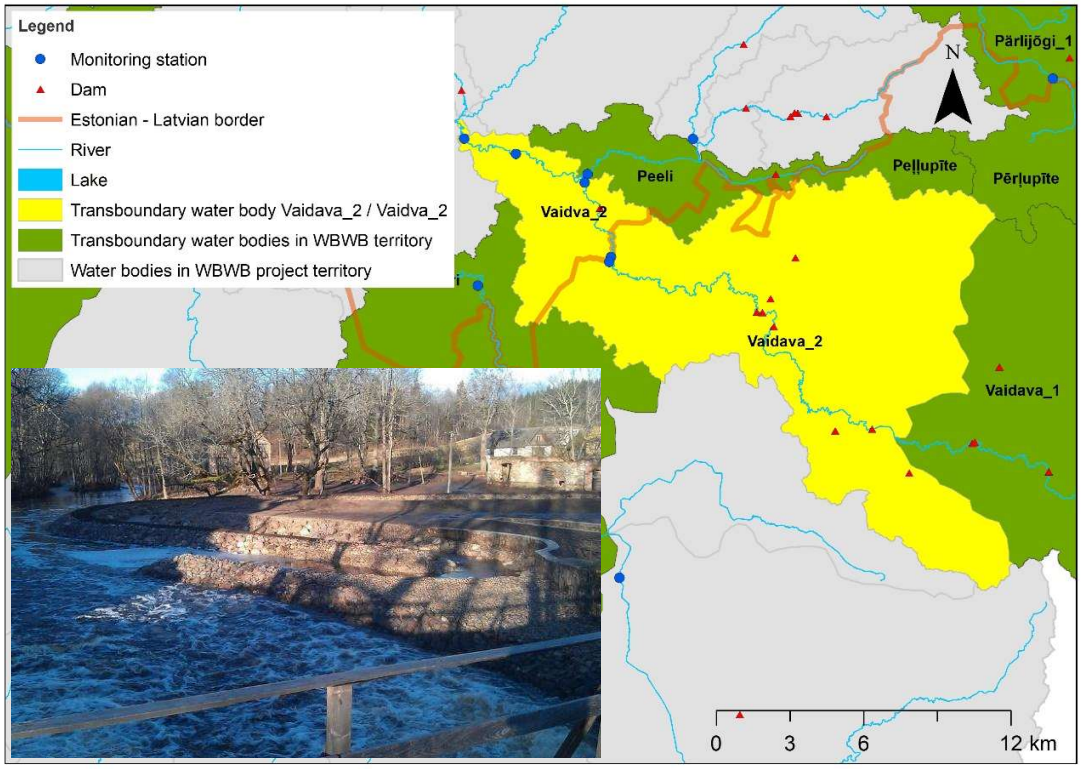

Figure 17. Transboundary water body Vaidava_2 / Vaidva_2. In photo - Vastse-Roosa fishpass on Vaidva in Estonia (2012).

3.1.5. Water body Pērļupīte/Pärlijõgi_1 *(LVEE1005)*

Latvian part

An existing water body Pērļupīte (G237), from the source (lake Trumulītis) to Latvian – Estonian border (Figure 18). The catchment area is 56.7 km^2. Length of the water body is 9.1 km and slope – 2.4 m/km. Water body type is R1. The water body is natural. Its area is covered in forests – 61.9% and agricultural lands – 35%. Population density is low. Existing monitoring station Mustigi (Pērļupīte), Latvian – Estonian border. Ecological quality is good (assessed in 2016). Part of the water body is located in the specially protected nature territory "Veclaicene".

Estonian part

An existing water body Pärlijõgi_1 (1155700_1), from Latvian-Estonian border to Saarlase dam. The catchment area in Estonia is 95.7 km^2 and length of the water body is 26.3 km. Water body type is V1A. The catchment area is covered in forest - 64.2% and agricultural land - 31.6%. Water body is located in 3 protected areas: Pärlijõgi meadow limited-conservation area, Luhasoo conservation area and Pärlijõgi limited-conservation area.

Water body has no monitoring station. General physico-chemical quality is likely to be good, but biological quality elements are affected by hydromorphological modifications. There are 3 dams on the water body: Mustahamba, Saarlasõ and Pärlijõe. Hydromorphological status of the water body is moderate because of the obstacles - dams. There are no good solutions available to construct a fish pass.

Figure 18. Transboundary water body Pērļupīte / Pärlijõgi_1. In photo – Pērļupīte in Latvia, straightened part (2019).

3.1.6. Water body Ruhja/Rūja_1 *(EELV1014)*

Latvian part

New water body Rūja, from Latvian – Estonian border to tributary Raudava, code G314. Transboundary water body which flows along the Latvian – Estonian border (Figure 19). Water body area is 51.15 km^2. The catchment area is 172.23 km^2. Length of the water body is 19.2 km and slope – 0.76 m/km. Water body type is R4. The river is mostly natural, but in some parts remains of former obstacles can be found.. The water body area is covered mostly in bogs – 75.5%, forests – 21.5 % and agricultural lands – 2.8%. There is a potential impact from Lode wastewater treatment plants and farms. Ecological quality is likely to be good. Water body is located in the specially protected nature territory "Ziemeļvidzemes biosfēras rezervāts".

Estonian part

New water body Ruhja (1153600_1), from Ruhijärv to Estonian-Latvian border (Figure 19). The catchment area is 23.8 km^2. Length of the water body is 15.3 km. Water body type

is V1B-KaVo. The catchment area is covered in forest - 70.5% and agricultural land - 29.5%. There is a monitoring station on the river. Ecological quality is good (assessed in 2017).

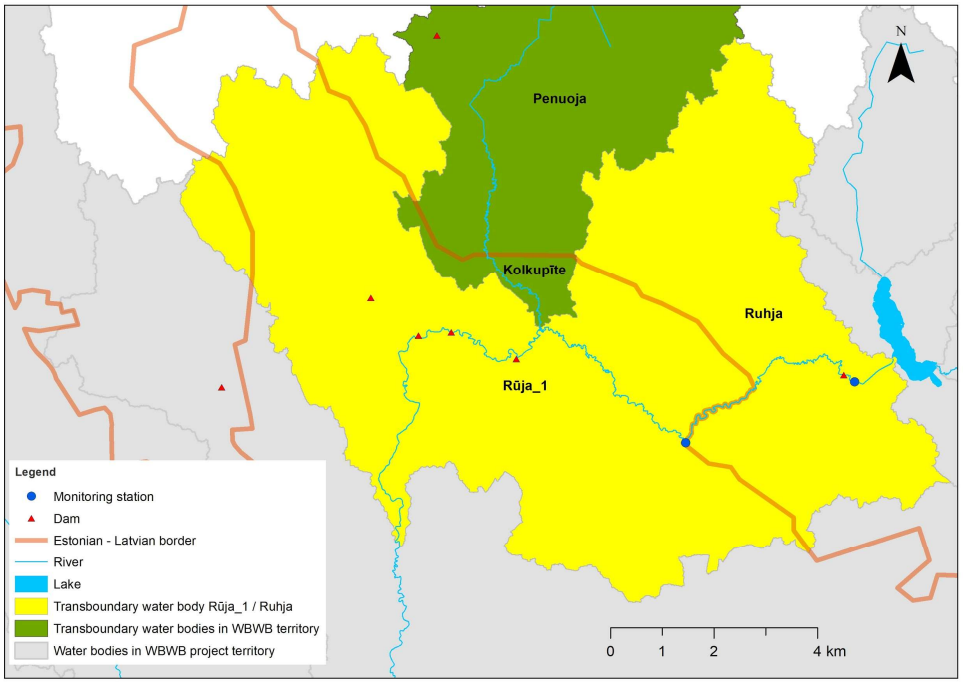

Figure 19. Transboundary water body Rūja_1 / Ruhja.

3.1.7. Water body Raamatu/Ramata *(EELV1013)*

Latvian part

An existing water body Ramata (G307HM), from Latvian - Estonian border to river mouth, Salaca (Figure 20). Water body area is 157.79 km^2. Catchment area is 178.07 km^2. Length of the water body is 27.1 km and slope – 0.68 m/km. Water body type is R4. The water body area is covered in forests – 70.7%, agricultural lands – 25.4% and bogs – 3%. Rauska HPP is located in the middle of the water body, remains of former impoundment are located in downstream reaches. There is also a potential impact from village Ramata, from a farm and a sawmill. Ecological potential is good. Existing monitoring station is located close to river mouth where river is natural and thereby no pressures can be assessed. Water body is located in the specially protected nature territory "Ziemeļvidzemes biosfēras rezervāts" as well as part of the water body in "Salacas ieleja".

Estonian part

New waterbody Raamatu (1153000_1), from source to Estonian-Latvian border (Figure 20). The catchment area is 8.9 km^2. Length of the water body is 5.4 km. Water body type is V1B-KaVo. The catchment area is covered in forests - 73.6% and agricultural lands - 21%. Water body is heavily modified due to agricultural drainage. Water body has no

existing monitoring station and has never been monitored. Overall, status of the waterbody could be good.

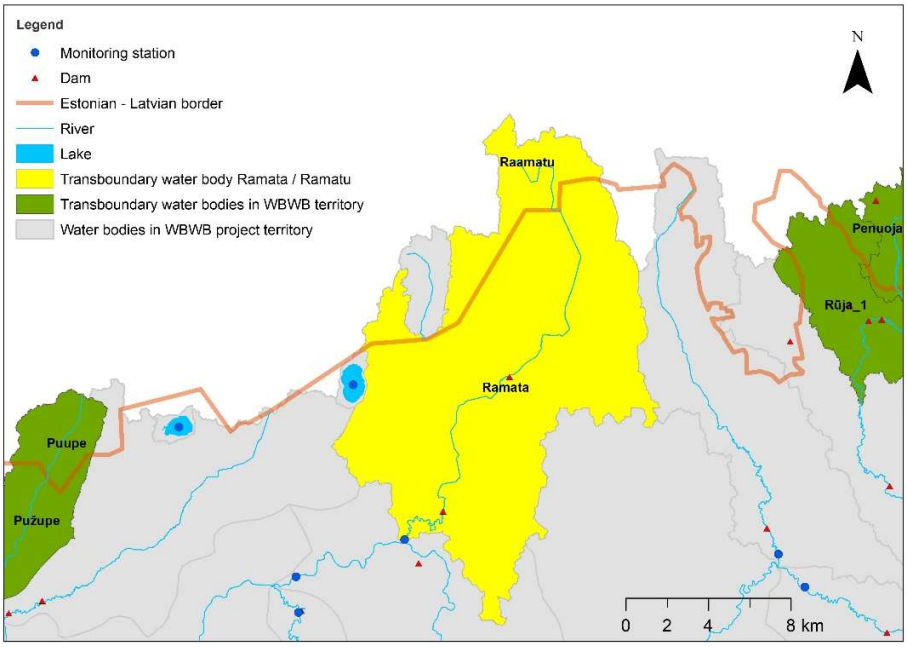

Figure 20. Transboundary water body Ramata / Raamatu.

3.1.8. Water body Pedeli_1/Pedele_1 *(EELV1015)*

Latvian part

New water body Pedele, from Latvian - Estonian border to tributary Ezupe, code G336 (Figure 21). The water body was delineated from water body Seda (G316). Transboundary river water body, river belongs to Peipus Lake catchment. Water body area is 7.87 km^2. The catchment area is 27.54 km^2. Length of the water body is 4.5 km and slope – 0.23 m/km. Water body type is R2. The whole length of the river is straightened. The water body area is covered mostly in forests – 96.2%. There are no significant pressures on the water body identified and ecological quality is likely to be good. Water body is located in the specially protected nature territory “Ziemeļvidzemes biosfēras rezervāts”.

Estonian part

Existing water body Pedeli_1 (1012100_1), from the source of river to Estonian-Latvian border (Figure 21). The catchment area is 17.4 km^2. Length of the water body is 6.2 km. Water body type is V1B-KaVo. The catchment area is covered with forest 98.8%. Water body has never been monitored. Ecological quality is likely to be good.

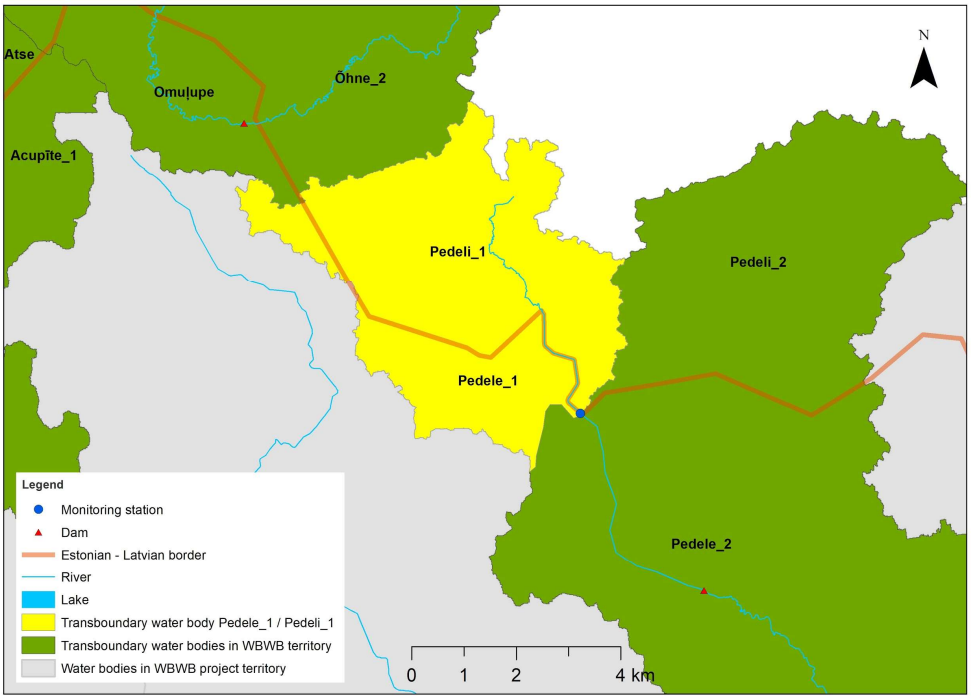

Figure 21. Transboundary water body Pedeli_1 / Pedele_1.

3.1.9. Water body Pedele_2/Pedeli_2 *(LVEE1016)*

Latvian part

New water body Pedele_2, from tributary Ezupe to Latvian - Estonian border, code G317 (Figure 22). The water body is delineated from the water body Seda (G316). Transboundary river water body, river belongs to Peipus Lake catchment. Water body area is 63.79 km^2. The catchment area is 115.62 km^2. Water body length is 12.5 km and slope – 1.56 m/km. Water body type is R3. Upstream part of water body is straightened, but downstream part is affected by hydropower and other impoundments. The water body area is covered in forests – 66.7%, agricultural lands – 20.3% and urban areas – 6.6% (Valka/Valga city). There is a potential impact from urban areas and Valka/Valga wastewater treatment plants. Hydromorphologically strongly affected water body: there are two HPP (Dzirnavnieku and Kalndzirnavu) and several sluices in Valka. Ecological quality assessment was done in 2018 and ecological quality is moderate (impact from hydromorphological modifications). According to Latvian fish experts, Pedele is important river for fish resources and thereby can not be considered as HMWB in Latvian side. Water body is located in the specially protected nature territory "Ziemeļvidzemes biosfēras rezervāts".

Estonian part

A new water body Pedeli_2 (1012100_2), from Estonian – Latvian border to a bridge on Pikk street in Valga town. The catchment area in Estonia is 30.1 km^2. Length of the water

body is 1.8 km. Water body type is V2B. It is a heavily modified water body. Hydromorphologically very affected water body: there are four dams on the water body. It has been decided that ecological status of the water body is good.

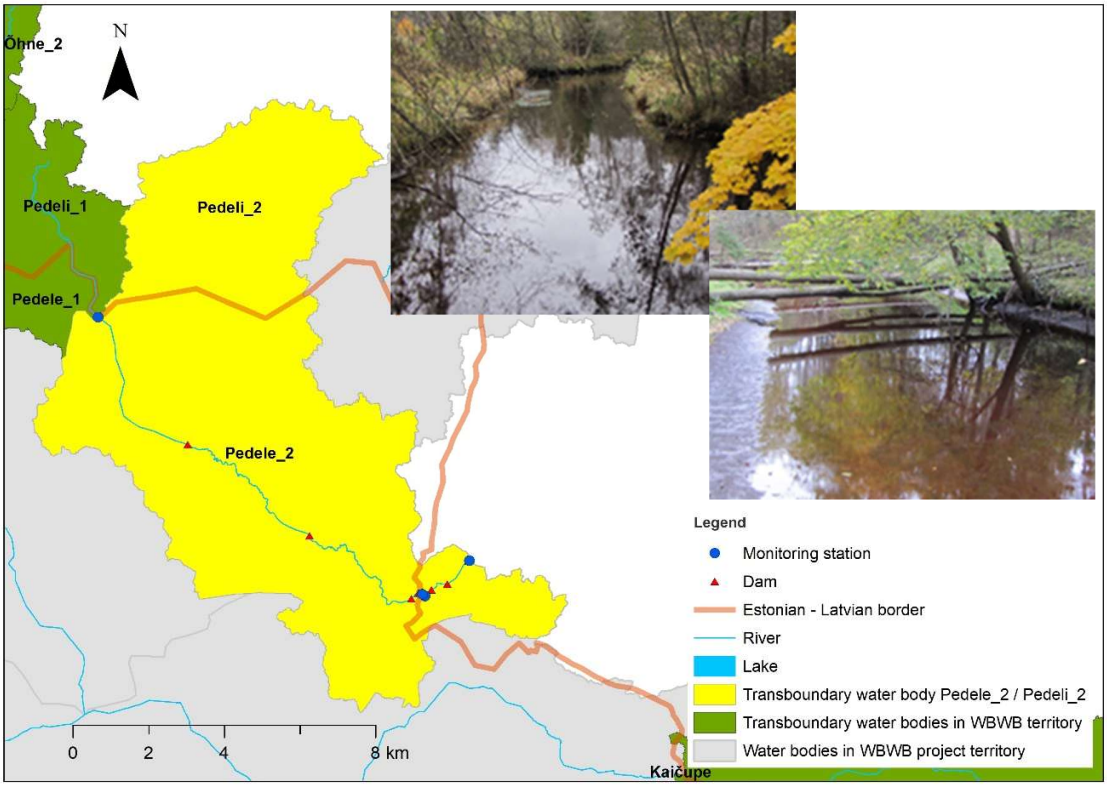

Figure 22. Transboundary water body Pedele_2 / Pedeli_2. In photos - Pedele, upstream Valka (2018).

3.1.10. Water body Ujuste/Kaičupe *(EELV1006)*

Latvian part

New water body Kaičupe, from Latvian – Estonian border to the river mouth (Gauja), code G329 (Figure 23). Transboundary water body which the source in Estonia. Water body area is 10.31 km^2. Catchment area is 61.77 km^2 (together with Estonia). Length of the water body is 7.3 km and the slope – 1.02 m/km. Water body type is R1. On the Latvian side, the water body is straightened in upstream and downstream parts. The water body area is covered with forests – 64.6%, agricultural lands – 26.2% and bogs – 9.2%. Population density is very low. There are no significant pressures on the water body. Ecological quality is likely to be good. Part of water body is located in the specially protected nature territory "Ziemeļgauja".

Estonian part

Water body Ujuste (1154300_1), from lake Kiiviti to Estonian-Latvian border (Figure 23). The catchment area in Estonia is 51 km^2. Length of the water body is 10.2 km. Water body

type is V1A-KaVo. The catchment area is covered in forests - 43.7% and agricultural lands - 55.7%. The water body is entirely in a straight artificial bed, but there are no other significant pressures. According to the monitoring results of 2012, the status of the water body is good.

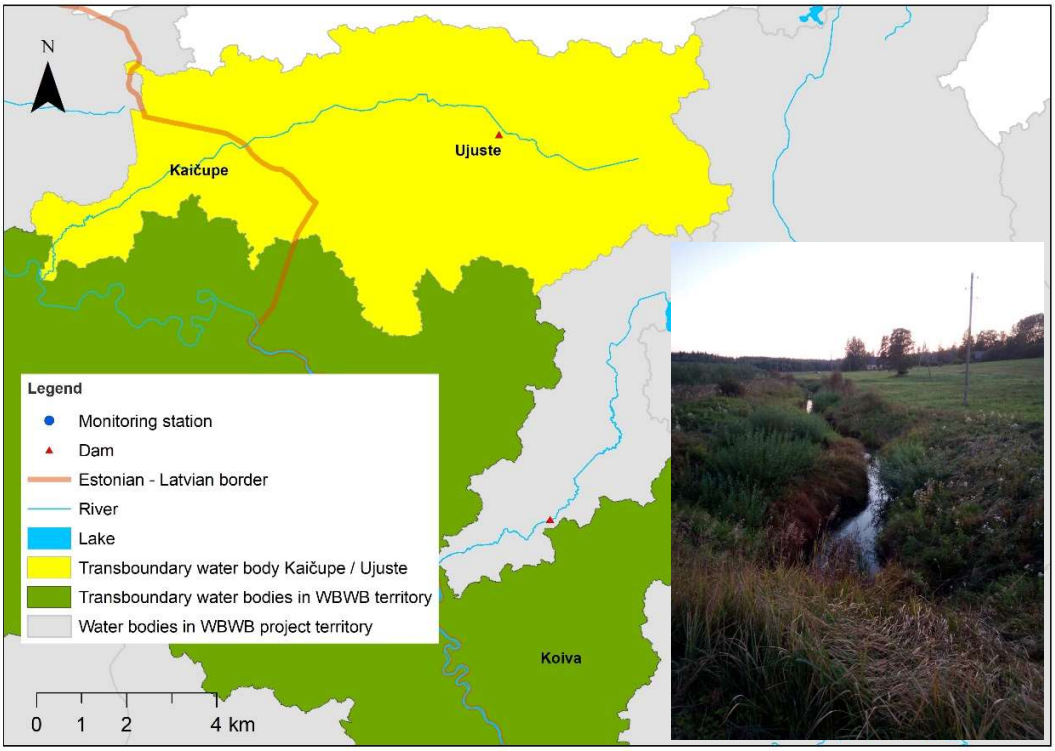

Figure 23. Transboundary water body Kaičupe / Ujuste. In photo – Kaičupe in Latvia (2019).

3.1.11. Water body Õhne_2/Omuļupe *(EELV1017)*

Latvian part

New water body Omuļupe, from Estonian-Latvian border back to Latvian-Estonian border, code G330 (Figure 24). Transboundary river which source and mouth are located in Estonia. Water body area is 9.1 km^2. Catchment area is 167.15 km^2. Length of the water body is 6.1 km, slope – 0.29 m/km. Water body type is R4. The water body downstream flows through the Omuļu reservoir (without HPP). The water body is natural. Water body area is covered in forests – 86% and agricultural lands – 14%. There is a quarry "Omuļi" (orthophoto map shows activity had been taking place in recent years). The impact on the water body is not significant. Ecological quality is likely to be good, although a large impoundment creates a barrier for migratory fish. Water body is located in the specially protected nature territory "Ziemeļvidzemes biosfēras rezervāts".

Estonian part

Transboundary water body from Ikepera stream Käärikmäe–Koorküla road to Koorküla bridge (1013700_2). The catchment area in Estonia is 108.1 km^2. Length of the water body is 39 km. Water body type is V2B. On the water body there is Koorküla Veskejärve dam (HPP). The water body is natural. The catchment area is covered with forests – 77% and agricultural lands – 19%. Downstream the Latvian border water body is located in Õhne river limited-conservation area. Water body has 2 monitoring stations. Ecological status is moderate. Main pressures reasons are HPP, historical pollution, dams and obstructed river continuity.

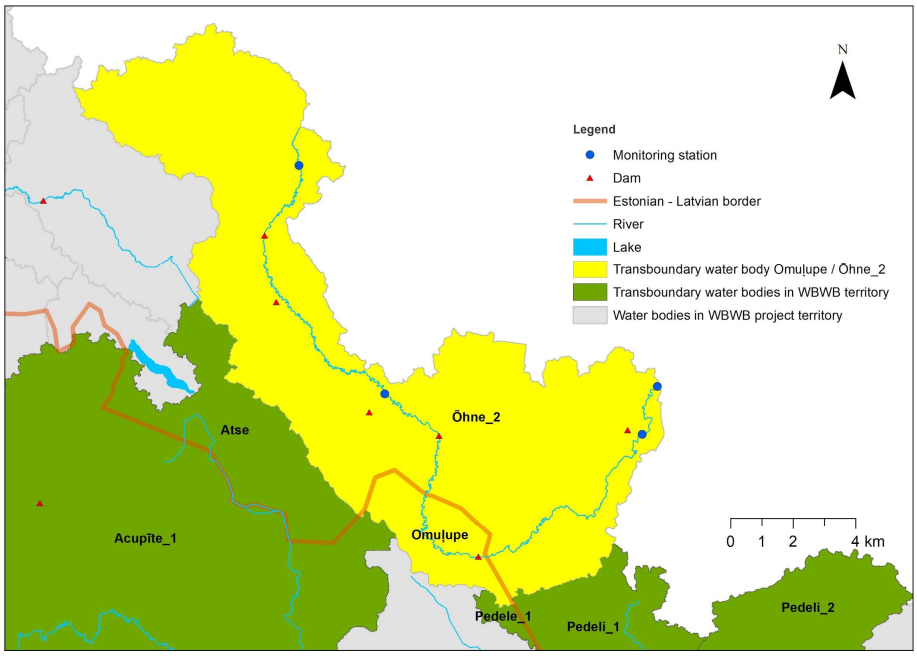

Figure 24. Transboundary water body Õhne_2 / Omuļupe.

3.1.12. Water body Penuoja/Kolkupīte *(EELV1011)*

Latvian part

New water body Kolkupīte, from Latvian – Estonian border to the river mouth (Rūja), code G331 (Figure 25). Transboundary river, source is located in Estonia. Water body area is 2.55 km^2. The catchment area is 30.83 km^2. Length of the water body is 3 km and the slope – 0.03 m/km. Water body type is R2. The water body is natural. The water body area is covered mostly in forests – 98.4%. Population density is low. According to initial assessment there are no significant pressures in the water body. Possible ecological quality is good. Water body is located in the specially protected nature territory "Ziemeļvidzemes biosfēras rezervāts".

Estonian part

New waterbody Penuoja (1153200_1), from the source to Estonian-Latvian border (Figure 25). Catchment area is 26.5 km^2. Length of the water body is 10.2 km. Water body is heavily modified due to agricultural drainage. Type of the water body is V1B-KaVo. Catchment area is covered in forests – 48.5% and agricultural lands – 51.5%. Water body has never been monitored. Ecological status is likely to be good.

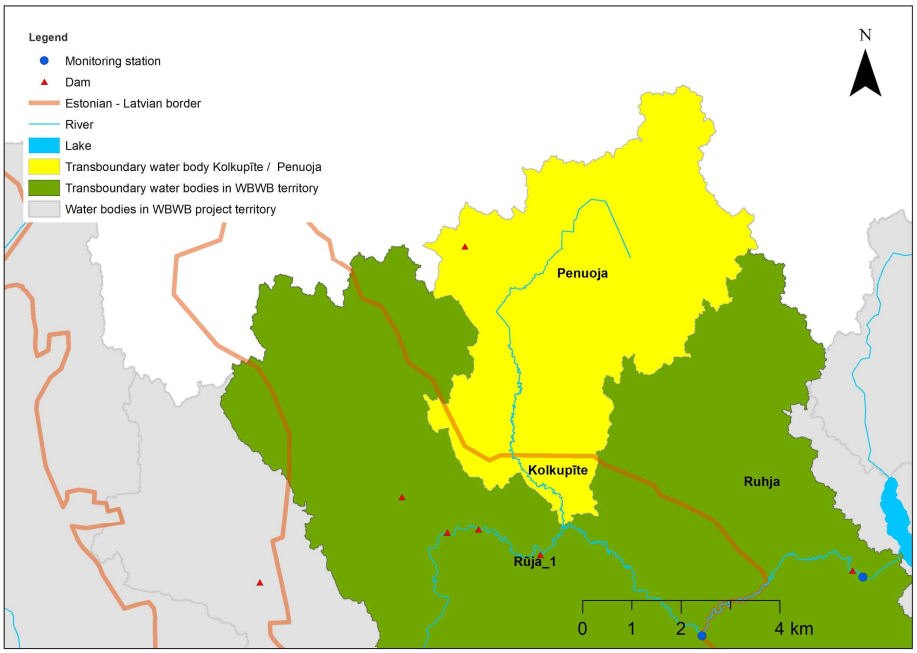

Figure 25. Transboundary water body Penuoja / Kolkupīte.

3.1.13. Water body Peļļupīte/Peeli *(LVEE1003)*

Latvian part

New water body Peļļupīte, from the source to Latvian-Estonian border, code G332 (Figure 26). Transboundary river which flows along Latvian-Estonian border. The source of water body is located at Ilgājs (lake Vizla) on the Latvian border but Peļļupīte river mouth is located in Estonia. The catchment area is 19.08 km^2(14.68 km^2 in latvia). Length of the water body is 4.3 km and slope – 5.9 m/km. Water body type is R1. The water body in the upstream passes through three transboundary lakes (free of locks): Sūneklis (Sarapuu järv), Smilšājs (Liivajärv) and Peļļu lake (Mudajärv). Lake Peļļu is overgrown with macrophytes. The water body flows along the border, in the middle entering Estonia and afterwards returning back towards the border and then again entering Estonia. The water body area is covered in forests – 60.4% and agricultural lands – 38.6%. There are no significant pressures on the Latvian side. Ecological quality is likely to be good. The water body borders with the specially protected nature territory “Veclaicene”.

Estonian part

Water body Peeli (1158100_1), from the Latvian-Estonian border to the river mouth, Vaidva (Figure 26). Catchment area is 21 km^2. Length of the water body is 17.1 km. Water body type is V1B. Catchment area is covered in forests – 60.1% and agricultural lands – 39.3%. On the water body there is Oruveski dam (not a HPP). Downstream of the water body there is a monitoring station (last monitored in 2007). No significant pressures. Ecological quality is likely to be good.

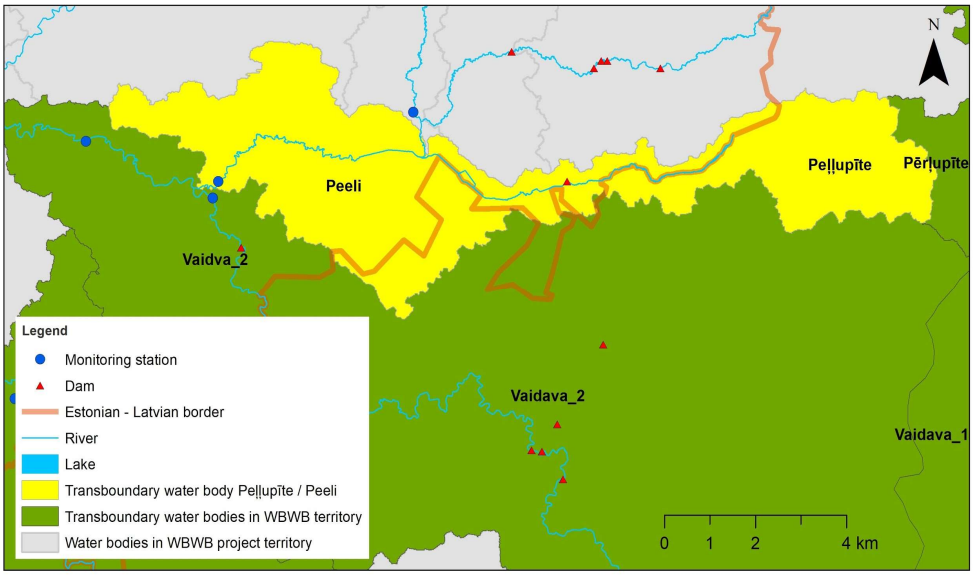

Figure 26. Transboundary water body Peļļupīte / Peeli.

3.1.14. Water body Atse/Acupīte_1 *(EELV1010)*

Latvian part

New water body Acupīte, from the source (lake Pilicis) to tributary Ķīre, code G319 (Figure 27). Transboundary water body, source located in Latvia. It flows along the Latvian-Estonian border and then through the territory of Latvia. Water body area is 134.51 km^2. The catchment area is 155 km^2. Length of the water body is 36.5 km and slope – 0.87 m/km. Water body type is R4. Some sections of water body are natural and some are straightened. All catchment area is heavily ameliorated. The water body in the upstream flows through lake Pukšezers (Pupsi järv). The water body area is covered in forests – 71% and agricultural lands – 28.2%. Several farms are located within the catchment area that may have a potential impact on the water body. The ecological quality is good. Water body is located in the specially protected nature territory “Ziemeļvidzemes biosfēras rezervāts”.

Estonian part

Water body Atse (1154000_1), from Latvian-Estonian border into Estonia and back to the border (Figure 27). A small part of water body is located on the territory of Estonia. The catchment area in Estonia is 19.9 km^2. Length of the water body is 7.3 km. Water body type is V1B-KaVo. The catchment area is mostly covered in forests – 96%. Ecological status is likely to be good.

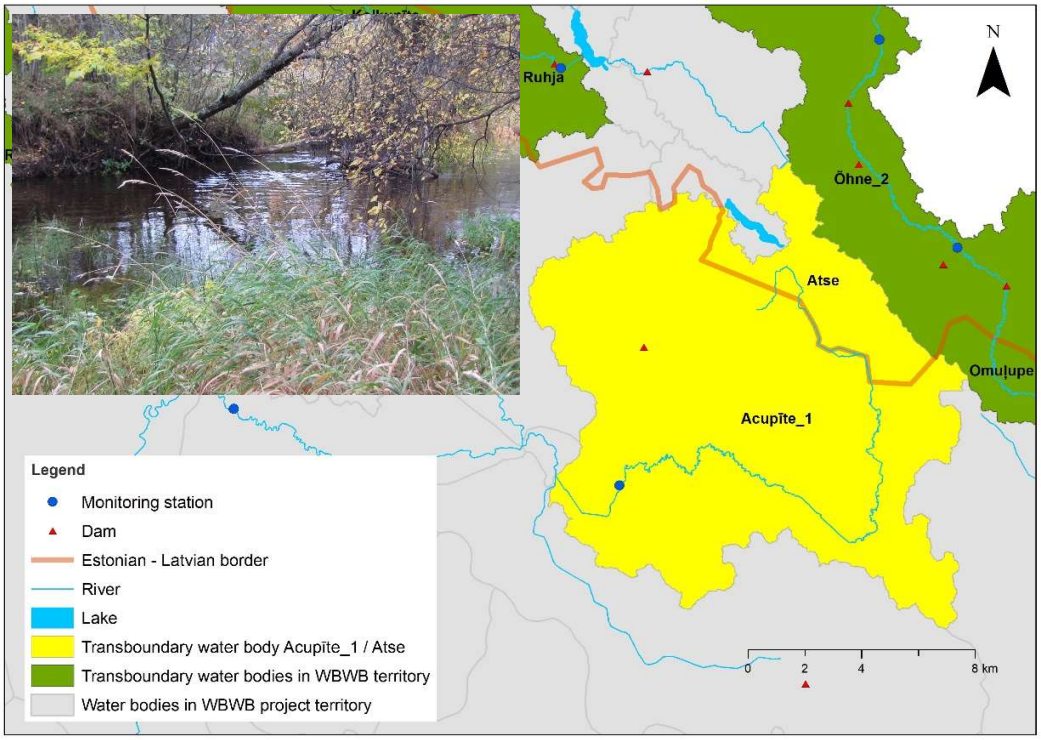

Figure 27. Transboundary water body Atse / Acupīte_1. In photo – Acupīte near Ērmuiža in Latvia (2018).

3.1.15. Water body Puupe/Pužupe *(EELV1012)*

Latvian part

New water body Pužupe, from Latvian – Estonian border to the river mouth (Salaca), code G333 (Figure 28). Water body area is 30.59 km^2. The catchment area is 40.3 km^2. Length of the water body is 9.2 km and the slope – 0.19 m/km. Water body type is R2. The water body area is covered by forests – 71.5%, agricultural lands – 18.3% and bogs – 10%. There is a potential small impact from several farmsteads located in the downstream stretches of the water body. No other significant pressures. Possible ecological quality is good, although there are some hydromorphological modifications (culverts as migratory obstacles). The water body is at risk. Water body is located in the specially protected nature territory "Ziemeļvidzemes biosfēras rezervāts"

Estonian part

A new water body Puupe (1152700_1) from source to Estonian-Latvian border (Figure 28). The catchment area in Estonia is 3.5 km^2. Length of the water body is 4.6 km. Water body type is V1A-KaVo. The catchment area is covered by forests 50%, agricultural land 43.3%. Water body is heavily modified. The main influencing factor is agricultural drainage. Ecological status is likely to be good.

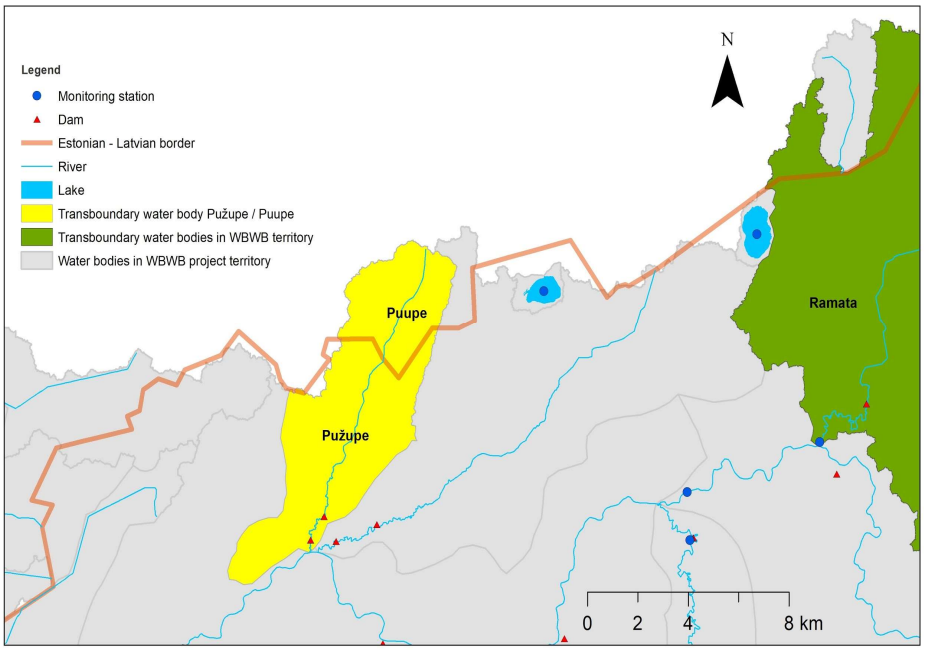

Figure 28. Transboundary water body Puupe / Pužupe.

3.1.16. Water body Pedetsi/Pededze_1 *(EELV2001)*

Latvian part

An existing water body Pededze (D450), from Latvian-Estonian border to tributary Alūksne (Figure 29). Water body area is 109.54 km^2. The catchment area is 251 km^2. Length of the water body is 26.2 km and the slope – 1.2 m/km. Water body type is R3. Despite its large size, river has very homogeneous catchment area. The water body area is covered in forests – 79.3% and agricultural lands – 20.4%. The population density is low. River continuity is interrupted by Jaunanna HPP and other obstacles in downstream water body. There is an existing monitoring station "Pededze, upstream from Alūksne". The ecological quality is good.

Estonian part

An existing water body Pedetsi (1159700_1), from lake Pedejä to Estonian-Latvian border (Figure 29). The catchment area is 102.5 km^2. Length of the water body is 27.8 km. Water body type is V1A. The catchment area is covered in forests - 73.3% and agricultural land

- 25.4%. Many lakes are located within river catchment area. The biggest are following: Kirikumae Lake - river source; Kisojarv, Pulli and Hino lakes. There is an existing monitoring station “Huuhanna sild”. Ecological status is good (assessed in 2017).

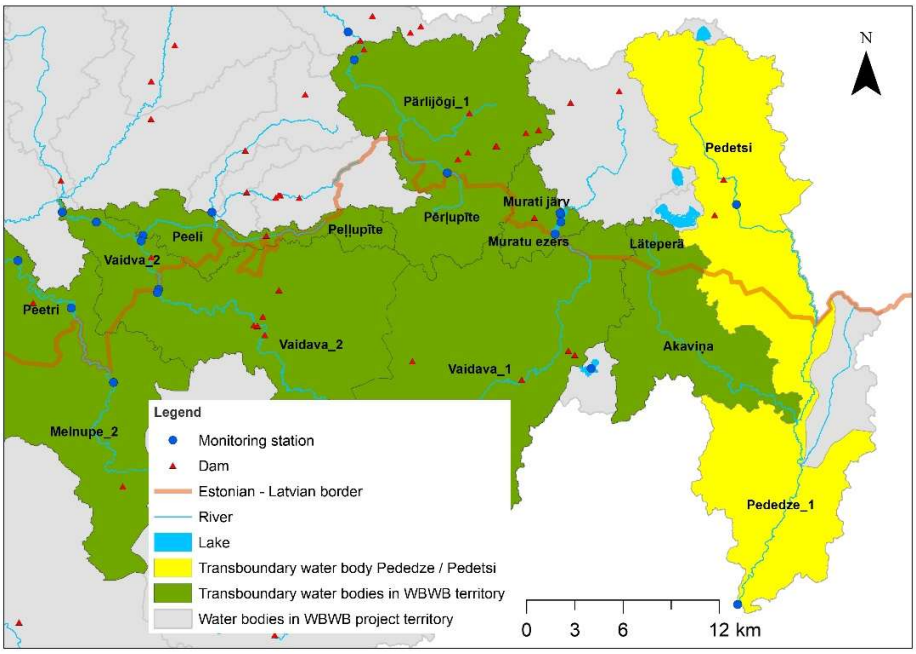

Figure 29. Transboundary water body Pedetsi / Pedzedze_1.

3.1.17. Water body Läteperä/Akaviņa *(EELV2002)*

Latvian part

New water body Akaviņa, from Latvian-Estonian border to the river mouth (Pededze), code D565 (Figure 30). Water body area is 66.18 km^2. The catchment area is 75.30 km^2. Water body length is 20.6 km and slope – 1.3 m/km. Water body type is R1. The water body is straightened. The water body area is covered in forests – 66% and agricultural lands – 34.1%. Akavina River cross the Zamanu bog near the EE-LV border. The anthropogenic pressures on the water body are minimal. The ecological quality is likely to be good (based on Gauja/Koiva project results and pressure analysis).

Estonian part

New water body Läteperä (1159704_1), from the source to Estonian-Latvian border (Figure 30). The catchment area in Estonia is 7.6 km^2. Water body length is 3.7 km. Water body type is V1A. It is a natural water body. Most of the water body is covered in forests – 96%. Ecological status is likely to be good.

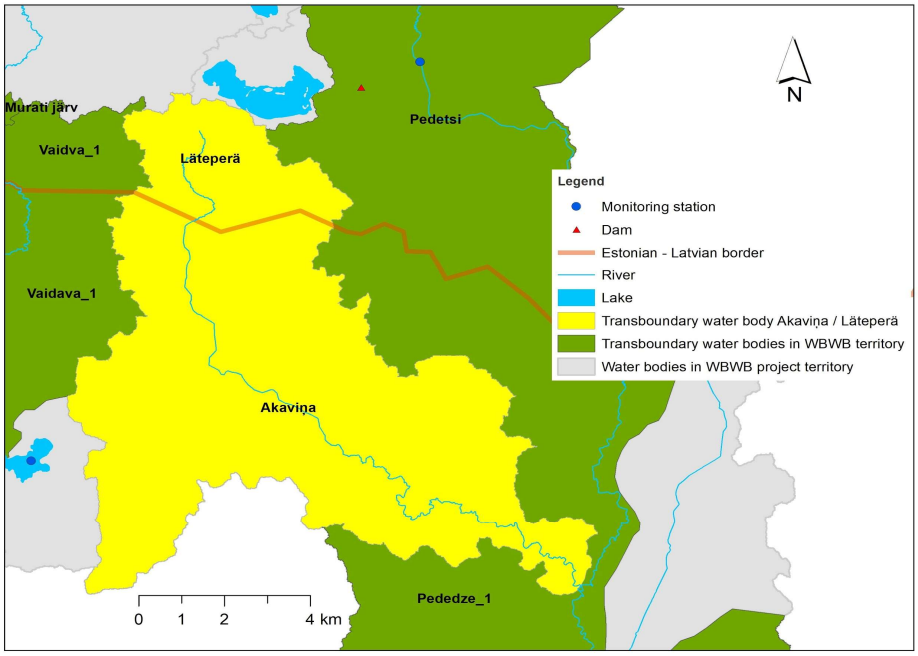

Figure 30. Transboundary water body Läteperä/Akaviņa.

3.2. Transboundary lake water body

3.2.1. Water body Murati järv/Muratu ezers *(EELV1009)*

Latvian part

An existing water body Muratu lake (E205). Transboundary water body, the largest part of WB is located in Estonia (Figure 31). Latvian part doesn't represent typical habitats and pressures of the lake. Total water surface area is 84 km^2 (6.9 km^2 on the Latvian side and 77 km^2 on the Estonian side). Mean depth of the water body is 2.2 meters, maximum – 3.0 meters. Water body type is L6. According to the hydrological regime it is a running-water lake (several streams and two rivers Allumäe oja from the lake Majoru and Kuura in Estonian part flows into the lake and river Vaidava in the SE side of the lake flows out. The water body area is covered in forests – 68% and agricultural lands – 32%. Anthropogenic pressures on lake are minimal in Latvian side, as there are no cities, villages, no industry or agriculture. There is a monitoring station - "Muratu lake, middle part". Ecological quality is good. Water body is located in the specially protected nature territory "Veclaicene".

Estonian part

An existing water body Murati järv (2155900_1). Catchment area of the water body is 12 km^2. The water body type is S3. The catchment area is covered in forest – 53% and agricultural lands – 40%. According to orthophoto (2017) lake has several small ditches on the NW area, close to Muratijärve village and close to Kuura river which may be a source

of local pollution. Water body has an existing monitoring station (last monitored in 2017). Ecological status is good. Water body is located in the specially protected nature territory "Murati loodusala".

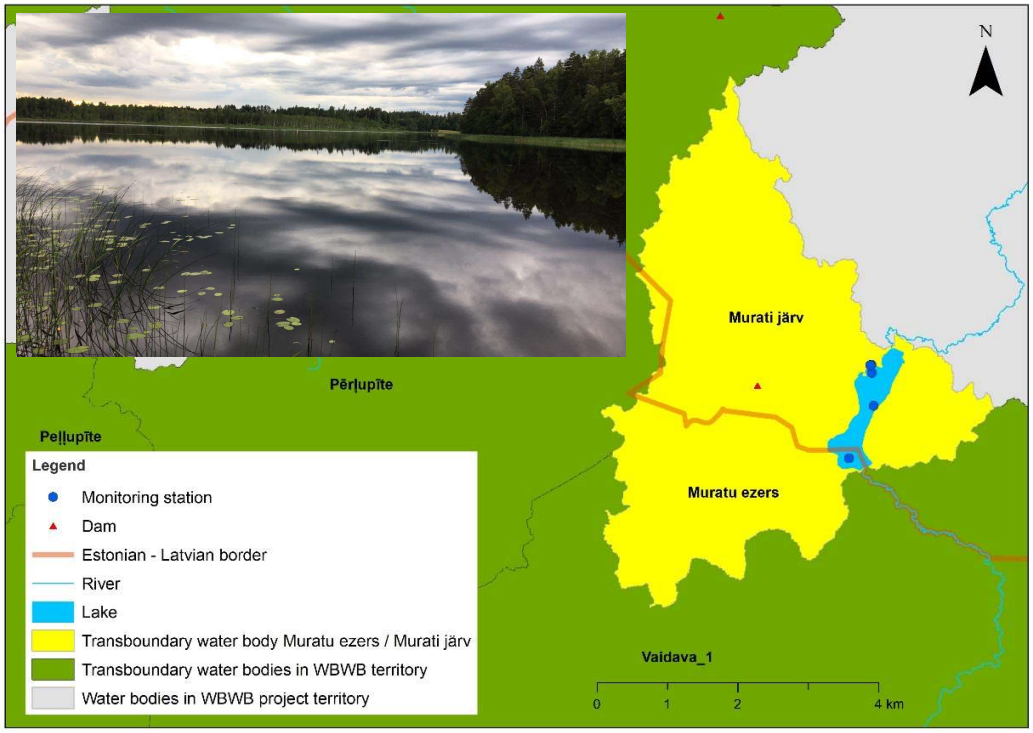

Figure 31. Transboundary water body Murati järv / Muratu ezers. In photo – lake Murati in Latvia (2019).

Annex 1. List of the water bodies in the project area.

WB code	WB name (Latvia)	WB code	WB name (Estonia)	Transboundary WB	Transboundary WB code
G319	Acupīte*	1154000_1	Atse	x	EELV1010
G320	Acupīte*				
D565	Akaviņa*	1159704_1	Läteperä	x	EELV2002
G236	Blīgzne*				
G325	Blusupīte*				
G321	Briede				
G322	Briede*				
G245	Gauja				
G241	Gauja				
G231	Gauja	1154200_1	Koiva_1		
G274	Gauja*			x	EELV1001
G309	Glāžupe*				
G304	Iģe*				
G305	Iģe				
G308	Jogla*				
G329	Kaičupe*	1154300_1	Ujuste	x	EELV1006
G331	Kolkupīte*	1153200_1	Penuoja	x	EELV1011
G302	Korģe				
G324	Krišupīte				
G315HM	Ķire*				
G323	Mazbriede*				
G233	Melnupe	1158700_1	Peetri	x	EELV1004
G234	Melnupe				

WB code	WB name (Latvia)	WB code	WB name (Estonia)	Transboundary WB	Transboundary WB code
G330	Omuļupe*	1013700_2	Õhne_2	x	EELV1017
D450	Pededze	1159700_1	Pedetsi	x	EELV2001
G336	Pedele*	1012100_1	Pedeli_1	x	EELV1015
G317	Pedele*	1012100_2	Pedeli_2	x	LVEE1016
G332	Peļļupīte*	1158100_1	Peeli	x	LVEE1003
G311	Pestava (Sapraša)*		(no WB)		
G237	Pērļupīte	1155700_1	Pärlijõgi_1	x	LVEE1005
G333	Pužupe*	1152700_1	Puupe	x	EELV1012
G307HM	Ramata	1153000_1	Raamatu	x	EELV1013
G318	Rikanda*				
G314	Rūja *	1153600_1	Ruhja	x	EELV1014
G313	Rūja*				
G312	Rūja				
G310	Rūja				
G306	Salaca				
G301	Salaca				
G303HM	Salaca				
G316	Seda				
G244	Tirziņa*				
G334	Vaidava*	1158000_1	Vaidva_1	x	EELV1007
G235	Vaidava	1158000_2	Vaidva_2	x	LVEE1008
G239	Vecpalse				
G326	Vēverupe*				
G238	Vidaga*				

WB code	WB name (Latvia)	WB code	WB name (Estonia)	Transboundary WB	Transboundary WB code
G228	Vija				
G229	Vija				
D533	Virguļica*				
G242	Vizla				
G243	Vizla*				
	(no WB)	1158400_1	Kolga_1		
		1153300_1	Vedäme		
		1154600_1	Laanemetsa		
		1154800_1	Mustjõgi lähtest Antsla-Litsmetsa teeni		
		1154800_2	Mustjõgi Antsla-Litsmetsa teest Pärlijõeni		
		1154800_3	Mustjõgi Pärlijõest Raudsepa ojani		
		1154800_5	Mustjõgi Koiva-Mustjõe luha kaitsealast riigipiirini		
		1155700_2	Pärlijõgi Saarlase paisust suudmeni		
		1157400_1	Ahelo		
		1154800_4	Mustjõgi Raudsepa ojast Koiva-Mustjõe luha kaitsealani		

WB code	WB name (Latvia)	WB code	WB name (Estonia)	Transboundary WB	Transboundary WB code
		1158400_2	Kolga Soomesilla paisust suudmeni		
		1158200_1	Pähni		
		1158700_1	Peetri		
		1152600_1	Ikla		
		1158400_1	Kolga_1		
		1152300_1	Loode		
		1012600_1	Piiri		
		1152500_1	Treimani		
Lake water bodies					
E227	Augstrozes Lielezers				
E225	Burtnieka lake				
E226	Dauguļu Mazezers				
E224	Ķiruma lake				
E228	Lielais Bauzis				
E204	Lūkumītis				
E205	Muratu lake	2155900_1	Murati jarv	x	EELV1009
E223	Ramatas Lielezers				
E203	Salainis				
E229	Sokas lake				
E269	Vēderis lake*				

WB code	WB name (Latvia)	WB code	WB name (Estonia)	Transboundary WB	Transboundary WB code
		2136600_1	Aheru järv		
		2136000_1	Ähijärv		
		2155500_1	Hino järv		
		2144700_1	Kirikumäe järv		
		2155200_1	Pullijärv		
		2099300_1	Ruhijärv		
		2114800_1	Tündre järv		
		2133700_1	Köstrejärv		

* New water body