

# ANNEX STUDY

## ENVIRONMENTAL IMPACT ASSESSMENT

**INVESTOR: BERANE MUNICIPALITY**

**BUILDING: WASTE WATER TREATMENT PLANT  
(WWTP)**

**LOCATION: BERANE**

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**december 2013.**

**INVESTOR: BERANE MUNICIPALITY**

**STUDY ON THE ENVIRONMENTAL IMPACT ASSESSMENT OF THE WASTE  
WATER TREATMENT PLANT  
(WWTP)**

**- A N N E X -**

**Location: Berane**

*The Study Annex has been prepared on the basis of recommendation given by the experts who are engaged through the European Commission instrument called JASPERS (Joint Assistance to Support Projects in European Regions). After the Study analysis the experts suggested supplementation of certain items, as well as clarification of certain allegations.*

## STUDY ON THE ENVIRONMENTAL IMPACT ASSESSMENT OF THE WASTE WATER TREATMENT PLANT (WWTP)

- A N N E X -

### Page 31.

In the end of section *Protected Areas in the Municipality of Berane*, the following paragraph should be added:

It should be noted that NP Biogradska gora is on the west side of the WWTP location, and around 15km far from it, whereas the community of dwarf pines is located on Bjelasica Mountain, and 12 km far from the location. So the construction and exploitation of the facility won't have any impact on them.

### Page 37.

Last paragraph under *Filling activities* is erased and the new is added.

The average altitude of the location is 659 m above sea level, whereas, according to Preliminary Design, leveling of the terrain for the facility setting is planned on 660 m above sea level, ie the average elevation of the location is 1 m.

### Page 39.

Following title **3.3. Detailed Description of the Design**, the new subtitle **3.3.A. Analysis of input parameters**, is added.

#### **3.3. A. Analysis of input parameters**

##### **3.3.A.1. Sewerage system**

As already been mentioned, construction of the plant for treating the waste water from Berane town has been aimed to lower the pollution of Lim River, and provide significant positive impact on public health and the environment, in the town of Berane as well as in the area downstream of Berane. Construction ie extension of sewerage network is the precondition for that.

The existing sewerage system covers the city of Berane and partly and/or entirely city areas **Beran Selo, Dolac, Donje Luge, Pesca, Jasikovac and Haremi**. According to the estimates of Feasibility Study (draft, WYG, 2010.), approximately 12.000 residents are connected to sewerage system. System is designed as separate (storm water and foul water are collected separately), but there are several collectors which are designed as combined. There is a significant infiltration of underground water and spring water from surface street flow which are discharged into the system through chambers, in parts where storm sewerage is not constructed. Waste water from the existing sewerage system is discharged in the river Lim and its smaller tributaries without treatment.

Majority of residents who are not connected to the sewerage system uses permeative/semi-permeative septic tanks which pollute soil, underground water and indirectly the river Lim and its tributaries. In cases where the houses are close to the river or its tributaries, waste water is discharged directly into the water without treatment.

Industrial zone of Berane is located on the right bank of the river Lim. Currently, only a few industrial manufacturers are working with reduced capacity. Industrial zone has its own sewerage system, but waste water is released into the river Lim without treatment.

Expansion of sewerage system is planned in II stages (2015. and 2035.). Stage I of the extension will include city areas **Beran Selo, Dolac, Pesca, Jasikovac and Haremi**, as well as parts of the area Donje Luge. Stage II will include extension of sewerage system to entire area of Donje Luge, Luzac and Buce. The design of primary sewerage system has taken into consideration the connection of the following areas: **Budimlja, Dapsice, Petnjik, Zagorje, Donja Rzanica and Vinicka** areas with accompanying hydraulic load. However, design of sewerage system within these areas is not the subject of this Preliminary Design. Construction of Waste Water Treatment Plant (WWTP) should be in stages (gradual), depending on the dynamics of sewerage system construction and for the purpose of rational utilization of the plant capacity.

According to Preliminary Design (AGRECO Consortium and CIJEVNA KOMERC ltd, year 2013) Waste Water Treatment Plant for a population equivalent of 20.000 will be constructed in the first phase ( year 2015), while in the second phase (year 2035) the capacity grows to population equivalent of 27.000.

Figure A1 shows the map of the area with marked town parts that are going to be connected to the sewerage network, ie to the WWTP planned on the location in the area of Tulum Settlement. Position of the sewerage network main components is also shown in the Appendix.

### ***3.3.A.2. Volume of Waste Water Designed for WWTP Bilans otpadnih voda za PPOV***

Real waste water volume which is created at the observed area is not clearly defined and thus it is calculated based on specific volume of waste water which is given in Feasibility Study and Strategic Master plan for sewerage and waste water in central and north region of Montenegro, and is 150 l/ ES x day.

Estimation of applicable waste water volume is based on the following data and/or assumptions taken from Feasibility Study:

- that the number of residents who are connected to sewerage system for the year 2015 will be 16.210, while their number will be 22.500 in the year 2035,
- that industry and entrepreneurs' portion in creating waste water will be in proportion with the portion of drinking water consumption,
- that the degree of infiltration into sewerage system will be 50% in the year 2015 and 30% in the year 2035.

Mean annual waste water flow includes waste waters from households, industry and entrepreneurship.

Industry/entrepreneurs' portion in waste water production ( $\Psi_{ind/obr}$ ) is observed as percentage of mean daily flow of household water. Coefficient value  $\Psi_{ind/obr}$  is taken from Feasibility Study (draft, 2010, WYG International). This coefficient for the year 2015 will be 21% for the industry ( $\Psi_{ind}$ ), while its value will be 25% for the year 2035. This coefficient for the year 2015 will be 4% for entrepreneurs ( $\Psi_{obr}$ ), while its value will be 5% for the year 2035.

Water consumption, and consequently waste water creation, varies during the day, so even coefficient of general nonlinearity<sup>1</sup> with its maximum value 3 is taken into consideration for the calculation of maximum daily flow.

Maximum (peak) dry discharge represents the sum of peak waste water flow and infiltrated water flow. Maximum (peak) rain discharge includes storm water which enters combined sewerage system through manholes. Having in mind that the precise volume of the stated storm water is not known, rain discharge is enlarged twice as compared to dry. Volume of waste water designed for WWTP for the years 2015 and 2035, provided per hour, per day and per year, is shown in the Table A1.

**Table A1.** *Volume of waste water designed for WWTP for the years 2015 and 2035, provided per hour, per day and per year*

	unit	year 2015.	year 2035.
<b>HOUSEHOLDS</b>			
Number of ES from households*	ES	16.210	22.500
Specific waste water quantity*	l/ESxd	150	150
Mean daily waste water discharge from households	l/s	28,14	39,06
	m <sup>3</sup> /h	101,31	140,63
	m <sup>3</sup> /day	2.431,44	3.375,12
	m <sup>3</sup> /year	887.475,6	1.231.918,8
<b>INDUSTRY AND ENTREPRENEURS</b>			
Industry's portion in waste water creation*	%	21	25
Mean daily waste water discharge from industry	l/s	5,91	9,77
	m <sup>3</sup> /h	21,28	35,16
	m <sup>3</sup> / day	510,72	843,84
	m <sup>3</sup> / year	186.412,8	308.001,6
Entrepreneurs' portion in waste water creation*	%	4	5
Mean daily waste water discharge from entrepreneurs	l/s	1,13	1,95
	m <sup>3</sup> /h	4,05	7,03
	m <sup>3</sup> / day	97,2	168,72
	m <sup>3</sup> / year	35.478	61.582,8
<b>ANNUAL WASTE WATER DISCHARGE (HOUSEHOLDS+INDUSTRY+ENTREPRENEURS)</b>			
Mean daily waste water discharge	l/s	35,18	50,78
	m <sup>3</sup> /h	126,64	182,81
	m <sup>3</sup> / day	3.039,36	4.387,44
	m <sup>3</sup> / year	1.109.366,4	1.601.415,6
General nonlinearity coefficient**		1,92	1,85

<sup>1</sup> D. Ljubisavljevic, B. Babic, A. Djukic, B. Jovanovic: *Communal Hydrotechnics – examples from theory and practice*, The Faculty of Civil Engineering, University of Belgrade, Belgrade, 2001.

maximum daily waste water discharge	l/s	67,59	93,99
	m <sup>3</sup> /h	243,34	338,35
	m <sup>3</sup> / day	5.842,56	8.120,4
	m <sup>3</sup> / year	2.132.534,4	2.963.946,0
<b>INFILTRATION</b>			
Infiltration degree, portion of total waste water flow*	%	50	30
Infiltrated water flow	l/s	17,59	15,23
<b>DRY DISCHARGE</b>			
Mean dry discharge	l/s	52,77	66,02
	m <sup>3</sup> /h	189,96	237,66
	m <sup>3</sup> / day	4.559,04	5.703,84
	m <sup>3</sup> / year	1.664.049,6	2.081.901,6
Maximum (peak) dry discharge	l/s	85,18	109,22
	m <sup>3</sup> /h	306,66	393,20
	m <sup>3</sup> / day	7.359,84	9.436,8
	m <sup>3</sup> / year	2.686.341,6	3.444.432
<b>RAIN DISCHARGE</b>			
Coefficient of increased discharge		2	2
Maximum (peak) rain discharge	l/s	170,37	218,44
	m <sup>3</sup> /h	613,32	786,39
	m <sup>3</sup> / day	14.719,68	18.873,36
	m <sup>3</sup> / year	5.372.683,2	6.888.766,4

Source: \* Feasibility Study – draft, WYG, 2010.

\*\* D. Ljubisavljevic, B. Babic, A. Djukic, B. Jovanovic: Communal Hydraulics – examples from theory and practice, Faculty of Civil Engineering, University of Belgrade, Belgrade, 2001.

Capacity of the planned WWTP is defined based on total daily biological loading (BOD) of the plant. Total daily load includes biological plant load caused by population, industry and entrepreneurs.

WWTP capacity is determined based on total WWTP load and unit biochemical load of 60 gBOD/d per 1 equivalent resident (ES).

Calculation of WWTP capacity is given in table A2.

**Table A2. Calculation of adopted WWTP capacity**

	unit	2015.	2035.
unit BOD– households*	gO <sub>2</sub> /ES×d	60	60
daily quantity of BOD– households	kgO <sub>2</sub> /d	973	1.350
unit BOD– industry*	mgO <sub>2</sub> /l	200	200
daily quantity BOD– industry	kgO <sub>2</sub> /d	102	169
unit BOD– entrepreneurs*	mgO <sub>2</sub> /l	250	250
daily quantity BOD– entrepreneurs	kgO <sub>2</sub> /d	24	42
total daily loading BOD	kgO <sub>2</sub> /d	1.099	1.561
necessary capacity of WWTP	ES	18.317	26.016
<b>ADOPTED WWTP CAPACITY</b>	<b>ES</b>	<b>20.000</b>	<b>27.000</b>

Source: \* Feasibility Study – draft, WYG, 2010.

### 3.3.A.3. The necessary degree of waste and storm water treatment

Quality and maximum allowed concentrations of dangerous and hazardous matter in waste water which can be discharged into ground waters are defined by the Rulebook on quality and sanitary-technical requirements for discharging waste water into the recipient and public sewerage, ways and procedures of testing waste water quality, maximum number of tests and content of the report on determined quality of waste waters ("Official Gazette of the Republic of Montenegro", no. 45/2008, 9/2010 and 26/2012).

A group of parameters significant in identifying the impacts of waste water discharge on the recipient quality, or WWTP designing, was selected from those specified in the Rulebook. Maximum allowed concentrations of selected parameters as in accordance with Montenegro and EU legislation, are shown in Table A3.

**Table A3.** Maximum allowed concentrations of hazardous matter in waste waters which can be discharged into ground waters, as in accordance with Montenegro and EU legislation

Parameter	Rulebook on discharging waste water ("Official Gazette of the Republic of Montenegro", no. 45/2008, 9/2010 and 26/2012) <sup>2</sup>	Directive on waste water (91/271/EEC) <sup>3</sup>
BOD, mgO <sub>2</sub> /l	25	25
COD, mgO <sub>2</sub> /l	125	125
Total suspended matter, mg/l	35	35
Total nitrogen, mg/l	15	15
Total phosphorus, mg/l	2	2

The necessary degree of waste water treatment is defined in accordance with the capacity of the plant and discharge location.

According to the legislation of the Republic of Montenegro, tertiary waste water treatment is necessary for the planned size of the waste water treatment plant of 20.000 ES (27.000 ES) and discharging waste waters in the river Lim which is classified as sensitive area. Tertiary waste water treatment includes mechanical and biological treatment of waste water and removing nutrients (reducing nitrogen and phosphorous compound load)

Storm waste waters are not completely clean and their impurement is a result of air and settlement surface pollution. Air and surface pollution is not the same in all areas and therefore the composition and pollution of storm waste water is not uniform. Storm waste water is rather clean in natural environment and small settlements without industry, such as Berane, while water is very polluted in cities with industrial plants.

Storm waste water pollution is changeable. Pollution is the biggest at the beginning of runoff (at the beginning of the rain period), and as the runoff continues, pollution is reduced as a result of washing off the catches.

<sup>2</sup> Rulebook on quality and sanitary-technical requirements for discharging waste water into the recipient and public sewerage, ways and procedures of testing waste water quality, maximum number of tests and content of the report on determined quality of waste waters ("Official Gazette of the Republic of Montenegro", no. 45/2008, 9/2010 and 26/2012).

<sup>3</sup> Council Directive of 21 May 1991 concerning urban waste water treatment (91/271/EEC)



Table A4. shows comparison of mean concentrations of waste water impurement indicators at busy areas at the entrance of the chamber and maximum allowed concentrations for discharging waste water into natural recipient, as according to the legislative of the Republic of Montenegro.

**Table A4.** Comparison of mean concentrations of waste water impurement indicators on busy areas at the entrance of the chamber and maximum allowed concentration for discharging waste water into natural recipient

Parameter	Storm waste water*	Maximum allowed concentration
BOD, mgO <sub>2</sub> /l	12,2	25
COD, mgO <sub>2</sub> /l	70	125
Total suspended matter, mg/l	110	35
Total nitrogen, mg/l	3,8	15
Total phosphorous, mg/l	0,28	2

Source: \* S. Tedeschi: *Water Protection*, Civil Engineering Association of Croatia, Zagreb, 1997.

According to the compared indicators, it is clear that the content of total suspended matter is to be reduced in storm waste water, which will be an important factor while designing storm drain system.

#### *Calculation of reducing the quantity of matter discharged into the recipient*

Reducing the quantity of matter discharged into the recipient is based on the difference in quality of the matter discharged in to the river Lim due to WWTP in accordance with the following:

$$\frac{X_{bez\ PPOV} - X_{sa\ PPOV}}{X_{bez\ PPOV}} \cdot 100 = \Delta X$$

where:

$X_{bez\ PPOV}$  – daily quantity of discharged polluting matter without constructing WWTP

$X_{sa\ PPOV}$  – daily quantity of discharged polluting matter with constructed WWTP

Daily quantity of discharged matter is calculated as:

$$X_{bez\ PPOV} = C_{otp.vode} \cdot Q_{otp.vode}$$

where:

$C_{otp.vode}$  – concentration of the polluting matter in waste water

$Q_{otp.vode}$  – daily quantity of discharged waste water

Concentrations of discharged pollutants, after been treated in WWTP, are taken from the literature together with the certain safety factors and are given in Table A5. **Error! Reference source not found.**

**Table A5.** Specific dissolved and suspended matter load

parameter	unit	value*
unit BOD	gO <sub>2</sub> /ES×d	60
unit COD	gO <sub>2</sub> /ES×d	120
unit suspended matter	g/ES×d	70
unit nitrogen	g/ES×d	11
unit phosphorous	g/ES×d	2

Source: ATV-DVWK Standard A 131E: *Dimensioning of Single-Stage Activated Sludge Plants*, 2000.

Evaluated percentage of reducing the quantity of matters discharged into the river Lim after WWTP construction, as well as legally prescribed values are given in Table A 6.

**Tabela A6.** Evaluated percentage of reducing the quantity of matters discharged into the river Lim

Polluting matter	X <sub>bez PPOV</sub> , kg/day	X <sub>sa PPOV</sub> , kg/day	Load reduction, %	Legislative
BOD	1.200	91,18	92,40%	70-90%
COD	2.400	547,09	77,20%	75%
Suspended matter	1.400	136,77	90,23%	90%
Nitrogen	220	50,15	77,20%	70-80%
Phosphorous	40	6,38	84,04%	80%

### Calculation of recipient load caused by polluting substances

Calculation of recipient load caused by polluting matter is given for the existing way of discharging waste water without treatment, as well as for the condition after constructing WWTP.

Testing the quality and relevant flow of river Lim small waters at waste water release point at the future WWTP location are not conducted and therefore the evaluation of influence is made based on the records of official institutions (Hydro meteorological Institute of Montenegro (HMZCG)).

Evaluation of waste waters' influence on the recipient is conducted based on mass balance and the following equation:

$$Q_{recip.} \cdot c_{recip.} + Q_{otp.vode} \cdot c_{otp.vode} = (Q_{recip.} + Q_{otp.vode}) \cdot c_{nakon ispuštanja}$$

where:

- $Q_{recip.}$  – recipient water flow above the location of waste water discharge
- $c_{recip.}$  – concentration of waste matter in the recipient above the location of waste water discharge
- $Q_{otp.vode}$  – quantity of discharged waste water
- $c_{otp.vode}$  – concentration of waste matter in waste water
- $c_{nakon ispuštanja}$  – average concentration of waste matter in the river Lim

The following parameters of mass balance do not depend on WWTP construction and are observed as constant:

- $Q_{recip.}$  – recipient water flow above the location of waste water discharge
- $c_{recip.}$  – concentration of waste matter in the recipient above the location of waste water discharge

$Q_{otp.vode}$  – quantity of discharged waste water

Their classification as mass balance results in the equation which shows dependency between the influence of waste water treatment for the city of Berane and concentration of polluting matter in the river Lim:

$$C_{nakon\ ispu\{anja, tret.} = \frac{C_{otp.vode, tret.}}{C_{otp.vode, netret.}} \cdot C_{nakon\ ispu\{anja, netret.}$$

Concentration of polluting matter downstream waste water discharge into the river Lim for the year 2015 is taken based on the data referring to river Lim quality at the measuring station Skakavac for the period 2006- 2011.

Having in mind that, even at small water level of river Lim, water flow (7,06 m<sup>3</sup>/s – minimum mean flow for 90% probability, as in accordance with Water management base of the Republic of Montenegro ((Ministry of Agriculture, Forestry and Water Management of the Republic of Montenegro, May, 2001.)) is much higher than waste water discharge (0,053 m<sup>3</sup>/s – applicable mean dry discharge), the assessment does not include increased concentration of impuring substances in the river Lim due to increase of the population.

Evaluation of polluting matter concentration in the river Lim, after been treated in WWTP, compared with polluting matter concentration at measuring station Skakavac (no treatment), is given in Table A 7.

**Table A7.** *Evaluation of polluting matter concentration in the river Lim after WWTP construction and comparison with polluting matter concentration at measuring station Skakavac*

	Suspended matter	BOD	COD
designed concentrations of impuring substances (with WWTP), mg/l	30	20	120
designed concentrations of impuring substances (without WWTP), mg/l	307,08	263,21	526,42
$\frac{C_{otp.vode, tret.}}{C_{otp.vode, netret.}}$	0,098	0,076	0,228
<b>waste matter concentration in the river Lim with WWTP, mg/l</b>	<b>0,16</b>	<b>0,18</b>	<b>0,31</b>
<b>Concentration in the river Lim – measuring station Skakavac</b>			
2006	1	1,8	1,3
2007	0	2,3	1,1
2008	0	3	1,7
2009	9	3,6	1,8
2010	0	1,5	1
2011	0	2,4	1,3
<b>Mean value, mg/l</b>	<b>1,67</b>	<b>2,43</b>	<b>1,37</b>

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Performed correction of Total Phosphorus and Total Nitrogen values, defined by EU Standards.

- Total Nitrogen                      15 mgN/l i
- Total Phosphorus                  2 mgP/l.

**Page 50.**

After *Sludge Treatment* section, a new subtitle *Sludge production* is added.

***Sludge production***

Activated sludge, i.e. microorganisms present in activated sludge use various organic and inorganic impurities for their growth and replication, which results in producing excess quantities of sludge.

In applied waste water treatment technology, sludge production implies creation of sludge due to degradation of organic and inorganic matters, as well as due to biological and chemical removal of phosphorous in accordance with the following equation:

$$SP_d = SP_{d,C} + SP_{d,P}$$

where:

$SP_d$  – daily quantity of created sludge

$SP_{d,C}$  – daily quantity of sludge created due to degradation of carbon compounds

$SP_{d,P}$  – daily quantity of sludge created due to biological and chemical removal of phosphorous

Daily quantity of sludge created due to degradation of carbon compounds is calculated by means of the following equation:

$$SP_{d,C} = B_{d,BOD} \cdot \left( 0,75 + 0,6 \cdot \frac{X_{SS,UL}}{C_{BOD,UL}} - \frac{(1 - 0,2) \cdot 0,17 \cdot 0,75 \cdot t_{SS} \cdot F_T}{1 + 0,17 \cdot t_{SS} \cdot F_T} \right)$$

where:

$SP_{d,C}$  – daily quantity of sludge created due to degradation of carbon compounds

$B_{d,BOD}$  – daily quantity of BOD in waste water

$X_{SS,UL}$  – concentration of suspended matter in waste water

$C_{BOD,UL}$  – concentration of BOD in waste water

$t_{SS}$  – sludge age

$F_T$  – temperature factor

Temperature factor is calculated by means of the expression:

$$F_T = 1,072^{(T-15)}$$

where:

$F_T$  – temperature factor

$T$  – temperature (20°C)

Daily quantity of sludge created due to biological and chemical removal of phosphorous can be calculated in the following way:

$$SP_{d,P} = \frac{Q_d \cdot (3 \cdot X_{P,BioP} + 6,8 \cdot X_{P,Talo,Fe} + 5,3 \cdot X_{P,Talo,Al})}{1000}$$

where:

$SP_d$  – daily quantity of created sludge

$Q_d$  – applicable discharge

$X_{P,BioP}$  – daily quantity of sludge created due to biological removal of phosphorous

$X_{P,Talo,Fe}$  – daily quantity of sludge created due the chemical deposition with iron salts

$X_{P,Talo,Al}$  – daily quantity of sludge created due to chemical deposition with aluminum salts

Calculation of daily quantity of produced sludge and specific sludge production is given in table A8. **Error! Reference source not found.** As for chemical removal of phosphorous, only the case of depositing phosphorous with iron salts is taken into consideration.

**Table A8.** Daily production of sludge

DAILY PRODUCTION OF SLUDGE	unit	value
quantity of created sludge (degradation of carbon compounds)	kg/d	1.134,38
quantity of created sludge (biological and chemical removal of phosphorous)	kg/d	148,40
quantity of created sludge	kg/d	1.282,78
specific production of sludge	kgST/kgBOD	1,07

Source: ATV-DVWK Standard A 131E: *Dimensioning of Single-Stage Activated Sludge Plants*, 2000.

## Page 81.

In section **6.2. Water Quality**, under **During the work execution** subtitle, the second paragraph is changed to the following:

Temporarily deposited waste-building materials (such as: wood, metal, plastics, etc) generated during the facility construction, if unsufficiently protected, can also be a potential pollution source, especially during the intense rainfall, and due to water from the access roads and machinery parking.

## Page 92.

Section **7.2. Anticipated Measures for Facility Construction** is amended, and the main impacts and measures are presented in tables.

- Before starting the works, citizens interested in construction of the planned project and the expected impacts that could be caused by the construction, should be informed through the media.

- In case of strong wind, it is necessary to protect the locations with waste from blowing the material into the environment.
- In case of intense rainfall it is mandatory to stop the works and protect the existing work locations from rain wash, or from potential impacts on water objects and land.

Table A 9 provides an overview of the potential, most significant impacts and protection measures during the phase of facility construction.

**Table A 9.** *Overview of the most significant impacts and mitigating measures during the phase of construction*

Phase	Impact	Measures of protection/mitigation
Preparation and construction	<p><b>On air:</b> Deterioration in quality of air caused by:</p> <ul style="list-style-type: none"> <li>- gases which are products of fuel combustion in the engine of engaged machinery,</li> <li>- increased concentration of dust in the air.</li> </ul>	<p>Use technically correct machinery. Workers need to use personal protective equipment at workplace. During the works execution in dry season and in time of wind, perform the wetting of the soil on micro-locations where increased dust emission may potentially appear</p>
Preparation and construction	<p><b>On water:</b> Pollution of surface and groundwater as a result of:</p> <ul style="list-style-type: none"> <li>- waste disposal at river banks</li> <li>- not suitable waste disposal site</li> <li>- accidental spillage or leakage of oil and fuel from used machinery</li> <li>- spilling of waste water from concrete mixer washing</li> <li>- spilling of wash water from machines, tools and containers (lime, mortar), or after cleaning used machinery from oil and fuel.</li> </ul>	<p>Disposal of waste at river banks is not allowed. Load the construction waste (without scattering) on vehicles and transport it immediately to the landfill or place intended for that purpose where it is disposed adequately. Regularly maintain construction machinery, identify potential leaks and repair them immediately. Restrict oil changes and refueling at the location, but carry them out on the nearest gas station. It is recommended to use vegetable-oil-based (edible) or synthetic polyglycol and ester-based lubricants, that are environmentally friendly (EFL), instead of harmful ones (oils and greases) produced from the mineral oil, because if reach a free space, their functioning is harmful. Prevent discharge of water from concrete mixer or water from machine cleaning into water objects. Water protection measures shall be ensured even through soil protection measures. In the event of an accident (spillage of oil or fuel) immediately intervene in accordance with prepared plan of measures and actions in such cases. Place the utility waste container and empty it regularly on the nearest landfill. Discharge of any untreated waste water into rivers is not allowed.</p>

Preparation and construction	<b>On soil:</b> Pollution of soil as a result of: <ul style="list-style-type: none"> <li>- not suitable waste disposal site</li> <li>- accidental spillage or leakage of oil and fuel from used machinery</li> <li>- soil degradation resulting from the presence of heavy machinery</li> </ul>	Load the potential construction waste (without scattering) on vehicles and transport it immediately to the landfill or place intended for that purpose where it is disposed adequately. Any part of the soil contaminated by oil or fuel, the Constructor shall cover with sawdust, then remove and dispose of in an approved landfill. In the event of an accident (spillage of oil or fuel) immediately intervene in accordance with prepared plan of measures and actions in such cases. For the execution of the works choose the machinery and means of transportation, which will minimally affect soil degradation
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Preparation and construction	<b>On flora and fauna:</b> Clear-felling and deforestation in the area that is to be prepared for the WWTP construction.	After clear-felling, all the waste material from the site should be transported immediately to the landfill or place intended for that purpose.
Preparation and construction	<b>Aesthetic disruption of the landscape</b> Caused by improper waste disposal.	Instead of accumulating the waste on the construction site, load it (without scattering) on the vehicles and transport it immediately to the landfill. Interventions occurring in the area should differentiate from the natural and environmental characteristics as less as possible, and should lead to a minimum visual degradation.
Preparation and construction	<b>Noise:</b> An increased noise level during the operation of engaged machinery.	Use technically correct machinery. Workers need to use personal protective equipment at workplace. Perform the activities within work hours during a day, without the overtime, in order not to disturb local residents.

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**7.3. Safety Measures During Facility Exploitation** section is amended, and most significant impacts and measures are shown in table.

- Since The Design anticipates transport and treatment of the septic tanks sludge from the surrounding settlements that will not be connected to the sewerage network, the construction of the access road coming from M-2Bijelo Polje – Berane main road to the location will provide better environmental conditions, because the route of the access road bypasses the town, thus avoiding pollution of settlements due to possible waste water leakage from cisterns or odors spreading.
- Reception and registration of arrived amounts of septic tank sludge should be conducted under WWTP staff surveillance.
- It is necessary to maintain the access road and all the other manipulative surfaces in the WWTP, which implies regular cleaning of the surfaces because of possible contamination with waste water from cisterns. According to the Design, wash water from the cleaning of manipulative surfaces is discharged into WWTP.



- Besides the fact that covering of certain WWTP parts helps in protection from noise and odors, it also reduces habitats suitable for insects, and prevents from rats and birds gathering. On the other hand, ventilation of covered objects and treatment of air evacuated in bio-filter will be performed using fans. Bio-filter is usually filled with organic material, such as coarse or fine sawdust. As the air passes through the bio-filter, microbes from the organic material convert the gases causing odors, to carbon dioxide and water preventing in that way spreading of odors during WWTP operation.
- To prevent and mitigate consequences of potential accidents, it is necessary to prepare Operational Contingency Plan for water protection in case of accidental contamination.

Table A 10 provides an overview of the potential, most significant impacts and protection measures during the phase of facility exploitation.

**Table A10.** *Overview of the possible impacts, their significance and mitigating measures during the phase of construction facility exploitation*

Phase	Impact	Measures of protection/mitigation
Facility exploitation	<b>On air:</b> Deterioration in air quality unless anticipated measures are not complied with.	Covered objects and buildings are going to be ventilated, and the evacuated air treated through bio-filter. As the air passes through the bio-filter, microbes from the organic material convert the gases causing odors, to carbon dioxide and water.
Facility exploitation	<b>On water:</b> Pollution of surface and groundwater unless anticipated measures are not complied with.	WWTP is designed in accordance with current regulations Conduct constant quantity and quality control of treated water that enters Lim River.
Facility exploitation	<b>On soil:</b> Soil pollution as a result of improper sludge disposal.	Utility Company in charge draws the sludge from the settlement and disposes it in accordance with legal requirements.
Facility exploitation	<b>On flora and fauna:</b> Unless anticipated measures are not complied with.	WWTP is designed in accordance with current regulations. Before WWTP construction, the status of flora and fauna on the location and its surrounding was analyzed, and Lim water monitoring provided.
Facility exploitation	<b>Noise:</b>	Selected equipment cannot increase noise level in the environment.

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Chapter 8. **MONITORING OF THE ENVIRONMENTAL CONDITION** is amended

***During the facility construction:***

Air quality monitoring in the construction phase is limited to the monitoring of dust emission on the location during the excavation of the foundations and terrain filling activities. Frequency of monitoring during prime construction period is once a day.



Authorized organization monitors, and The Agency for Environmental protection, over authorized inspectors, once in 15 days supervises and informs the public about concentration of air pollutants, all in accordance with the Law on Air Protection (Official Gazette of Montenegro No 25/10) and amendments to the Law on Air Protection (Official Gazette of Montenegro No 40/11).

If the Constructor does not comply with the legal regulations concerning dust emission, his responsibility is defined by the penalty provisions, Law on Air protection, Articles 53 and 54.

During the facility construction phase, monitoring of noise coming from heavy machines and vehicles is conducted once a day on the location in prime construction period.

According to the Law on Environmental Protection, project holder provides the systematic measurement of noise.

According to the Law on Noise Environment Protection (Official Gazette of Montenegro No 28/11), local government unit monitors the noise level, and The Agency for Environmental protection submits the information, and informs the public once in 15 days time.

If the Constructor does not comply with the legal regulations concerning noise level, his responsibility is defined by the penalty provisions, Law on Noise Environment Protection, Articles 30 and 31.

Impact of the facility construction (under regular operating conditions, with the exception of accidents) on other environmental segments (such as: waters, ground-waters, and soil) will not be emphasized, so for these reasons, their specific monitoring has not been recommended.

#### ***During the facility exploitation:***

Waste water monitoring at entering point in WWTP, monitoring of discharged treated water and dehydrated sludge, will be conducted according to the parameters shown in table A.11.

**Table A.11.** *Parameters to be analyzed and presented in the report on plant operation*

		Frequency of measurement			
		Daily	If necessary	Weekly	Monthly
1.	Climate parameters	X			
2.	Flow of waste water at the WWTP entrance	X <sup>a</sup>			
3.	Characteristics of waste water inflow (pH, temperature, conductivity)	X <sup>c</sup>			
4.	Concentration of waste water inflow parameters (SS-suspended solids, BOD5-five-day biological oxygen demand, COD-chemical oxygen demand )	X <sup>d</sup>			
5.	Concentration of waste water inflow parameters (TKN-total nitrogen according to Kieldal, NH <sub>4</sub> -N – ammonium ion as nitrogen, P <sub>tot</sub> -total phosphorus)			X <sup>d</sup>	

6.	Parameters of the biological reactor (temperature, dissolved oxygen, pH, redox)	$X^{ca}$			
7.	Parameters of the biological reactor (MLSS-suspended solids in the mixture, sludge volume, sludge volume index)	$X^d$			
8.	Calculated parameters of the biological reactor (sludge, sludge volume, sludge age)	$X^f$			
9.	Concentration of waste water at release point (SS - suspended solids, $N_{tot}$ - total nitrogen, $P_{tot}$ - total phosphorus, BPK5 - five-day biological oxygen demand, COD-chemical oxygen demand)	$X^b$			
10.	Concentration of waste water at release point ( $NO_3-N$ , $NH_4-N$ - ammonium ion as nitrogen, $PO_4-P$ )	$X^a$			
11.	Filtration efficiency for different parameters	$X^I$			
12.	Sludge flow (excess and return sludge, thickened sludge)	$X^a$			
13.	Concentration of solids and the initial loss of all the above mentioned additionally dehydrated sludge types			$X^g$	
14.	Concentration of waste water-return sludge mixture parameters (SS – suspended solids, TKN - total nitrogen according to Kieldal, $NH_4-N$ , $P_{tot}$ – total phosphorus, BPK5 - five-day biological oxygen demand, COD-chemical oxygen demand)				$X$
15.	Quantity of dehydrated sludge, sludge from WWTP		$X^g$		
16.	The amount of waste from the grid and from the sand trap.		$X^g$		

a) continuous online measuring

b) proportional intake of mixed samples from the automatic sampler during the 24-hour flow

c) calculate a daily average, based on continuous online measuring

d) sample taken appropriately (5 parts for a sample, taken in every 5 minutes) with the time specified. Move the appropriate sampling one hour ahead every day, if the necessary is calculated.

e) sample from each container leaving the WWTP

Waste water control should be done in the internal laboratory which meets the requirements, but temporary control by an external laboratory is also necessary.

According to Water Law (Official Gazette of Montenegro No 27/07 and 22/11) and amendments to the Water Law (Official Gazette of Montenegro No 22/11, 32/11 and 47/11), Article 85, legal entity is allowed to perform physical-chemical and microbiological tests of waste water, if it is enrolled in the appropriate register and meets the requirements in terms of personnel, equipment and accreditation.

The Ministry, together with the previously obtained opinion of the ministry responsible for the environmental protection, and the ministry responsible for health care, shall specify more closely the terms to be fulfilled by the entity, so it could do waste water testing.

Legal entities who discharge waste water into the recipient use the forms for record keeping of testing frequency, the amount and composition of hazardous and harmful substances (Article 32 of the Rulebook on quality and sanitary technical requirements for

wastewater discharge to the recipient and public sewage system, method and procedure for wastewater quality inspection, minimum number of inspections, and the content of reports on wastewater quality (Official Gazette of Montenegro No 45/08)). Authorized legal entity for waste water quality inspection, once a month submits the filled forms (in accordance with the Water Law, Article 85) to the test purchaser, or to the ministries responsible for water care, environment protection, health care, and to the government authority responsible for hydrometeorological affairs.

Monitoring should include even Lim water quality testing that is to be done on the vertical profile upstream and downstream of the outlet.

First year after starting the facility, conduct the monitoring quarterly. Depending on the results, which should be compared to the findings of the current water quality state before WWTP putting into operation, adjust the frequency of monitoring in consultation with the relevant authorities.

During the facility exploitation, monitor the Lim ecosystem annually, and after the first year of monitoring, depending on the results, adjust the frequency of monitoring. Authorized and accredited organization does the researches, and submits the reports to the government authority responsible for environment protection.

Continuous supervision of operation, accuracy and efficiency of the Waste Water Treatment Plant performed by the water inspector, all in accordance with the Law on Waters, Article 162. If legal entity does not comply with the legal regulations concerning WWTP operation, his responsibility is defined by the penalty provisions, Law on Waters, Articles 165 and 166.

As for the sewage sludge, according to Law on Waste Management ("Off. Gazette of Montenegro" No 64/11), Article 58, sewage sludge producer shall keep a record of the following sludge features: volume, composition, characteristics, technological characteristics of the process by which it is produced, and the location where it is applied. Sewage sludge producer shall submit the information for the previous year to the local government unit on whose territory the sludge is produced, by the end of 31 March of the current year.

The Agency for Environmental protection shall monitor the implementation of the sludge disposal activities, exercising the monitoring through local inspectors for environment protection.

**Remark:**

After section **3.2.1. Description of the Road Route**, the new one is added **3.2.A. Regulation of Lim watercourse in its part within the subject area** - (page 36).

*However, this issue has not been processed from the ecological aspect or the protection degree of WWTP location from possible flooding, since The Design of Lim Watercourse in its Part Within the Subject Area, has not been completed yet.*

*There are some information about great waters of Lim in the WWTP Preliminary Design, but they are not supported by facts so the team experts has not been able to accept them as relevant, because there is a big difference between the elevations of WWTP location and Lim great waters. Also, information from the terrain – the subject area, during previous floods (especially from the years 2010 and 2011), do not confirm the elevations of Lim great waters given in the Preliminary Design.*

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