Construction of the **Sewage Network and Waste Water Treatment Plant (WWTP) in the Municipality of Berane**

Volume 3-1 Employer’s Requirements Section 1. General Requirements for Execution of Works

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# Introduction

These General Requirements for Execution of Works are Part of the Employer’s Requirements (Volume 3-1) and should be read in conjunction with the following sections:

* Section 2 Particular Design and Process Requirements
* Section 3 General Specifications for Mechanical Works for WWTP
* Section 4 General Specifications for Electrical Works and SCADA for WWTP
* Section 5 General Specifications for Civil Works for WWT

Section 2 provides specific process and design requirements whereas Sections 3, 4 and 5 provide general specifications for mechanical, electrical and civil works respectively.

## Scope of works

The main objective of this Contract is the design and construction of a wastewater treatment plant (WWTP) to environmentally sound treatment and disposal of wastewater generated within the Berane municipality.

The Scope of Works will include the following:

* Detailed Design (glavni projekat) and construction of the WWTP
* Detailed Design (glavni projekat) and construction of the WWTP site regulation and flood protection
* Detailed Design (glavni projekat) and construction of the Access Road
* Detailed Design (glavni projekat) and construction of the connection pipeline to Water Supply System
* Detailed Design (glavni projekat) and construction of Connection to Power Supply System
* Detailed Design (glavni projekat) and construction of Connection to Telecommunication System

Detail description of the Scope of Works is presented in Volume 3-1 Section 2. Particular Process and Design Requirements for WWTP.

The Contractor should design and build the contracted project in a complete manner which includes all parameters relating to the required shape, type, quality, tolerances, functional standards, safety criteria, and limits on the whole-life cost of the permanent works upon completion; the tests which must be successfully passed both during and after the construction; the expected and required performance of the permanent works upon completion; the design life and durability of the permanent works upon completion; how the permanent works are expected to be operated and maintained upon completion; the operational software and manuals to be supplied; and details of the spare parts required to be provided and their cost.

The Contractor's scope of works and supply shall include all elements and aspects to ensure the proper implementation of the project which includes the design, construction and commissioning of a fully functional WWTP and associated structures as described in Volume 3-1, Section 2, Particular Design and Process Requirements. In addition training of the Employer’s personnel would be responsibility of the Contractor. The Contractor shall provide attendance at the WWTP of 90 days in total during the Defect Notification Period including period of Tests after completion.

The following stages shall be performed but are not necessarily limited to the following:

* Any and all necessary design encompassing process, civil, structural, mechanical, electrical, etc. and other "non-construction" activities for the WWTP;
* Preparation of documents and designs as required by the relevant National laws and regulations to enable the Beneficiary to obtain all necessary permits for supply the WWTP with electricity, potable water, telephone, gas etc if not already provided to the site;
* Preparation of all documents and designs to enable the Beneficiary to obtain (or adjust the available solution) all permits related to preparation for construction of the Works. After the approval of the designs by the Engineer, the Contractor will prepare all documents and drawings for all necessary certifications and permits, necessary for the Contractor or the Beneficiary in accordance with the Montenegro Law on Planning and Construction published in the Official Gazette of Republic of Montenegro nº 51/08 and it’s amendments (Official Gazette of the Republic of Montenegro 40/10, 34/11, 47/11, 35/13, 39/13, 33/14).
* Construction, installation and commissioning of the Works, incl. flow diversion and discharge pipeline to the recipient or the location indicated on the drawings;
* All channels and interconnecting pipe work within and between process units, structures and for inlet systems, bypass systems, outlet, washout systems, service water systems, process related piping and connections to the channels and pipe system; within the limits of the Contract as required, including pipes and drains of any description and of all materials with all fittings, penstocks, valves and pipe protection, both coating and lining;
* Mechanical, Electrical, Instrumentation, Control and Automation (MEICA) equipment, including motors and pumps;
* Laboratory equipment, furniture and spare parts, and reagents as listed;
* Workshop equipment and furniture, and spare parts as listed;
* Supervisory Control and Data Acquisition (SCADA) System for the WWTP
* Regulators, instrumentation, indicators, probes, recorders, gauge plates, platforms, floor plates and frames, fixed and portable ladders, handrail, flanges, connectors, gaskets, bolts, nuts, flexible couplings, nameplates, identification tags and bandages, cable splices, glands, boxes, junctions and ancillary material; fasteners, clips, stands, trays, hangers, all other auxiliary materials of any description and all materials;
* Spare parts for fixed and mobile MEICA equipment, including instrumentation and control required for 2 years operation after issue of the Taking Over Certificate, in accordance to these requirements;
* Testing, commissioning and handover documentation;
* Training;
* Attendance at the WWTP site during testing after completion.

# Documents to be provide in Tender Stage

The Tenderer shall present in his Tender a sufficiently detailed preliminary design for the Works with wherever possible brands and models for equipment to be supplied.

All drawings and documents to be submitted by the Tenderer shall be delivered both in hard and soft copies (in open electronic formats such as Microsoft Word, Excel and CAD as related).

The Tenderer shall furnish his Design Proposal in accordance with these Employer’s Requirements for the Main Proposal and also for the optional items, if applicable.

The design proposals and documents prepared by the Tenderer shall comprise as a minimum the requirements, as listed in Volume 1, Section 4 - Form 4.6.10 and Volume 3-1.

Should the Tenderer be selected as the Contractor, the Contractor will be expected to fully honour the offers made.

# General Performance Requirements

The Contract is based on a performance specification which reflects the Employer’s (Contracting Authority) Requirements. The Contractor shall propose his own Detailed Design for all parts of the works and take full responsibility for it. The Contractor is, free to suggest his own solutions as long as the Employer’s Requirements and the standard of solutions are, at least as good, as those specified in these Tender Documents.

All design, materials, workmanship and tests shall, as a minimum, comply with all Statutory Regulations, Standards and Codes of Practice that apply in Montenegro and in conformity with the requirements of the Contracting Authority and relevant National Legislation.

The Particular Design conditions more precisely are defined in the Volume 3-1, Section 2 of these Employer’s Requirements.

It shall be the responsibility of the Contractor to include all works necessary to ensure the intended performance of the new facilities in his Tender documents.

Continuous operation of the existing facilities with minimal disturbance when connecting new works shall be maintained.

No additional costs shall be awarded for subsequent design changes resulting from the Contractor’s failure to fully understand and assess the works before Tendering.

## Site organization

The site shall mean all areas where Works has to be completed as defined in the Contract.

### Temporary Fencing and Marking of Site

The Contractor shall provide, maintain and remove on completion of the Works any temporary fencing around the site and he shall operate appropriate security measures on access roads, but without prejudice to his obligations such as maintenance of free access for the Engineer and any other persons entitled to such access.

All open excavations shall be protected sufficiently to ensure the safety of workmen and to keep out the public and livestock.

### Signboards

The Contractor shall, at his own expense, provide, install and maintain signboards at the site of work and shall remove the same on completion.

A project signboard will be required at the main Sites. Signboards and commemorative plaques have to be provided and erected by the Contractor at the entrance of the WWTP and at the corner of the access road to the WWTP and the main road.

The Contractor shall erect a project signboard at the Main Site Office. This signboard shall be free standing or attached to the building as allowed by relevant Public Authorities.

The Contractor shall obtain instructions from the Engineer regarding information to be displayed on the signboard.

The Contractor shall not undertake or allow billposting or advertising of any kind upon the Works without the written consent of the Engineer.

## Facilities for the Contractor and for the Engineer

The Contractor shall provide and maintain on site suitable site offices for his own use. He shall also provide and maintain on approved sites, sufficient stores, tanks and workshops for the proper storage of materials, fuel plant and equipment. The stores shall be of such size and construction to provide adequate storage and protection of stocks of material, fuel, spares, etc, in quantities ensuring uninterrupted progress of the work. Workshops shall be suitably equipped to provide for carrying out major repairs, overhaul or modification by the Contractor of all plant and equipment in or on the Works. The Contractor shall allow in his rates for all costs related to provision of the offices and workshops for his own use.

The services which must be provided to ensure the serviceability of these offices have also to be provided. The costs of the provision of facilities for the Engineer are included in the Contract.

Prior to construction of the site facilities, the Contractor shall prepare drawings for site facilities which will cover the following aspects of the works:

* Location and arrangement of the Constructor’s buildings and offices, including access facilities, utilities and fencing;
* Location and arrangement of work-yards, workshops, depots and stores for equipment, fuel and materials, including access facilities, electricity, water and telephone connections and fencing;
* Location of and proposals for the temporary works required for constructing the Works;
* Working drawings and calculations for all the temporary works proposed by the Contractor for constructing the Works.

The future Works Contractor(s) shall provide an office on site (in the municipality of Berane) for the Engineer. None of the mentioned furniture and office equipment shall be transferred to the Engineer after completion of the project. At the end of the Contract all furniture and office equipment shall be returned to the Contractor.

The Works Contractor(s) shall design and erect at locations agreed with the Employer and the FIDIC Engineer the following facilities for the use of the Employer and the FIDIC Engineer:

There shall be only one Engineer for both Lots included in this Tender (Lot 1: WWTP, Lot 2: Sewerage Network) and therefore the Engineer (for Lot 1 and for Lot 2) shall use the facilities and premises as specified herein below.

**Table 3 1 - Facilities for the FIDIC Engineer**

|  |  |  |
| --- | --- | --- |
| **Room** | **Size (appr.)** | **Furniture** |
| **Fix Office at a construction site - 1 Office 25 m2** | | |

Before commencement of any construction works on the WWTP site and before providing all necessary utility connections to the WWTP site (access road, power supply, water supply, telecommunication line etc) the offices of the Engineer shall be located in the Town of Berane as approved by the Contracting Authority and by the Engineer. However, after the commencement of the construction works on the WWTP site and provision of the aforesaid utility connections, the location of the Engineer’s offices shall be located at the WWTP site.

Provision of the above mentioned facilities and premises for the Engineer shall be the responsibility of the Lot 1 (WWTP) Contractor.

External doors shall be fitted with a secure lock for which a minimum of four keys shall be provided. All windows shall have anti-mosquito nets and venetian blinds. Lighting shall be of the fluorescent strip type. The office shall have at least four grounded electrical sockets. Sufficient heating and cooling shall be provided.

The Contractor shall be in charge with all costs of the above-mentioned facilities.

The facilities shall be installed, furnished, equipped and ready for occupation and use and fully serviced within 14 days of the commencement of the works.

## Site Services

Where utility services are not already available on the site, the Contractor is to make his own arrangements for the supply of electricity, water, telephone and sewerage until such time as the permanent works are available for use.

The Contractor shall provide and maintain wherever required adequate supplies of electricity at a suitable voltage and compressed air for all operations to be undertaken to complete the Contract. The Contractor shall also make these services available to subcontractors and, when instructed by the Engineer, to other Contractors and employees of the Engineer.

The Contractor shall be responsible for entering into any agreements with the appropriate suppliers, and shall issue all notices and pay all fees, dues, rents, charges and other costs incurred thereby.

The Contractor shall, in connection with such supplies, adopt precautions to ensure the safety of all personnel.

### Site Lighting and Electrical Power

The Contractor shall provide and maintain efficient temporary lighting and power supplies for all parts of the works as may be necessary and shall, in connection with such supplies, adopt precautions to ensure the safety of all personnel.

The Contractor shall provide adequate lighting for the proper execution and inspection of the works. If the Engineer considers the intensity of lighting to be inadequate for the proper execution and inspection of the work being undertaken the Contractor shall install such additional lighting as the Engineer may require.

The minimum standard of temporary lighting required in all structures, culverts, underground chambers and the like shall be one 200 watt bulb to every 8 meters length. Such lighting shall be maintained throughout the Contract until the end of the Defects Liability Period or until an alternative date as may be agreed to by the Engineer.

### Drinking Water and Technical Water

The Contractor shall provide wherever required adequate supplies potable and service water of proper quality and pressure for all operations to be undertaken to complete the Contract. The Contractor shall also make these services available to subcontractors and, when instructed by the Engineer, to other contractors and employees of the Engineer.

The Contractor shall be responsible for entering into any agreements with the appropriate suppliers, and shall issue all notices and pay all fees, dues, rents, charges and other costs incurred thereby.

### Hygiene

The Contractor shall clean as necessary and maintain the site in a hygienic condition and shall comply with the equipment of the Safety Officer appointed by the Engineer and any instructions of the Engineer.

The Contractor shall provide, maintain and remove at the end of the Contract or when directed by the Engineer, adequate toilet facilities including flushing toilets, hot water and showers for the use of his own staff and that of the Engineer adjacent to or as part of their site offices and additional suitable facilities in various parts of the site as necessary for the use of his workmen.

### Communication

The Contractor shall provide and maintain adequate communications around the site. A telephone network internet connected with the telephone service required by the Engineer shall serve principal offices, installations and site facilities. If the Contractor supplements the telephone network with a radio communications network he shall allow the Engineer reasonable use of the facility.

## Site Offices

The Contractor shall provides, erect, service and maintain all necessary buildings as offices, housing or plant yard/stores for himself, his staff and his employees. These buildings shall, from the time of their erection until the completion of the Contract is the property of the Engineer and the Contractor shall not demolish or remove any buildings or part of any buildings without the written permission of the Engineer.

All buildings shall comply with the local regulations or generally accepted standards, and the Contractor shall maintain approval of the appropriate Authority prior to construction. The Contractor shall also construct and maintain adequate roads or paths to all buildings.

All huts, buildings, fixtures and fittings provided under this Clause shall be removed and the site reinstated at the end of the Contract, the site is to be left either gravelled or grassed as instructed by the Engineer.

## Cleanliness on Site

The Contractor shall make every effort to keep the site tidy and in orderly manner and to take at any time every possible precaution against the contamination of subsoil and groundwater. The Contractor shall be responsible for making all arrangements for the disposal of solid and liquid wastes from the site. Furthermore, he shall give strict instructions to all persons employed by him to use the sanitary accommodation provided at site.

## Access Roads

The Contractor shall, at his own expense, carry out all protective works and strengthening of public streets and roads used by him as necessary to avoid damage from heavy loads and plant moved to the site. He shall also construct, maintain and remove temporary access roads as he may require for carrying out the works at his own expense. The Contractor shall observe all restrictions, which apply to public roads. He shall comply with all reasonable restrictions, which may be imposed by the Engineer, the Police or other competent Authorities.

Public and private streets, roads and other surfaces used by the Contractor shall be kept free from dirt and rubbish and be cleaned as required by the Engineer. Immediately after ceasing the use of any temporary road the Contractor shall restore the road to the satisfaction of the Engineer and the responsible Owner Authority.

## Temporary Access

The Contractor shall provide and maintain all footways and structures necessary for the purposes of the Contract. On completion of the works, unless instructed otherwise by the Engineer, the Contractor shall remove such footways and structures and restore the ground to the satisfaction of the Engineer.

The Contractor shall provide and maintain all temporary gangways, ladders and staging on and about the Sites necessary for the purposes of the Contractor and shall remove such gangways, ladders and staging when no longer required.

## Public Roads Cleanliness

The Contractor shall minimize pollution of public roads. The Contractor shall take all measures to keep all public roads clean of any spillage or droppings from his own and his Sub-contractor’s vehicles travelling to and from the site. All such spillage or droppings shall be immediately cleared to the satisfaction of the Engineer and appropriate Public Authority.

The Contractor shall indemnify the Engineer against all claims by the third parties, which may arise out of the Contractor’s failure to comply with this Section.

## Storage of Equipment and Materials in Public Space

Construction materials and equipment shall not be stored outside the site of the WWTP.

Where Works has to be completed on public spaces, all plant and excess material shall be removed immediately from the site.

## Traffic Arrangements

#### The Contractor shall as far as required, comply with all requirements and recommendations of the Police and Authorities regarding traffic arrangements and road safety measures on public roads outside the WWTP site.

The Contractor will provide skilled personnel for traffic control at the adjacent magisterial road as directed by the responsible Authorities, but mandatory when cars, tracks and machinery are entering or exiting the construction site.

The Contractor shall if needed, provide all barriers and traffic signs approved by the Engineer.

Traffic diversions, if necessary, shall be planned and arranged with the responsible Authorities by the Contractor and harmonized with the Engineer. No diversion shall be implemented without the written consent of the responsible Authority and after given information to the Engineer. Access to the site shall be available to vehicles of emergency services and residents in the areas.

The Contractor shall provide, erect and maintain on the sites and at locations on the access to the sites all traffic signs and traffic control signals, as necessary and/or may be required by the Police Authority for the safe direction and control of the traffic. The location and size of all such signs and the lettering thereon shall be approved by the Engineer before erection of the signs.

The Contractor shall reposition, cover or remove signs as required during the progress of the works.

## Health & Safety

The Contractor shall use his best endeavours to ensure, so far as is reasonably practicable and to the satisfaction of the Engineer, the health, safety and welfare at work of his employees including those of his Sub-contractors and of all other persons on the site.

The Contractor shall comply with the requirements of European Directives 92/57/EEC and 89/391/EEC and the Montenegrin law concerning the Health and Safety Protection and all relevant national health and safety regulations.

The Contractor shall execute the works in a manner complying with the best European or Montenegro Safety Regulations and Standards.

Should be Engineer consider the Contractor’s method of working unsafe or that there are insufficient or inadequate safety barriers or other devices or that there is insufficient safety or rescue equipment, the Contractor shall change his method of working or install or strengthen safety and rescue equipment if so instructed. Such instructions shall not relieve the Contractor of any of his responsibilities under the Contract.

The Contractor shall notify the Engineer immediately any accident that occurs, whether on site or off site, in which the Contractor is directly involved, and which resulted in any injury to any person whether directly concerned with the site or a third party. Such initial notification may be verbal and shall be followed by a written comprehensive report within 24 hours of the accident.

Transportation of any material by the Contractor shall be in suitable vehicles, which do not cause spillage when loaded, and all loads shall be suitably secured. Any vehicle shall be removed from the site, which does not comply with this requirement or any of the local traffic regulations and laws.

The Contractor has to enable access to sites at any time to any external institutes or experts carrying out safety inspections.

The recommendations contained in the booklet ”Safety in Sewers and at Sewage Works” published by the Institution of Civil Engineers, London, shall be adhered to in respect of all work in operational sewers, pumping stations and wastewater treatment plants.

The Contractor shall make all necessary arrangements with the appropriate authority before entering in or working on existing sewers and associated works.

## Safety Equipment

The Contractor shall install and maintain adequate provisional safety equipment such as handrails for all platforms, unsecured ceilings and gangways of scaffoldings and high formwork elements, accessible tops of high walls and stairways for all temporary and permanent Works. Life belts, swimming belts and rescue bars for open basins are to be provided, accordingly.

## Accidents, Extraordinary Events

The Contractor shall give immediate written notice to the Engineer of any accident or extraordinary event occurred on the work site giving details of the same whether or not such an accident or event affects the progress of work. The Contractor is also obliged to report on any measure taken.

National and internationally accepted safety standards shall be strictly considered. A security plan, which includes the relevant standards, shall be submitted to the Engineer for approval before commencement of the works.

## Fire Prevention

During the performance of the Contract the Contractor shall make arrangements to the satisfaction of the Engineer for the protection of the permanent works and any temporary works and any adjacent property from fire and, if required, he shall give the Fire Authority admittance to all facilities periodically to inspect the fire prevention arrangements.

Particular care must be exercised in connection with the operation of electric arc welding equipment, oxyacetylene cutting equipment and other processes involving the use of naked lights. Special arrangements will be necessary for the storage of highly flammable liquids on the site.

The Contractor shall remove all rubbish and material of a flammable nature and take such other steps as the Engineer may require but this shall not relieve the Contractor of any of his obligations under the Contract.

## Equipment Safety

The Contractor is obliged by his signature to supply the machines, devices, pieces of equipment and the like complete with the safety protection required for accident prevention according to regulations of the local accident insurance associations or trade associations.

## Security

The Contractor shall, at his own expense, case up and suitably protect all work liable to injury, either by the weather or by the method adopted for the execution of the Works and take all precautions against the contamination of the works.

# Quality Assurance System

## Quality Assurance Plan

The QAP shall, as a minimum, cover the following issues:

* Staff and management organization (organisation chart, staff qualifications & experience etc)
* Management plan (procedures, information system etc)
* Quality control plans (procurement, design, construction etc)
* Document Control (information system, storage, dissemination, archive etc)

The person responsible for the Contractor’s QAP shall be authorized and qualified to take decisions on quality assurance issues, and his reference and communication lines to the Company’s overall quality assurance organization and its responsible management shall be clearly shown. His duties shall as a minimum be as follows:

* Management of documents.
* Management of procurement.
* Management of Sub-Contractors and suppliers, and requirements to their QAP’s.
* Control of materials and workmanship, defects and material reconciliation, procedures for corrective actions, etc.
* Handling of the deviations, additions or variations to the Contract Documents.

Persons performing quality control and testing shall be independent of those executing or supervising the Works.

The Contractor’s system of management of documents for the execution of the Works shall include his Sub-Contractors and suppliers, and shall be designed to ensure the following:

* Only valid and approved documents are used for the execution of the Works;
* A complete record of changes and amendments to documents is maintained

The Contractor’s shall present with his Tender a preliminary Control Plan describing important and critical control activities which shall be based on the Tender Document and the Contractor’s own consideration in respect of execution.

## Design Control

The Contractor’s designer shall institute a quality assurance system to ensure that his design is completed with due care and attention as per the technical requirements.

The designer must maintain a documented Quality Control Plan (QCP) which is compatible with the Contractor’s QCP plan. Sub-providers shall either agree to comply with the providers QCP or have their own documented QCP in place.

The QCP for design shall cover the following activities:

* Selection and assignments of appropriate qualified professionals to perform the project tasks
* Appointment of qualified specialists to oversee and review all elements of the work and carry out a consistent, deliberate program of quality control
* Creation of a design team with a management structure conducive towards quality and continually improving the quality process
* Procedures to ensure that all personnel involved in performing the work have a clear understanding of the scope, intent of the overall project as well as their own responsibilities
* Procedures to prepare appropriately design criteria and environmental assessment
* Procedures for preparation and dissemination of the project schedule to ensure that all personnel involved in performing the work are aware, and understand the importance of meeting intermediate deadlines as well as final completion dates
* Procedures for peer reviews to be conducted by qualified personnel outside of the design team
* Procedures for maintaining documents recording the quality control process properly, to the degree appropriate to each project

The Contractor must present for the approval of the Engineer his quality assurance plan and quality control plans.

## Construction Control

The responsibility rests with the Contractor to produce work which conforms in quality and accuracy of detail, to the Contracting Authority Requirements.

The Contractor must, at his own expense, institute a quality control system and provide experienced Engineers, foreman, surveyors, material technicians, other technicians and other technical staff, together with all transport, instruments and equipment to ensure adequate supervision and positive control of the Works at all times. All quality controls shall be recorded by documents which format and content shall be approved by the Engineer.

A comprehensive Quality Assurance System (QAS), covering all aspects of the Contract and the Works must be implemented, documented and maintained by the Contractor during the period of the Contract.

The QAS shall as a minimum consist of:

* Quality Assurance Plan(QAP)
* Control Plan(CP)

The QAS system shall be presented to the Engineer for approval within one month from the commencement of the works.

## Quality Control Plan for Construction (QCP)

Within one month of the commencement of the works, the Contractor shall present for the Engineer’s approval his detailed CP for all quality assurance efforts or measures for the works or sections thereof. However, such CP shall be presented to the Engineer not later than one week before any actual construction activity.

The QCP shall include controls as specified in the Contract as well as any other normal and special controls that the Contractor finds necessary in order to ensure the quality of his work.

The QCP shall for each control activity describe type, method, range, time/frequency, criteria for approval and documentation and who is responsible for performing the activity.

If the Employer does not approve the QCP as submitted, then the QCP shall be amended for further approval. Subsequent changes in the range and contents of the quality assurance work will not be allowed as a reason to extend agreed deadlines or to increase contract sums.

## Documents Control

During the Contract period, the Contractor shall, to the satisfaction of the Engineer, document that the Works comply with the quality assurance requirements stipulated in the Contract or approved during the Contract period.

Consequently, based on the approved QAS and the QCPs, the Contractor shall during the execution of the works carry out and document the quality control and its compliance with the stipulated requirements.

The Contractor’s quality control does not limit his responsibility for completing the Works according to the Contract.

At any time during the period of the Contract, If the Engineer can substantiate that the Contractor’s control and/or documentation is not functioning as planned or is not being adhered to, the Contractor must propose improvements to remedy the situation at his own cost and within the agreed time for completion.

All control activities specified in the Control Plan shall be documented.

The QCPs and all other issues related to the QAS shall be kept and maintained by the Contractor in the Quality Manual.

On the basis of the QAP and QCPs the Contractor shall produce the necessary form for registration, log books, and check lists, etc. before the Works are commenced.

All documentation shall be provided with identification, the date and signature of the person responsible for the documentation. The identification shall as a minimum comprise: name of project; activity number as defined in the CP; time and place of control activity.

All original documentation shall be inserted in Control File in the Quality Manual, which shall be kept and maintained by the Contractor at the project site throughout the period of the project. In addition to the control documentation the Control File shall also include all other relevant quality documentation. The Engineer shall have full access to the Control File at all the times.

# Technical Standards and Building Regulations

## General

In accordance with these Employer’s Requirements the Contractor shall ensure that his Designs incorporate the following key principles:

* For all required works and services specified in this Tender Dossier, the relevant National (Montenegro) Standards and codes of practice shall apply. In any case, if Montenegro Standards are more strict or dominant, they shall apply to replace other standards given or not in other parts of this document.
* For works and services where no relevant National standard or codes of practice exists, the latest generally accepted European Standards and code of practice such as harmonised National, German or British Standards, and any other Standards shall be applied.
* The proposed application of other standards and code of practice for certain works and/or services shall be such as to ensure equal or higher than specified quality and safety of works, and to facilitate operation, inspection, maintenance, repairs, lubrication and similar operations.
* In any case, it is required to state standards and code of practice to be used for each service and work, accompanied with explanations to demonstrate to the satisfaction of the Engineer that application of these standards and code of practice shall give required quality, safety, functionality and durability of works and completed WWTP.
* The applicable version of any standard shall be that valid 28 days prior to the latest date for submission of tenders.

## SI-Units

SI units (Système International d'Unités) of measurement shall be used throughout this Contract. All calculations and technical information shall be in SI units.

The Contractor shall transfer all information and data originating in another system into the SI System.

## Reference Standards

The Montenegro Standards shall be predominant and EU-Standards or other acceptable standards and codes in their latest Edition which satisfy also the harmonised National (Montenegro) Standards shall be used throughout this Contract.

In referring to the Standard Specifications the following abbreviations are used:

DWA/ATV German Water Association, formerly German Association for Water, Wastewater and Waste

BS British Standard

BSCP British Standard Code of Practice

CE CE Certificate acc. to EU Directive 2001/95/EG

CEE International Commission of Rules for the Approval of Electrical Equipment

CESMM Civil Engineering Standard Method of Measurement, GB

CESWI Civil Engineering Specification for the Water Industry, GB

DIN Deutsches Institut für Normung e.V. - German Institute for Standardisation

DVGW Deutsche Vereinigung des Gas- und Wasserfachs e.V. - The German technical and scientific organisation on Gas and Water

EN European Standards

FIDIC Fédération Internationale des Ingéniieurs-Conseils, Geneva

IEC International Electro technical Commission

ISO International Organisation for Standardisation

SIS Sveriges Standardiserings Kommission (Swedish Standard Commission)

MEST National Standard, to be applied in harmonised editions, only

USBR United States Bureau of Reclamation

UVV Unfall-Verhütungs-Vorschriften (Regulations of Accident Prevention)

VDE Verband Deutscher Elektrotechniker – German Association for Electrical, Electronic & Information Technologies

The Contractor shall supply and maintain in his office on the site at least one complete set of all Standard Specifications referred to in the Contract. In addition, one set shall be made available for the use by the Engineer Team.

Except where otherwise specified, all materials and workmanship shall comply with the requirements of the latest editions of European, Montenegro and German standards and codes of practice and any other Standards, which referred to in the Specifications but are superior to the Montenegro standards and regulations. A list of the Standards is included in the Annex to this Section.

The Standards and Codes to be used for the Works shall be current at 28 days prior to the last Tender submission date.

## Other Standards

Where such standards and codes are National, or relate to a particular country or region, other authoritative standards which ensure an equal or higher quality than the standards and codes specified will be accepted subject to the Engineer’s prior review and written approval. Differences between the standards specified and the proposed alternative standards must be fully described in writing by the Contractor and submitted to the Engineer, with a translated copy of the relevant standards in the English language, at least 28 calendar days prior to the date when the Contractor desires the Engineer’s approval. In the event the Engineer determines that such proposed deviations do not ensure equal or higher quality, the Contractor shall comply with the standards specified in the documents. Only materials in accordance with approved standards shall be used in the Works.

## Copies of Standards on Site

The Contractor shall purchase and keep on site at least one copy of each of the Standards, Codes and manuals or approved National Standards, which are referred to in the Specifications. In addition the Contractor shall keep on site a copy of any other Standard, Code or Manual or National Standard, which applies to materials supplied.

Copies of the standards shall be available any time for reference at the office of the Engineer. If the Engineer requires an English or Montenegro translation of any of the Standards or Manuals the Contractor shall provide a typed copy of the translation within 7 days of receiving a written request from the Engineer.

The Cost providing all the Standards mentioned and Standards required during the execution of the Works shall be included in the rates and prices and no payment will be done to the Contractor for these.

## Matters not covered by Standards

Any materials and workmanship not fully specified herein or covered by the Standards, Codes or Manuals shall be of such type and quality so as to produce a first class work. In such circumstance the Engineer shall determine whether all or any of the materials offered or delivered to the site are suitable for use in the Works and the Engineer’s decision in this respect shall be final and conclusive.

## Abbreviations and Terminology

Table 5‑1 List of abbreviations and terms

|  |  |  |
| --- | --- | --- |
| **%** | shall mean | per cent |
| **c** | shall mean | centre |
| **CA** | shall mean | Contracting Authority |
| **CESWI** | shall mean | “Civil Engineering Specification for the Water Industry”, 5th Edition” published by UKWIR Ltd., WRc plc, Franklin Road, Blagrove, Swindwon, Wiltshire, SN5 8YF |
| **Day** | shall mean | Calendar Day |
| **DD** | shall mean | Detailed Design |
| **DIN** | shall mean | German Standard |
| **DN** | shall mean | nominal diameter |
| **EN** | shall mean | European Standard |
| **FFL** | shall mean | Final floor level |
| **h** | shall mean | hour |
| **HDPE** | shall mean | High density extruded polyethylene |
| **ISO** | shall mean | International Standards Organization. |
| **kg** | shall mean | kilogram |
| **km** | shall mean | kilometer |
| **kW** | shall mean | kilo Watt (1000 Watts) |
| **l** | shall mean | liter |
| **L.S.** | shall mean | lump sum |
| **m** | shall mean | meter |
| **m/d** | shall mean | man-day |
| **m²** | shall mean | square meter |
| **m³** | shall mean | cubic meter |
| **mASL** | shall mean | Meters abobe see level |
| **mm** | shall mean | millimeter |
| **mm²** | shall mean | square millimeter |
| **Month** | shall mean | 30/31 Calendar Days |
| **MSDS** | shall mean | Material Safety Data Sheet |
| **pcs** | shall mean | pieces |
| **PE** | shall mean | Population Equivalent |
| **PM** | shall mean | Project Manager |
| **PVC** | shall mean | Polyvinyl chloride |
| **QAS** | shall mean | Quality Assurance System |
| **RC** | shall mean | Reinforced Concrete |
| **t** | shall mean | tone (1000 kg) |

# General Design Requirements

## Legislation

#### All design and construction activities are governed by the Law on Planning and Construction as published in the “Official Gazette of Montenegro, No. 51/08, 34/11, 35/13 and 33/14 and relevant secondary legislation.

Although Montenegro is not a member of the European Union, its status of potential candidate country puts an obligation on Montenegro to approximate its Laws to the Directives of the EU. Not all Montenegro Laws have yet been amended but it shall be assumed that this approximation will become effective. Therefore all design and construction work will have to be completed in accordance with the EU Directives unless Montenegro Laws provide for stricter conditions.

Where certain conditions are not covered either by Montenegro Law or EU Directives, alternative texts with adequate justification for the proposal can be proposed by the Contractor for the approval of the Engineer. In case where the texts are in a language different from the language of the Contract, the Contractor shall provide a translation. The Engineer shall issue his decision within 28 days of the receipt of all justified request.

Where there are contradictions between the different Laws and Directives, the matter shall be brought to the attention of the Engineer.

## Permits to be obtained by the Beneficiary

Montenegro legislation dictates that a certain number of permits (approval, authorizations, decisions etc) are required prior to the execution of certain tasks or putting into service a facility. The types of permits which may be required are as follows:

* Approval of EIA
* Building Permit
* Usage permit
* Various design conditions (water management, roads, electricity, telephone etc)
* Consequent certificates that the abovementioned design conditions have been fulfilled

The Contractor shall prepare all necessary design documentation in order to enable the Beneficiary to obtain all conditions and permits necessary for the design, construction, occupation and use of the WWTP in accordance with the Montenegro Law on Spatial Planning and Construction of Structures and other Laws.

The Contractor shall supply the Beneficiary with all necessary design data for the purpose of obtaining new or updating the existing design conditions, as required by competent Montenegro authorities.

The Contractor shall be responsible for ensuring that all the necessary conditions required by Montenegro Laws are fully satisfied.

It shall be the responsibility of the Contractor to ensure that he has all necessary permits before he proceeds with any works and to advise the Engineer when any particular permit is no longer valid or is necessary.

The Contractor must therefore ensure that he has prepared all the documentation necessary for obtaining a permit in time for his own execution of the Works bearing in mind the required number of days specified in the Law for obtaining a particular permit. The Contractor must also allow sufficient time for the Engineer and the Beneficiary to process the request for a permit.

## Site Conditions and Further Investigations

Available specific site conditions such as site boundary, topography, geotechnical conditions are provided in Volume 3-1 Section 2 and/or in Volume 5.

The Contractor shall review and assess the quality of this general information and where considered necessary he shall gather all additional information necessary to complete all design work at his own cost. The Contractor shall assume responsibility for all such additional investigations and include these activities in the main schedule of activities.

### Topography

A preliminary topographical survey is included in Volume 5. The Contractor shall identify the Montenegro mapping benchmarks and establish control points which shall be used for construction activities. The attributes of the topographical control points shall be communicated to the Engineer.

The Contractor shall carry out a detailed topographical survey of the site prior to the start of any construction works to record the existing situation. The survey shall be completed by an independent surveyor to be approved by the Engineer. The results of the survey shall be presented to the Engineer as a record of the existing site condition.

### Levels and Benchmarks

The works shall be set out and tied to the local National Co-ordinate System. Except where otherwise specified all levels shall be in meters above mean sea level (m.a.s.l.) with accuracy of three decimals. The Contractor shall supply to the Engineer details of the value and location of the temporary benchmarks and reference points that he proposes to use.

The Contractor shall, before construction commences, establish from the reference point’s and benchmark’s, an adequate system of control points and benchmarks at suitable locations on the site of the works, which shall be clearly marked, adequately referenced and properly recorded. Temporary benchmarks and survey stations shall, unless otherwise approved, be located clear of the construction works.

The Contractor shall establish, construct and project during the period of construction of the Works necessary additional benchmarks, which shall be checked periodically. The Contractor shall be solely responsible for carrying out these operations. He shall make the control points and benchmarks available to the Engineer together with the relevant records.

The Contractor shall submit to the Engineer for approval drawings in duplicate showing the locations and levels or co-ordinates as appropriate of each and every temporary benchmark and survey station used for the setting out of the works.

The Contractor shall be responsible for constructing the works in accordance with the data on levels, benchmarks and other points of reference in the vicinity of the site(s) if they are not shown on the drawings.

### Setting out of the Works

The Contractor shall before commencing execution of any given section of the Works submit to the Engineer complete setting out details with supporting calculations and drawings (including drawings showing the locations and co-ordinates of the reference points used) in duplicate for approval.

The Contractor shall identify setting out dimensions for all structures by the relating them to existing works and by interpretation of the drawings.

The locations of structures to be constructed as part of the works shall be identified by reference to steel pins set in concrete or other approved markers set up by the Contractor, who shall also determine the co-ordinates of the markers and their distances from adjacent existing structures.

The Contractor shall set out sections of the works at such times as may be directed by the Engineer to enable Utility Service Authorities to carry out temporary or permanent alterations to their equipment or buried services.

Data and information on levels, dimensions, alignments and gradients other than these to be determined by the Contractor when preparing his structural and detailed design drawings are shown on the drawings. Details not shown on the drawings shall be established by the Contractor during the execution of the works.

The Contractor shall employ well-qualified and experienced surveyors approved by the Engineer for the execution of the survey work and setting out as described in the Contract. The survey instruments to be used by the Contractor shall be of the modern type, suitable for the work to be executed and shall be maintained in a first class condition. The instruments and/or equipment shall be subject to the approval of the Engineer.

For all survey instruments used in the works the Contractor shall submit recent calibration certificates issued by competent authorities. Further calibration of the instruments shall be carried out every three (3) months. All field-books, calculations, maps, etc. of survey activities mentioned above shall be handed over to the Engineer immediately after completion of the survey work.

### Geotechnical Investigations

The available geotechnical investigations are included in Volume 5 .

The Contractor shall assess the quality and applicability of the provided data and carry out all necessary geotechnical investigations he considers necessary for completing the design of all facilities included in this contract.

Geological, hydro-geological and geotechnical surveys shall be completed in accordance with Montenegro and other specified Standards (DIN4201 and its subsequent replacements where applicable like DIN EN ISO 22475-1:2007-01, and other), including subsoil tests and ground water analysis.

Details of the number, location of the boreholes or trial pits and reference points that he proposes to use shall be submitted for approval to the Engineer.

The fieldwork to be carried out by the Contractor may comprise:

* Sampling and laboratory tests
* Penetration tests
* Plate bearing tests
* Permeability tests
* Ground water table and ground water quality determination

The site investigation work shall be carried out using modern methods and equipment and by fully competent staff under the Contractor's manager. The equipment employed shall be such as to provide the necessary data.

If any suspicion of soil pollution is evident, samples must be taken for laboratory soil tests or field testing shall be carried out. Pollution shall mean that the material is considered as “unsound” and has to be replaced by “sound” material. “Unsound” soil structures (gypsum, salt, sulphate, etc.) have to be treated by technical precaution measures to achieve the necessary characteristics or they have to be replaced with “sound” material.

The Contractor shall use the results of his own site investigations to design in detail every aspect of the Works, permanent or temporary, which is affected by the subsoil. This design shall be entirely Contractor’s responsibility and it is a subject of Engineer's approval.

### Existing Utility and Other Services or Buried Structures

The Contractor shall make his own enquiries and shall carefully excavate inspection pits to locate accurately the utilities indicated to him by the drawings or by utility undertakings.

Before starting any work, the Contractor must carry out a survey of his work area to identify any services or structures (foundations, walls, archaeological findings, etc.), which may be present and may interfere with his design and the Works. The Contractor’s design shall take into consideration the discovered utilities.

The Contractor shall take all necessary steps to inform himself and the Engineer and Beneficiary and other Authorities responsible for water, sewerage, electricity and communications and from private companies the location of underground utilities / structures.

## Design Documentation Requirements

The contractor shall provide the beneficiary with all necessary data, documentation and related information that are necessary in the process of applying for and obtaining of a Building Permit by the Employer.

The Contractor shall prepare his Detailed design to cover the whole plant up to the (inclusive) outfall of effluent discharge pipe into the Lim River and including sludge treatment to the extent described in Section 2 of the Employer’s Requirements. The Detailed design shall be reviewed and approved by the Engineer. On full approval without reserve of the Detailed Design, the Employer will apply for a Building Permit to the competent authority. Construction activities can only proceed after obtaining of the Building Permit.

## Third Parties

The Contractor shall comply with all conditions stipulated in any permits granted by third parties, including conditions stipulated in those permits obtained by the Beneficiary.

## Documents and Data Furnished by the Engineer

The Engineer will provide access to the Contractor to all available documents listed in the Volume 5 of this Tender document.

The Contractor shall ensure copying of the documents, or parts of them, when he considers he needs such, and carry out himself all surveys, investigations, studies and analyses of any kind as may be necessary and specified elsewhere.

The Contracting Authority will not entertain any claim by the Contractor on account of incompleteness or inaccuracy of drawings and data furnished by him, irrespective of when the Contractor shall discover such incompleteness or inaccuracy.

## Principal Design Objectives

The design of the facilities shall be in accordance with best available European practice and applicable local design standards, and shall be such as to facilitate construction, operation, inspection and maintenance of all processes and equipment.

The following fundamental objectives, minimum requirements and constraints shall be generally considered for the design of the WWTP:

* Continuous operation of existing facilities with minimal disturbance when connecting new works;
* High operation safety and high system stability of the wastewater and sludge treatment process with regard to the required effluent standards;
* Ease of operation in order to allow the WWTP to be operated by a reasonably experienced personnel and to minimize personnel requirements;
* High flexibility of the treatment process in order to easily allow plant operation to be very well adjusted according to the actual wastewater load (low and-or high concentrations and diurnal peaks for short periods of time) of the WWTP and to allow to reasonably keep up with the effects of unexpected industrial wastewater discharges;
* High degree of reliability using mechanical and electrical equipment with proven reliability record in similar works
* Sufficiently high degree of redundancy by means of installed spare capacity and/or spare units of equipment to overcome without problem all normal maintenance situations and emergencies due to temporary malfunctioning (or non-functioning) of main mechanical and electrical equipment and civil constructions
* Reduction of the volume of sludge and other residues in order to minimize disposal expenditures;
* Minimization of capital costs;
* Minimization of operation and maintenance costs

## Design Life and Criteria

The design of all facilities shall be such that the minimum design life shall be as presented on the following table:

| Description | Design Life (Years) |
| --- | --- |
| Civil Works and Buildings  Process Structures | 50 |
| Pipes & sewers | 50 |
| Buildings | 50 |
| Roads | 50 |
| HVAC equipment | 20 |
| Building Services | 20 |
| Process, Mechanical and Electrical Plant  Process Equipment | 20 |
| Mechanical equipment | 20 |
| HV switchgear and transformers | 40 |
| LV Motor Control Centers | 20 |
| Electrical Installations | 20 |
| Instrumentation, Control and Automation equipment | 15 |
| SCADA and PLC systems | 15 |

The design shall be such that all materials, components and sub-components including connections or connecting methods shall have a design life compatible with the design life of the whole facility under all service conditions.

Mechanical and electrical equipment shall be suitable for 24 hour per day continuous operation and also under discontinuous operation under all local climatic conditions and be designed such that complete replacement shall not be required until at least 15 years after the date stated on the Taking-Over Certificate.

Parts designed to wear out, other than consumable items, shall have a design life of at least 5 years, all gearboxes shall have a calculated design life of at least 60,000 hrs. assuming continuous operation.

Flood protection for the facilities shall be for a 1:100 year event.

## Requirements for Materials and Equipment

All materials and equipment shall conform to the technical specifications as provided in Volume 3. The following general requirements shall be applicable:

* Materials and equipment shall be fit for purpose;
* Materials and equipment shall be suitable for the environmental, physical conditions which are likely to exist at its place of use;
* Whenever possible, the Contractor shall provide equipment of a similar nature from the same manufacturer, e.g. electric motors;
* Standardisation of types of equipment, such as pumps, mixers, valves, instruments, shall also be adopted;

The Contractor shall note that particular attention will be paid to these requirements. In cases where the proposed equipment is not standardised with regard to manufacturer and type, the Contractor shall be required to provide conclusive technical justification; considerations of price alone will not be accepted. Equipment and components that have not been standardised will not be approved.

## Plant Layout Requirements

The layout of the plant shall consider the following:

* The direction of the prevailing winds and the location of the facilities;
* All weather vehicle access to buildings and major structures;
* All weather pedestrian access to all facilities including process units, chambers, enclosures etc.
* Flood protection for all civil structures, electrical and mechanical equipment by raised construction platform elevation, embankments, etc.;
* Modular arrangement of the treatment units to allow future extensions of the plant;
* All process units for the ultimate design situation shall fit within the site boundary as presented on the preliminary site layout in Volume 5.

## Requirements for Operation Stability and Reliability

The whole Plant shall be designed for maximum operation stability, reliability and flexibility at least system operation / maintenance and capital costs considering at least the following requirements:

* Appliance of safety factors wherever necessary in order to cover not predictable situations and conditions especially concerning variations in wastewater flow, pollution loads, and sludge characteristics (sludge volume index etc.);
* Provision of indicating systems for an early stage not predictable situations and conditions like inflow of substances into the WWTP disturbing or inhibitory the treatment process;
* Provisions to manage particular operation conditions like start-up, regular shut-down, emergency shut-down, operation with reduced number of process units, etc. without any deterioration of the effluent quality;
* Provisions to manage normally expectable particular operation conditions like capacity under- and overloading and shock load (in-flowing wastewater, sludge waters etc.), without any deterioration of the effluent quality;
* Provisions to manage normally expectable failures in operation like bulking sludge, foaming, etc. for any process unit, without any deterioration of the effluent quality;
* Provision of by-passes of all principal process units so that each process unit can be put out of operation without stopping the whole treatment process;
* Provision of fix piped installation of spare pumps, machines, aggregates, easily to put into operation (“n-i” rule), whereas i = 1 for n ≤ 4 and i = 2 for n > 4;
* Provision of connection points sufficient in number and capacity for easy installation of additional and spare pumps, machines, aggregates;
* Provision of spare pumps, machines, aggregates in sufficient number and easily to install where fixed installation is not recommended for practical reasons;
* Simplification and standardization of brands and types to allow for utmost interchange-ability of pumps, machines, and aggregates and to ease preventive maintenance;
* Free adjustable and wide range of controlled variables to cover all possible operation conditions

## General Hydraulic Design

The Hydraulic Design of the whole Plant shall consider at least the following requirements:

* Hydraulic structures, interconnections, distribution shafts, etc., and treatment units which will also serve future extensions shall be designed and constructed for the peak hydraulic load of the plant.
* Water level in the inlet/distribution chamber sufficient to ensure gravitational flow through the WWTP for its ultimate design capacity, and for the a 1:100 year water level (See hydrology for the site) in the recipient;
* Size of structures shall be such the hydraulic losses shall be as low as possible;
* The “n-1” rule for two or more tanks of a treatment stage shall be used for the hydraulic design of any tank and its piping system. The hydraulic capacity of any weir, collection trough, pipe, channel and chamber shall be sufficient for the maximum flow increased by the factor n/(n-1), whereas n = number of tanks;
* Distribution chambers shall be sized and constructed to permit easily operation of the facilities located within the chamber;
* Arrangement of any weir, collection trough, pipe, channel, chamber, tank in that way that later extension is possible without any major alterations;
* Sufficient hydraulic uncoupling that shall be accomplished by free overflows. Free overflow is defined herein as the case that the energy level of the tail water is lower or equal than the weir crest level. Free overflows shall be arranged as a minimum at distribution chambers and settling tanks.
* Sufficient freeboard of channels and basins must be provided;
* Respect of the minimum and maximum velocities in channels and pipes according to international standards;
* All piping and channels shall be designed to carry maximum expected flows;
* Changes in direction of gravity sewers shall be provided manholes. The minimum radius to the channel shall be 2.0 x pipe diameter and completed with benching with adequate slope and sufficiently wide for providing a foothold;
* Pipes subject to clogging (sludge, polymer, lime pipes, etc.) shall be provided with flush valves in sufficient number and diameter;
* All bottom corners of channels shall be filleted;
* All channels shall be designed to avoid creation of pockets and corners;
* Suitable gates of non-corrodible materials shall be used to seal off bypass, distribution chambers and unused channel sections reserved for future extension;
* Blanked-off connection pipe sections shall be provided for connection to future process units;
* Bypass channels or pipes must be designed such that effluent shall not be allowed to stay within the structure i.e. gates and washouts shall be provided at suitable locations to keep the channel or pipe empty during non usage;
* Plant components shall be arranged for greatest operating and maintenance convenience, flexibility, economy, continuity of maximum effluent quality, and ease of installation of future units;

## Requirements for Operation and Maintenance

The design shall incorporate every reasonable precaution and provision for the safety of all staff concerned with the operation and maintenance of the works.

To guarantee access to all mechanical and electrical parts of the whole plant for cleaning, maintenance and repair, the following requirements shall be fulfilled as a minimum:

* The space between the different process units (tanks, chambers, channels, pipe, machines, aggregates etc.) shall be big enough to guarantee acceptable accessibility for the working personnel to facilitate inspection, cleaning and repairs, especially when working with lifting units;
* All submersible aggregates (pumps, mixers, aeration grits) as well as screens and blowers shall be provided with sufficient lifting devices for operation and maintenance; A minimum gangway width of 0.80 m shall be provided between the main units (e.g. blowers, pumps);
* For heavy engines and for all mechanical and electrical parts (> 50 kg), appropriate lifting units such as cranes or crabs, assembling aids, etc., shall be provided where practical. For lighter units, mobile lifting units shall be provided;
* Moving parts shall be provided with adequate guards;
* Assembly orifices holes and access facilities such as doors and gates shall be provided. Access to assembly orifices holes over consolidated ways or lifting facilities must be guaranteed;
* All covers such as gratings for channels or assembly orifices holes shall be provided/designed with antiskid surface and constructed in such way that they can be opened by one person only, without danger;
* All railings and security installations shall be so arranged in that way that they can be removed easily and quickly in the case of assembly, disassembly, maintenance or repair of mechanical or electrical units;
* Handrails shall have a work safe height of 1.1 m, access bridges and stairs shall have a minimum clear width of 0.8 m;
* All tanks and reservoirs, etc., shall be provided with platforms and gangways, duckboards if they are not readily accessible; Access to platforms and gangways shall be simple (without vertical ladders, for instance);
* All tanks and chambers shall be designed in a way so that easy emptying is possible, either by providing a washout for each tank or a pump sump;
* The arrangement of the individual pieces of apparatus, pipelines and operational monitoring device must be such that the operation of the installation can be carried out unhindered and that any necessary repairs, which may arise, can be carried out without difficulty and without hindering the running of the other parts. Special care must be taken that the control systems and monitoring instruments are arranged so as to be easily visible;
* Adequate ventilation and lighting shall be provided to all operational areas;
* Noise suppression and heat insulation shall be provided at appropriate locations;
* Accessible means shall be provided for the easy lubrication of all bearings, mechanisms and moving parts. Grease lubricating points shall be fitted with hexagon nipples.

## Odour Control Requirements

The Contractor shall provide odour control at all areas where principal sources of odorous air occur.

Ventilation systems shall provide a safe working environment to comply with Montenegro regulations and to the following key-principles:

* Those areas, with hazardous and work guard potential concerning dangerous gas concentrations for hydrogen sulphide, methane gas and aerosols which will regularly be entered by personnel in the course of operating the plant, shall have a minimum air change rate of 6-12 air changes per hour.
* Those areas that would not normally be occupied or entered regularly may be ventilated to a lower air change rate, minimum 4, and be constructed from sulphate resistant cement as determined by the Contractor in his proposal.

The Contractor shall clearly identify in his proposal;

* Those areas which are to be ventilated to the minimum rate of 6-12 air changes an hour;
* Those areas which are to be ventilated to the minimum rate of 4-6 air changes an hour;
* Those areas where no ventilation is to be provided.

Where necessary, the Contractor shall provide equipment for removing odours from the air which is to be ventilated out of the facilities. This is particularly applicable to process units where risks of odours are high. The proposed equipment shall be limited to simple filters for which cartridges can be easily replaced.

## General Structural Design

The Contractor shall carry out the design for all structures included in the Works according to the scope of Works mentioned in this Tender Document, in general in accordance with the following design criteria:

* All water retaining structures shall be with sulphur resistant cement;
* Structures should be capable of withstanding external lateral soil and or water pressure when empty;
* Structures should be capable of withstanding internal water pressure when filled with water to maximum design water level and assuming no lateral external support from soil and/or groundwater;
* For the structural design of all reinforced concrete structures and water retaining structures Montenegro Standards and design regulations are prevailing.
* All structures in which the water levels can drop suddenly shall be secured against uplift by their own weights together with the surrounding soil. Where needed, anchors have to be installed;
* Securing against uplift by permanent or occasionally ground water drawdown is not allowed; in this context the installation of anti-flood valves in tank slabs and walls is not allowed.

The safety factor against uplift should meet the following requirements when calculated:

* The safety factor shall be at least 1.05 when the weight of the concrete together with the weight of soil on bottom slabs (calculated vertical upwards from the edges of the slabs-without any friction in the soil) only is taken into consideration.
* The safety factor to be at least 1.2 when allowing friction in the soil to be taken into account.
* Safety factor 1.5 for pipes when soil coverage or anchorage in subsoil is taken into consideration.
* The minimum concrete coverage of the reinforcement of new water retaining structures shall be 5cm for the permanently wet surface and 4cm for the permanently dry surface of concrete walls;
* In order to incorporate the effects from thermal action, shrinkage and creep the Contractor should make the construction joints in accordance with the approved drawings. No other joints will be allowed. The Contractor shall make his structural documentation in accordance with this layout.

The Contractor may propose alternative design codes of practice subject to the approval by the Engineer.

## General Electro / Mechanical Design

All materials used shall be of the best quality of the class most suitable for working under the conditions specified and shall withstand the variation of temperature and climatic conditions arising under working conditions without distortion or deterioration or the setting up of undue stresses in any part, and without affecting the strength and suitability of the various parts for the work which they have to perform.

All mechanical and electrical equipment shall be thus designed considering:

* Provision of machinery, electrical systems, and instrumentation according to the principles “simplicity” and “reliability” with long trouble-free service with low maintenance needs;
* All apparatus shall be designed to ensure satisfactory operation under the climatic conditions prevailing at the site, and under such sudden variations of loads, pressures, and/or voltage, temperatures as may be encountered under normal working conditions;
* All Electrical equipment shall be of adequate strength to withstand the stresses and forces imposed by the working and ambient conditions without distortion or deterioration affecting the efficiency and reliability of the plant; electromechanical forces that may be set up by the prospective short-circuit current.
* Electrical equipment shall be completely satisfactory for use with the mechanical equipment chosen;
* Each component or assembly shall have been proven in service in a similar application and under conditions no less arduous than those specified herein;
* Outdoor equipment shall be weatherproof and designed to prevent the collection of water at any point;
* Where equipment has to be protected from the weather, appropriate chambers, housing, shelter, structures shall be provided to maintain the desired environmental condition;
* Corresponding parts requiring replacement shall be interchangeable in order to limit the stock of spare parts required.

All works to be carried out under this Contract shall take special attention on the local conditions, i.e. climatic, economical and cultural conditions, etc.

## Process Design

General Process Requirements are provided hereafter:

* Process requirements not in accordance with the specific requirements of Volume 3-1, Section 2 are not acceptable;
* The number of process units to be provided shall be sufficient to satisfy reliability and redundancy criteria and in particular individual elements of the WWTP as tanks, chambers, grit channels etc. can be isolated from the flows without affecting the overall operation of the plant;
* The number of process streams provided shall be such that one stream can be taken out of service without unduly affecting the overall quality of treatment;
* Process design shall be in accordance with recognized national or international norms and practices, i.e. the German Design Regulations DVWK A-131, DVWK M-210, DWA M-368 or equivalent European/International Standards in order to meet the requirements of EU-Directive 91/271 EEC and the permitted effluent parameters as specified in the particular technical requirements.;
* The latest state of the art approach shall be adopted wherever possible;
* Process shall be sufficiently robust to deal with intermittent hydraulic as well as loading peaks;
* The equipment provided shall be sufficiently flexible to allow adjustment of process parameters to cope with varying flows and loads;
* Sufficient probes and monitoring points shall be provided to allow continuous monitoring of the process parameters at key locations.

## Plant Control Philosophy

The Contractor shall submit a fully developed plant control philosophy for the WWTP based on the requirements set in Section 2 of these Tender Documents and shall comprise the detailed description of the individual control circuits for the different process units and electro-/mechanical equipment, including specification of the foreseen SCADA and measuring instruments.

The SCADA system shall be designed with consideration of the following:

* Standard design principle shall be prepared for use in present design and future extension of the system;
* Naming convention, symbols and colour scheme (status and groups) for graphic screens shall be consistent across the system;
* Controls should be arranged and grouped in an intuitive and logical manner;
* Decentralized control system (DCS) shall be adopted;
* Long term data storage and retrieval shall be provided;
* Flexible communications topology linking master terminal unit, programmable logic controllers, remote terminal units and intelligent electronic devices shall be provided;
* All levels (master or slave) shall be provided with sufficient redundancy for future expansion of the system;
* SCADA protocols (mod bus, profibus, Ethernet/IP) shall be open and non-proprietary
* Standby facility shall be provided;
* SCADA equipment should be protected from the effects of dust, dirt, water and other contamination by appropriate location within the facility or within appropriate enclosures;
* Transient voltage suppression shall be provided to protect the SCADA system.

## Environmental Impact Assessment

The design of WWTP plant shall satisfy the requirements of the Environmental legislation in Montenegro. An environmental impact assessment (EIA) for the WWTP Berane, including proposals for mitigation measures, has been prepared by independent environmental experts (the EIA included in Volume 5). The Contractor should follow the recommendations of the EIA report and incorporate them in his Design.

## Detailed Design

The Detailed Design contains the final WWTP layouts solution and final data about the micro location of the facility, the final functional, construction and representational properties, the technical - technological and exploitation characteristics, details needed for construction, the geological engineering and technical properties of the terrain and soil with final calculations of stability and safety, detailed bill of quantities, the technical, technological and organizational construction elements, the mitigation environmental measures, final infrastructure design.

The DDs shall be prepared in both English and Montenegrin language by licensed engineers as required by National Laws.

The correct number of hard copies in Montenegrin language shall be presented to the Employer for the purpose of design review and for obtaining a Building Permit. The document shall also be presented to the Engineer in electronic format and also in editable electronic format.

In accordance with the Law, the abovementioned designs should be prepared by companies licensed for this specific type of projects.

Within the period stated in the Contractor’s Program the Contractors shall complete the Detail Design and submit it for approval to Engineer. The DD shall include the following detailed design/ working drawings and information and any other material necessary for comprehension and evaluation of the design:

* Process, structural, hydraulic and pipeline calculations;
* Electrical calculations including power supply sizing;
* Protection discrimination curves and calculations for the whole works, including co-ordination with the local Electricity Company’s supply and protection;
* Routing diagrams for all services, incl. cable schedules;
* Equipment layouts and schedule
* Methods of installation for large equipment
* Structural details, calculations, drawings and reinforcement bending schedules;
* Pipeline layout with longitudinal pipeline sections and connection details;
* Small power and lighting calculations and drawings;
* Building/kiosk details, incl. architectural design drawings & house installations;
* Road constructions and routes; landscaping and fencing details;
* MEICA equipment installation drawings in detail, performance, connections, materials used, product type and casing broken down to machine units;
* MCC panel drawings and detailed information,

Drawings and other information submitted at the previous stage that have been revised or updated shall be resubmitted, accordingly.

## Workshop Drawings

For components manufactured off-site, the Contractor shall prepare shop drawings which clearly demonstrate the functionality of the component as required by the solution defined in the Detailed Design.

The design and shop drawings shall clearly indicate as a minimum the following:

* Full dimensions to enable site installation
* Dimensions of supporting substructure
* Location of fixings, size and types
* Stresses and loads which will have to be supported by the supporting structure
* Installation instructions
* Lifting and handling requirements
* Environmental protection requirements including during storage
* Operation and maintenance requirements and manual

## Requirements for Reports and Drawings

All reports, designs and drawings shall be prepared in both Montenegro and English language.

The detailed content of engineering documents, which shall be prepared by the Contractor and submitted for approval to the Engineer, shall be adequate for the purpose. The Engineer will reject all documents and designs in cases where he considers them to be unsatisfactory, not in compliance with these tender requirements or not sufficiently detailed. The Contractor shall be responsible for preparing all documents in a good standard, with the contents fully in accordance with the Technical Requirements. The documents and drawings to be submitted by the Contractor shall take their final form after approval by the Engineer.

Design Documents and drawings shall be numbered following a system described in the Contractor’s Quality Assurance System (QAS). The numbering system shall clearly distinguish the source and the type of each document i.e. process, structural, electrical, WSS, HVAC, SCADA and MEICA.

The Contractor shall maintain an electronic register of all reports, documents and drawings to be used under the Contract. The register shall be accessible by the Engineer.

Amendment and revision to any document or drawing shall be recorded as required by the QAS and only the latest approved version shall be considered valid.

All drawings shall preferably be A1 and/or A3 paper sizes unless this is impracticable and shall comply with the requirements of the Engineer. Documents submitted, other than drawings and manufacturers' literature shall be A4 in size.

Any abbreviations used in drawings and documents shall be explained. Only SI units shall be used, some of the applied units are present in the following table:

|  |  |
| --- | --- |
| **Description** | **Unit** |
| Length | m |
| Area | m2 |
| Volume | m3 |
| Flow | L/s, m3/h, m3/d |
| Velocity / Surface Load | m/s, m/h |
| Temperature | °C |
| Pressure | N/m2, bar |
| Weight | kg |
| Energy / Heat | kWh |
| Power | kW |

All drawings and documents shall bear in a title box in A4 format (from top to bottom) the following information’s:

* Engineer and Beneficiary;
* Contractor;
* Contract Title;
* Contract number;
* Project No;
* Document or Drawing Title;
* Scale;
* Date;
* Drawing Number;
* Revisions (No., date, made by, checked by, descriptions);
* Boxes for preparation of the drawing / document (made by, checked by, each date and signature);
* Box indication drawing / document superseded;
* Box indication drawing / document to be read in conjunction;
* Box indication status of drawings (“working drawing / document” or “as-built drawing”);
* Other boxes (preparation mode, size, CAD No., etc.);
* Boxes for approval signatures (Engineer, Contractor);

All drawings produced on CAD systems shall be in the form of black lines on a white background when printed. Use of collared lines should be avoided. All line thicknesses; text height and text style shall comply with ISO standard.

All layout and arrangement drawings shall be to scale and shall include a graphical scale to aid the use of reproductions to different scales. All dimensions shall be given in SI metric units.

Drawing size shall comply with ISO standard and shall not be larger than A1. Calculations and other documentation shall include a cover page giving at least the same information as required to be shown on the drawings.

## Contractor’s Designer

The documents and drawings to be submitted by the Contractor shall be prepared by a design Engineer to be proposed by the Contractor and approved by the Engineer. The design Engineer shall hold all necessary licenses as required by the Montenegro legislation for the type of works to be constructed.

The Contractor shall only employ appropriately qualified and suitably experienced personnel who are familiar with all aspects of WWTP and works in connection with Sewerage systems and also be well acquainted with Montenegro Planning and Construction legislation.

The Contractor shall include within his bid detailed CV’s of the staff he intends to use. Change of key personnel i.e. Project Manager, Site Manager, Process Design Engineer, Civil Hydraulic Expert, Mechanical Engineer, Electrical Engineer, Architectural Engineer, Civil Engineer-Structure, Geodetic Surveyor, Geotechnical Engineer and SCADA –Automatic Control Engineer shall only be made after CVs have been submitted to the Engineer and approved in writing by him.

## Approval of Documents and Drawings

Documents and Drawings shall be submitted for approval to the Engineer as provided in the technical requirements.

Request for approval shall be submitted at least 28 days prior to the date on which the Contractor plans to start ordering material, start fabrication or start construction.

In his application for approval, the object, extent, section of works and purpose of the request for approval shall be clearly stated and it may be one of the following:

* Approval of detailed design
* Approval for purchase of material or equipment
* Approval for shop fabrication
* Approval for shipping
* Approval for construction

Approval by the Engineer of the technical and equipment installation documents is a mandatory requirement prior to the ordering of any material and equipment. The Contractor shall not commence manufacturing or construction of any part of the Works before the approval of the Engineer to the relevant designs, drawings, specifications or other documents has been given and shall not make any changes on the approved drawings without the knowledge of and written approval by the Engineer. No work shall commence on any structure until complete submissions showing all details affecting its size or location have been approved.

The Engineer may not process the documents and drawings or alternatively, if they are not submitted in the specified manner or if the application is not complete. The Contractor shall not be entitled to make any claims as a result of this action.

The Engineer will also not process the application if construction drawings are not supported by approved Design properly and transferred to the drawings by the Contractor.

The fact that any document or drawing has been approved by the Engineer or the Employer, that no objection has been made to the details shown on these documents and drawings shall not relieve the Contractor of any of his responsibilities and shall not put any responsibility on to the Engineer or the Employer.

Approval by the Engineer will be accompanied by a hard copy of the document printed with the appropriate approved stamp. The results of the Engineer’s review are categorized as follows:

|  |  |  |
| --- | --- | --- |
| Engineer’s Review of Submissions | | |
| Items submitted for review by the Contractor and returned by the Engineer will be categorized as follows: | | |
|  | Category | Description |
| 1 | “**Approved**” | Subject to its compliance with the Specification’s and conformity with the overall design, the Engineer has no comment on the submission. |
| 2 | “**Approved with comments as noted**” | Subject to its compliance with Specification and conformity with the overall design, the Engineer has comments on the submission but they are not such as to necessitate formal re-submission |
| 3 | “**Rejected**” | Subject to its non-compliance with Specifications & Tender Requirements or Standards. The Engineer will indicate the reasons for his not accepting of the submission; the Contractor shall amend or revise the submission accordingly and re-submit the item for review. |
| In the case of first submissions by the Contractor to the Engineer for review, each design, drawing and document shall reach the Engineer in time to allow the required 28 days for review by the Engineer before return to the Contractor. | | |
| Re-submissions by the Contractor to the Engineer of the same design, drawing and document shall reach the Engineer in time to allow at least 14 days for review by the Engineer before return to the Contractor. | | |
| Following receipt of the Contractor’s program for submissions the Engineer will notify the Contractor as to which particular drawings must be classified by the Engineer as “**Approved**” prior to the commencement of manufacture or construction on that section of the work by the Contractor. Otherwise, if the Engineer does not return to the Contractor his submissions after the review periods stated above, the Contractor might proceed with his program as though the submissions had been categorized as “**Approved**”. Such assumed acceptance shall not relieve the Contractor of his sole responsibility for compliance with the Specification in the completed works. | | |

## Design Deliverables

The Contractor shall submit 6 hard copies of all drawings, schedules, calculations and other documents for which approval from the Engineer is required. All drawings and documents to be submitted by the Contractor shall be bi-lingual in English and Montenegro language or an equal number of copies in English with translation in Montenegro language, whereas the English version is the prevailing one.

Where Engineer’s approved documents have to be submitted for administrative reviews, further copies as required by Law shall also be submitted to the Beneficiary to enable the permitting procedures to be completed.

## Design Program

A program for submitting drawings, schedules, calculations and other required documents shall be submitted by the Contractor to the Engineer on approval in accordance with the Contract provisions. The program shall identify the stages of submission and the drawings, schedules, calculations and other documents to be submitted for approval as required by the Employer’s Requirements and the Conditions of Contract.

An indicative program for the design activities is provided hereafter:

|  |  |  |
| --- | --- | --- |
| **Item** | **Indicative period from the Commencement Date** | **Comments** |
| Quality assurance system and quality control plan | 1 Month |  |
| Contractors Detailed design for Building Permit and execution of Works | 6 months (1\_4+1l) | The design for the components of the WWTP to be constructed shall be prepared and reviewed and approved fully in accordance with provision of the National Law on Planning and Construction. |

# General Works Requirements

All works, whether specified in the Contract Documents or not and whether specified in part, incomplete or incorrectly or not explicitly described or only implied, must be completed to ensure that the Works shall be functional as per the technical requirements described in the Contract.

## Geotechnical Works

The term "Geotechnical Works" shall mean the obligations of the Contractor under the Contract to cover all manufacturing, excavation, earthworks, structures and other construction Works, which shall be performed by the Contractor.

The following shall be included, but not limited to, within the limits of the Works:

* Removal of topsoil, organic and unstable materials and safe disposal.
* Transport of excavated and new materials will be done safely and with no pollution. In particular no seepage is allowed on the roads.
* Thickness of layers of new materials will be in accordance with the proposed compaction method but not more than 300mm.
* Compaction will be carried out to achieve levels defined in the design, which will not be below 90% Proctor.
* Vertical tolerances will not exceed limits defined in the design but will never be more than 20cm
* Settlement of all layers will be monitored during the length of the contract. It will not exceed limits defined in the design but under no circumstances it will be more than 25mm.

The following material specifications will apply to the fill material to be used at the location of WWTP:

## Civil Engineering Works

The term "Civil Engineering Works" shall mean the obligations of the Contractor under the Contract to cover all manufacturing, excavation, building, structures, process units and other construction Works, which shall be performed by the Contractor.

The following shall be included, but not limited to, within the limits of the Works:

* Site investigation levelling, excavation, fill and other earth works;
* Demolition of existing structures and removal of debris;
* Complete process units and buildings, incl. sludge treatment facilities and associated sewerage connections (influent/effluent);
* Civil works related to complete drainage systems and structures necessary for the disposal of process waste, overflow, and drainage water, waste or used chemical solutions (including from any laboratory) sludge and storm runoff to receiver;
* Landscaping and similar area works with plant roads, temporary roads, and site facilities;
* Indoor and outdoor sewerage systems including all sanitary installations inside the buildings;
* Water supply plumbing, fixtures and fittings inside buildings;
* Complete heating and ventilation/air-conditioning systems together with all facilities for all buildings and process units, which shall conform to these Requirements;
* Complete potable and non-potable water supply systems for the Works for area supply, fire fighting, supply to all buildings, including all pipe work with all necessary fittings, specials, valves, hydrants, storage and make-up tanks and service water systems, booster pumps etc.;
* Necessary equipment and material for all storm water and plant internal wastewater drainage system, including those to be separately provided for such as wastes from laboratory, waste or used chemical solutions;
* All other works whether specified in the Contract Documents, (including the Contractor's proposal) or not, as necessary for the completion of the Works and the operation thereof, and as required under the terms of the Contract;
* Excavation of trenches, laying of pipes, welding and protection of the pipes, transport and disposal of excess and demolished materials;
* All works for completion of the connection to the existing sewer system;
* Reinstatement of any existing facilities demolished during construction;
* All temporary and provisional works necessary for proper erection of the plant (temporary roads, keeping excavation free of water, excavation sheeting and bracing, etc.).

## Mechanical Installations

The term "Mechanical Installations" shall mean the obligations of the Contractor under the Contract to cover all manufacturing, delivery, assembling and installation, testing and commissioning of the required mechanical equipment and machinery for the process units, which shall be performed by the Contractor.

The following shall be included, but not limited to, within the limits of the Works:

* All materials and equipment for the Wastewater Treatment Plant within and between process units structures including connection force mains and effluent system, such as inlet structures, mechanical treatment facilities, biological treatment facilities, sludge treatment facilities or other facilities belonging to the treatment and/or transport process;
* Mechanical equipment and machinery, including motors and pumps and spare parts;
* Complete piping system, incl. armatures and fittings;
* Workshop equipment;
* Laboratory equipment;
* All other auxiliary materials of any description and all materials.
* Spare parts for fixed and mobile mechanical equipment.

## Electrical Systems

The term "Electrical Systems" shall mean the obligations of the Contractor under the Contract to cover all manufacturing, delivery, assembling and installation, testing and commissioning of the required power supply, power distribution and sub-distribution systems for the process units, which shall be performed by the Contractor.

Electrical power supply from the public mains network, incl. all co-ordination and technical clarification with the responsible power supply companies.

The following shall be included, but not limited to, within the limits of the Works:

* Equipping connection point and Power supply line where included in the contract;
* Transformer station where included in the contract;
* Low voltage main distributions, reactive power compensation units, battery systems, safety and protection devices, etc.;
* Low voltage systems, c/w separate low tension distributions at all process stages with switch gear panels; control systems for manual, automatic, local and remote control; PLC units; marshalling cabinets; safety and protection devices, etc.;
* Complete SCADA, process control and instrumentation system, incl. all instruments required to supervise and control the various process stages, control systems, control centres at all major process sections, building security, building intrusion, fire fighting etc.;
* Bi-directional telecommunication control system between control points and local control centre.

## Electrical Installations

The term "Electrical Installations" shall mean the obligations of the Contractor under the Contract to cover all manufacturing, delivery, assembling and installation, testing and commissioning of the complete lighting, telephone and signalization systems for indoor and outdoor (at/in all buildings, streets, ways, places, structures, etc.), incl. emergency lighting, sub-distributions, switches, light sensors, clock timers, poles, fittings and fixtures, etc., which shall be performed by the Contractor.

The following shall be included, but not limited to, within the limits of the Works:

* Standby generation with all switchgear and automatic switch over equipment;
* Local electricity distribution panels, starter panels, cable ways, motor control centres;
* Complete system of power outlet sockets for indoor and outdoor at/in all buildings, streets, ways, places, structures, etc. incl. sub-distributions, earth-leakage circuit-breakers, etc.;
* Complete medium voltage-, low voltage-, communication-, signalling-cable-systems and wiring, incl. all connecting, mounting, routing, labelling and testing, etc. for the WWTP structures.
* Telephone and telecommunication system for the WWTP, incl. all co-ordination and technical clarification with the responsible telephone company; all telephone instruments, exchanges, etc.;
* Complete fire alarm systems, security systems, etc. for WWTP buildings and structures;
* Complete earthing, lightning and over voltage protection and potential-equalization-systems, etc. for the new MEICA equipment of the WWTP and diversion structures.

# Dealing with surface and underground water

The Contractor shall be responsible for dealing with water, whether from existing watercourses, surface water and storm water, drainage systems ground water, underground springs or any other source or cause. In discharging and diverting water he shall avoid flooding or damaging other works or services, causing erosion and polluting watercourses.

The Contractor shall provide all temporary works and do all things which may be necessary to maintain those parts of the existing water supply, sewerage, and drainage systems and water courses which may be affected by his operations in a condition not less satisfactory than they were prior to the commencement of the works and shall maintain the normal flows therein at all times until the connections to the new system shall have been made except when written permission to interrupt the flows has been obtained from the Engineer.

The Contractor shall submit to the Engineer his proposal accompanied with a schedule for maintaining the flow in the water supply, sewerage, and drainage systems and water courses affected by the Works and the works necessary for making the connections to the new system where ever applicable. The Contractor’s method proposed for each location shall be subject to the approval of the Engineer. Such approval will not relieve the Contractor of his obligations under the Contract.

The Contractor shall perform all works for maintaining flow in existing water supply, sewerage, and drainage systems and water courses including but not limited to the construction of diversion systems and relocations and other works necessary during the construction period including the removal and dismantling of such works on completion as required by the Engineer.

The Contractor shall as required by the Engineer keep excavations free from water and sewage whether caused by floods, storms or otherwise so that the works shall be constructed in dry conditions.

Unless otherwise specified the Contractor shall furnish, install, maintain and operate all necessary pumping and other equipment for de-watering the various parts of the works and for maintaining the foundations free from water as required for construction of each part of the works.

The Contractor’s method of removal of water from the foundations will be subject to the approval of the Engineer. Where excavations for foundations of structures extends below the groundwater table, the portion below the water table shall be de-watered in advance of excavation unless specified otherwise.

The de-watering shall be accomplished in a manner that will prevent loss of fines from the foundation, will maintain stability of excavated slopes and the bottom of the foundation, will result in all construction operations being performed free from standing water, unless otherwise specified, and will result in all foundations being sufficiently dry for proper bonding of the backfill materials with the foundations and proper compaction of the materials placed.

The Contractor will be required to control any seepage along the bottom of the foundations and elsewhere prevent the accumulation of the standing water. Generally de-watering at foundations shall comply with the requirements of DIN 4095 or equal.

The Contractor shall be responsible for dealing with storm water, whether from normal or extraordinary rainfalls and weather conditions or any other source or cause. In discharging and diverting water he shall avoid flooding or damaging other works or services, causing erosion and polluting watercourses.

The Contractor shall perform all works for maintaining of storm water flows and shall as required by the Engineer keep excavations free from water and sewage whether caused by tides, floods, storms or otherwise so that the works shall be constructed in dry conditions.

Unless otherwise specified the Contractor shall furnish, install, maintain and operate all necessary pumping and other equipment for storm water protection and de-watering the various parts of the works.

## Existing Underground Utilities/Structures

The Contractor has (for his own safety) take care about any buried power cables, gas lines or pipes. He shall locate these utilities /structures sufficiently in advance of his construction operation and use modern detection equipment, satisfactory to the Engineer, allowing to minimize the risks to damage or to interrupt the underground utilities/structures. The Contractor will be held responsible for maintaining these utilities and shall repair without any delay any damage caused by his operations at his own expense.

No excavating machines shall be used in the immediate surroundings of cables and/or pipelines unless approved by the Engineer. Special care shall be taken to ensure that the existing facilities are accessible in the case of an emergency.

Temporary works which have to be made in the vicinity of the existing facilities during the execution of the works shall be maintained by the Contractor and shall be removed as soon as practicable. Before works are started that might affect or damage neighbour structures the contractor has to have prepared a “Record of Evidence” by experts about the condition of the structure. This expertise should include photographs to approve any defects of the structure before the execution of the works.

## Maintenance / Diversion of Existing Utilities

The Contractor shall be responsible for maintaining all such utilities/structures encountered by him in the construction of the works and shall bear the cost of making good any damage caused directly by his activities.

The Contractor shall indemnify the Beneficiaries and shall be responsible for all claims whatsoever arising from any damage, injury etc. caused to the services as a result of his construction activities associated with this Contract.

## Contractor's Equipment

Details of all Contractors’ Equipment to be used by the Contractor in the execution of the Works shall be submitted to the Engineer prior to its use.

The Engineer's consent to use the Contractor's Equipment will not be unreasonably withheld, but if in the Engineer's opinion circumstances arise which make it desirable that the use of the Contractor's Equipment should be suspended either temporarily or permanently, the Contractor shall change the method of performing the work affected and he shall be deemed to have no cause for claims against the Engineer on account of having to carry out the work by another method, nor shall he be deemed to have cause for claim if any order issued by the Engineer results in the Contractor's Equipment having to stand idle for a period of any duration whatsoever or having to be removed.

In particular, where it is impossible due to the proximity of, and danger to, existing roads, structures, or services, to excavate except by hand methods, then in such cases it shall be deemed reasonable for the purpose of this Clause for the Engineer to withhold consent to use the Equipment.

## Other Contractors on the Site

The Contractor shall make appropriate allowance for liaison and co-operation with this and possible other Contractors of any utility providers (gas, electricity, water and telephone) which might interfere with the Works under this Contract.

In case it is necessary for other contractors employed by the Beneficiary, and employees of the Beneficiary to work on and around the site, such other contractors and employees may reserve areas for use. The Contractor shall not enter or use these areas without the prior written permission of the Engineer, unless such entry is permitted elsewhere in the Contract, and shall not obstruct access to such areas without having provided an acceptable alternative access.

The Contractor shall not interfere in any way with any works, whether the property of the Engineer or of a third party and whether the position of such works is indicated to the Contractor by the Engineer or not. The Contractor shall respect the construction and finish of works and articles supplied or installed by others and will be held responsible for any loss or damage thereto if caused by him, his employees or his Sub-contractors.

## Subcontracted Works

The Contractor shall appoint licensed Sub-contractors for all those parts of the work described herein for which he is not himself an experienced, recognized and approved Contractor.

The Contractor shall submit for consent, the names of all proposed specialist Sub-contractors and suppliers of special manufactured items with full details of local agents or, if local agents do not exist, the procedures for service and supply of spare parts and shall indicate the precise sections of the work for which each will be responsible.

The Contractor shall provide evidence that each firm undertaking manufacture or fabrication has satisfactorily executed work of a similar nature. In the case of work, which the Contractor proposes to manufacture or fabricate on the site, the Contractor shall provide evidence that he can satisfactorily execute the work.

The Contractor shall be solely responsible for the overall co-ordination of the Contract. Direct formal communication between his Sub-contractors and the Engineer will not be allowed.

# Materials and Workmanship

## Local and Environmental Requirements

All materials and manufactured items shall be suitable for the climatic and environmental conditions described in this specification.

The environmental conditions may be different in different parts of the Works and materials shall be selected and manufactured items designed accordingly to withstand the relevant corrosive elements. In particular:

* All materials shall be suitable for the environment expected at its built location and the Contractor must bear in mind the climatic condition which may be dictate the use of particular material.
* All products or materials in contact with sewage or a sewage environment shall be non-biodegradable.
* All products or materials in contact with potable water shall not constitute a toxic hazard, shall not support microbial growth, shall not cause taste, odour, cloudiness and coloration of the water, and shall be approved by a recognized certifying authority as being suitable for use in potable water supply systems.

All local customs, laws and regulations relating to the supply or source of materials shall be complied with.

## Material Safety Data Sheet

Any product or substance used by the Contractor or its Subcontractors, which are a toxic or hazardous substance, shall be identified to the Engineer by the Contractor’s submission of a Material Safety Data Sheet (MSDS). The MSDS or a manufacturer’s standard form shall be submitted to the Engineer to advise him of the use of such material during the project before the material is brought on site.

## Quality of Manufacture and Standards

All materials and manufactured items supplied for incorporation in the permanent works shall be new, of high quality and of sound workmanship. They shall be purchased only from approved suppliers who shall be capable of demonstrating the suitability of their products by reference to similar works or certified test results.

Materials and manufactured items shall normally be certified as complying with relevant specifications of a recognized national or international standards organization which shall be subject to the approval of the Engineer. Approval shall be in accordance with the Quality Assurance System.

The Employer’s Requirements indicate approved standards for specific materials as a quality guide for the materials and articles to be provided. This indication or schedule in no way prejudices the approval of any other equivalent or superior national or international standards. Also included in this schedule are publications for guidance on procedure and practice.

Where the requirements of the Specifications and an approved standard differ, the approved Standard’s requirements will prevail.

Any reference to a Manufacturer/product is to be taken as indicative of quality only.

## Warranty for Materials Incorporated in the Works

Over and above the Design Life specified for the Plant, a warranty made out in the name of beneficiary shall be provided by the manufacturer of the materials listed below. The warranty shall include appropriate dimensioning of components, correct choice of materials (including auxiliary materials like ancillary materials of welding, corrosion protection coating) and workmanlike installation for the periods shown.

| **Description/Subject** | **Warranty Period** [Years] |
| --- | --- |
| Special components and auxiliary equipment included in or attached to water retaining structures | 5 |
| Pipes & Sewers | 5 |
| Steel & Metal Constructions | 2 |
| Machine Units, Machines, Fittings | 2 |
| Cables & Accessories | 2 |
| New Electrical Equipment | 2 |
| Process Control & SCADA Equipment | 2 |

The warranty period shall commence after the date stated on the Provisional Acceptance Certificate.

## Approval of Materials and Manufactured Items

Full information, as detailed below, for all proposed materials and manufactured items shall be submitted to the Engineer.

Prior to the placing of any order for materials or manufactured items, a Request for Approval shall be submitted in triplicate. The information shall be clearly and neatly presented in a standard format to be agreed with the Engineer. Four weeks should normally be allowed for approval and no orders shall be placed until one copy of the Request for Approval has been returned duly signed and dated. The information required is as follows:

* Name and address of proposed supplier or manufacturer;
* Reference numbers and title of relevant specifications of a recognized national or international standards organization with which the materials or manufactured items will comply together with copies of the specifications in English where required by the Engineer;
* Samples of materials representing the quality of the bulk of such materials the Contractor proposes to use;
* Manufacturers' literature and data sheets for articles and fabricated items;
* A description of the items to be supplied with a description of quality, grade, weight and strength;
* Sufficient information to demonstrate that the materials or manufactured items are suitable and comply with the Specification;
* Any other information called for in particular clauses of the Technical Requirements.

Following approval of an order for manufactured items designed for incorporation in the Works detailed drawings and installation drawings shall be submitted for approval. Following approval three copies of such drawings shall be submitted.

Prior to dispatch to site or to a designated place of storage the following shall be provided:

* Facilities for inspection and testing at suppliers' pits or quarries, manufacturers' works or at approved independent testing centres as appropriate. Inspection and /or witness testing may be carried out by the Engineer or other appointed Inspector;
* Details of the supplier's or the manufacturer's quality control test procedures;
* Manufacturers "type" test certificates, or recent test results carried out on similar items, i.e. CE-certification, certificate of origin, etc;
* Warranty certificates;
* Shipping and consignment identification details.

All materials shall be delivered to the site a sufficient period of time before they are required for use in the Works to enable the Engineer to take such samples as he may wish for testing and approval.

The submission of details and samples under this Clause shall not relieve the Contractor from any of his responsibilities under the Contract.

## Rejected Materials and Defective Work

Materials or work, which in the opinion of the Engineer, do not comply with the Specification, shall be classified as rejected materials or defective work and shall be cut out and removed from the Works and replaced as directed by the Engineer.

## Materials in Stacking Yards

Considerable quantities of Material will have to be stored during the execution of the works. The Contractor shall take all reasonable precautions to protect these materials from any damage including fire and theft and shall furnish evidence of the insurance cover to this respect.

## Method Statements

The Contractor shall provide in writing a general description of the arrangements and methods that the Contractor proposes to adopt for the execution of the Works. This shall be submitted to the Engineer at the same time as the Contractor's Detailed Design.

Detailed Method Statements shall show in detail the methods proposed by the Contractor for carrying out the principal activities of construction in full safety. In particular the Contractor shall indicate the resources (plant, personnel, materials) to be allocated, their timing and sequencing, emergency/contingency measures, and any other information required to clearly detail the proposed methods. All necessary health and safety measures required shall be clearly indicated.

For all elements of the Works, fully detailed method statements describing proposed construction techniques and program for execution shall be submitted to the Engineer in duplicate. These shall be supported, where applicable, by calculations for temporary works for supporting excavated faces and shuttering of concrete. Flowcharts, sketches and drawings shall be included as necessary to facilitate comprehension.

Proposed Construction Methods shall be submitted to the Engineer, in two copies, at least 45 days before the start of relevant work. The Engineer will review and provide his comments within 15 days. The Contractor shall make final corrections (if any) and submit to the Engineer, for final approval, 21 days before the commencement of relevant work. Written approval shall be obtained before any work is commenced.

## Value Engineering

The Contractor is at liberty to put forward alternatives for items of plant or methods of construction for which he claims advantages to that indicated in the Specification and Drawings, providing the mode of operation and method of construction is fully detailed and is at least equal to that shown on the Drawings or implied in this Employer’s Requirements. The Contractor shall fully state his reasons for submitting any alternatives and the Contractor shall price separately any reduction in his rates if and where applicable. Alternative materials to those specified shall have an equivalent proven performance for its intended use, demonstrate to be economically advantageous, will sustain the design life of the Works.

The Engineer shall accept or reject any such alternative and shall not be under any obligation to give the reasons for any rejection to the Contractor.

## Spare Parts

The Contractor shall supply spare parts for the first two (2) years of operation from the completion date stated after the issue of the Taking Over Certificate.

Spare parts shall be defined as components or parts, either consumable or repairable, used to maintain or repair machinery or equipment. A Bill of Materials for spare parts (spare parts list) shall be elaborated based of the manufacturers recommendations and included in the offer.

## Additional Drawings

The Contractor shall prepare and submit all additional drawings and workshop drawings, including details for the construction and completion of the works on request from the Engineer. These additional drawings shall be based on the format and principles adopted for the Engineering Documents and shall be produced and submitted to Engineer on approval.

The additional drawings prepared by the Contractor shall cover the following aspects of the works:

* Working drawings and calculations for all the temporary works proposed by the Contractor for constructing the Works;
* Full working drawings indicating the Contractors proposed method of construction together with supporting calculations where applicable;
* General arrangement detail drawings showing access to safety equipment and emergency escape plans.

# Work Programme and Reporting

On approval of the design, the Contractor must prepare a works program which takes into consideration the overall time schedule for completion of the works as follows.

## Provisional Time Schedule

The following provisional time schedule shall be considered for the completion of the Works:

* Quality assurance system and quality control plan within one month of commencement date
* The completion period for all works under the Contract shall be thirty (30) months including 6 months design period and Trial run period.
* Intermittent operation supervision of the WWTP during the Defects liability period with a total presence on site of 90 days;
* Defects liability period shall be twelve (12) months under the Contract. The above one month operation supervision included in these 12 months. Additional months shall be considered under the Montenegro law.

The duration and sequence of the various activities making up the works may be varied by the Contractor to suit his own proposals for carrying out the works, subject to the approval of the Engineer, under no consideration to extend the contract completion dates.

## Work Programme

Pursuant to the requirements the works programme, which has to be submitted by the Contractor, shall show the planned monthly rates of progress between the program dates for commencement and completion of each major item or work for the various stages of construction, in accordance with the Conditions of Contract.

The programme for the works shall take into account climatic conditions, flows in existing sewerage and/or drainage systems, groundwater, geo-technical data and other conditions, to ensure the completion of the works in accordance with the Contact.

The Contractor shall not be permitted to commence any construction work on that part of the works until the Engineer approves the drawings and calculations. Sufficient time for approval of materials and method statements must therefore be allowed for in the work program.

The Contractor shall allow in his program reasonable period for work to be carried out by Public Utility Services Authorities and the Beneficiary. The Beneficiary will provide all necessary assistance in liaising with such Authorities.

The Contractor shall also allow in his programme sufficient time required for taking over, Contractor’s operation and training period and for the maintenance periods (Defects Liability Period) as stipulated in the Conditions of Contract.

## Monthly Progress of Works Reports

The Contractor shall prepare and submit to the Engineer copies of monthly reports in English language in accordance to the provisions of Contract. Monthly reports shall be due on 7 days of the end of the reporting month. The reports shall be in a style and format as agreed with the Engineer and shall be submitted in six copies. In addition to the contents as required in the Conditions of Contract, the monthly reports shall include but no be limited to the following:

* Progress of works, divided into design, construction, delivery, installation, testing;
* Quality of works;
* Any events, difficulties and problems arisen during the reporting period;
* Follow up of the approved work programme: occurred delays, reasons for such delays, and measures to make up such delays; actualisation (if necessary) of the work programme;
* Cash flow forecast based upon the forecasted progress of works:
* Photo report.

Each copy shall be durably bound in a volume or volumes, on size A4.

## Progress Photographs

Digital colour photographs showing the progress of the Works in detail shall be taken by the Contractor every week, from positions to be selected by the Engineer.

Each photograph shall be numbered and a statement shall be submitted giving the location, date when taken and a brief description or title.

The Contractor shall hand over to the Engineer on a CD the corresponding electronic files and an electronic list numbering and labelling each photograph (location, date when taken and a brief description or title).

## Construction Log-Book, Construction Diary, Site Inspection Book

The following description is just an outline description. The Contractor shall strictly comply with Montenegrin related by-laws and codes of practice, particularly by the *“Pravilnik o načinu vođenja i sadržini građevinskog dnevnika, građevinske knjige i knjige inspekcije” ("Sl. list Crne Gore", br. 81/08).* In addition, the Contractor shall issue to the Engineer, for information purpose, a copy of all above mentioned documents translated in the language for communication.

The Contractor shall supply to the Engineer on a daily basis details regarding the site working conditions and performed activities in the form of a Construction Diary. This Diary will be signed by the Contractor and the Engineer who will keep the signed copy of the daily entries. If there would be a need for any remarks on the performed work-activities or entrances included in the Diary by the Contractor, the Engineer shall issue them to the Contractor as described in Condition of Contract, clause 1.3 Communications. The Contractor shall also provide to the Engineer on a daily basis plant and labour sheets. These shall provide detailed information of what plant and labour is on the site that day.

Entries recorded in the signed Diary, shall serve as evidence of facts included therein. They may be used by either Party as contemporary records under Sub-Clause 2.5 (Employer’s Claims) or Sub-Clause 20.1 (Contractor’s Claims). However, they shall not itself present a demand of any payment or claim under the Contract.

The Contractor shall keep on site, fill it and submit to the Engineer a Construction Log-Book, all according to the Montenegrin Laws and Codes of Practice. Thus, the measured quantities of the executed works shall be entered as well. The Construction Log-Book shall be inspected and signed by the Engineer on a monthly basis.

The Contractor shall keep on site the Site Inspection Book serving demands prescribed by the by-law.

# Environmental considerations

## General

The following environmental protection measures shall be observed during the execution of the construction of the WWTP.

### Demolition material

Reuse of demolition materials as backfill for trenches and excavations or/and hard fill for construction foundations and roadways is possible, unless contaminated or hazardous materials such as asbestos are identified. The Contractor will be responsible for environmental sound disposal of any material resulting from the demolition and other site materials under permission from the relevant local Authorities and shall be disposed of in a licensed tip.

### Excavated soil

Reuse of excavated natural soil, which is free of cohesive components, salt, sulphate and/or clay materials as backfill for trenches and excavations. The Contractor will be responsible for environmental sound disposal of surplus materials under permission from the relevant local Authorities.

### Ground water

With reference to the available Geotechnical Investigations (if any), the ground water table is below top of the ground level. Temporary and/or permanent groundwater lowering will be required for deep foundations, basement of tanks and trenches during construction to proceed. The Contractor will be responsible for ensuring of these measures, as well as day- and surface water discharge.

### Air pollution

Construction may give rise to dust and vehicle exhausts. Due note is to be taken of the proximity of residential housing to the WWTP and Sewer connection works. The normal health and safety controls will be required to safeguard construction and the residential and passing population.

### Noise pollution

Construction may cause annoyance caused by noise. The normal health and safety controls will be required to safeguard construction and the residential and passing population.

## Maximum Noise Levels

The Contractor shall comply with the local and National requirements and the issued permission for construction. The Contractor shall be legally responsible and financially liable to observe Montenegro environmental legislation.

The noise levels shall be in accordance with the relevant Montenegro noise environmental legislative.

In addition to the specifications of these requirements the WWTP shall be designed to ensure that the maximum noise level at site boundaries shall not exceed an equivalent continuous sound level of 55dB(A) when all equipment installed is being operated.

The noise level at a distance of 1.0 m from each sound-producing item of mechanical or electrical plant or equipment shall not exceed 72 dB(A). The Contractor shall estimate and substantiate by calculation to be submitted at design submission stage the equivalent noise levels.

Noise and disturbance shall be kept to the reasonable minimum as far as required for this project. The Contractor’s attention is drawn to the close proximity of some working sites to buildings in continuous use. All plant and tools used at such sites above or near ground level shall be silenced or of a silent type.

The Contractor shall take all necessary steps to ensure that his workmen carry out their duties in a quiet manner particularly when working at night.

The Contractor shall obtain the Engineer’s consent to the details and arrangement of all plant before installation. All plant shall be kept in good condition and safe working order. Operation of any particular item of plant shall be stopped whenever, in the opinion of the Engineer, it is causing unreasonable noise or disturbance. The Contractor shall immediately take steps to eliminate such noise or disturbance or replace the plant.

Where compressors or generators are to be used for less than one-month suitable baffles or other provisions to reduce noise emission shall be provided with suitable acoustic baffles to reduce the emission of noise. Acoustic screening shall be provided for outside plant equipment to the satisfaction of the Engineer.

The Contractor shall perform take noise intensity readings as required by the Engineer and shall submit the results to the Engineer. The Contractor shall comply with any additional measures required by the Engineer to keep noise and disturbance, e.g. odours to the minimum.

## Pollution Prevention

The Contractor shall not pollute or unnecessarily disturb lands, roads and other places on and around the Site. No trees or other vegetation shall be removed except to the extent necessary for the Works.

The Contractor shall take all reasonable precautions to prevent:

* Silting, erosion of beds and banks and pollution of rivers and watercourses;
* Interference with the supply to or abstraction from underground water sources;
* Pollution of the surface waters at site.

The Contractor shall provide, maintain and remove on completion of the works, settling lagoons and other facilities to avoid pollution caused by the Contractor's operations such as but not limited to quarrying, aggregate washing, concrete mixing and grouting.

# Annex 1 - List of Standards

Generally all Montenegro and Internationally recognized Norms and Standards are accepted. Nevertheless with respect to safety, health and working protection the related standards and laws which are directly linked to local legal provisions, the local law respectively the relevant binding local standards and norms shall be applied.

The work must be performed according to the most recent relevant international codes, standards, accident prevention regulations and the local rules and regulations.

The Engineering documentation shall correspond with ISO standards. Used symbols on drawings etc. conforming to the following Systems and Standards (DIS = Draft International Standard).

1. Electrical: International Electrotechnical Commission (IEC).
2. Instrument: ISO 3511/1‑4: Process measurement control, functions and instrumentation – symbolic representation.
3. ISO 4067‑1: Graphical symbols for plumbing, heating, ventilating and ducting.
4. ISO 4067/2: Simplified representation of sanitary appliances.
5. ISO 8545: Graphical symbols for automatic control.
6. ISO/DIS 4067/4: Symbols for refrigerant plants.

All materials and equipment supplied and all work carried out as well as calculation sheets, drawings, quality and class of goods, methods of inspection, specific design features of equipment and parts and acceptances of partial works shall comply in every respect with the technical codes of the International Organization for Standardization (ISO) and of the International Electro technical Commission (IEC).

Goods and special guarantees beyond the scope of ISO or IEC shall conform at least to one of the following standards and codes:

* British: BSS, BSI, BA, CP
* German: VDE, VDEW, VDI, AD, DIN or equivalent as far as these standards, codes and regulations are available in an English language edition.
* Pipes and accessories shall be in accordance with European or similar acceptable Montenegro standards if the use of other standards is not specially requested.

Other internationally accepted standards which ensure a quality equal to or higher than the standards mentioned above, but only if these are submitted in the English language (it is the obligation of Vendor/Contractor to demonstrate this requirement).

The Tenderer must clearly state his proposals concerning the use of Standards and Codes.

It is the Contractor’s responsibility to provide sufficient evidence that any national or other standard the Contractor proposes (other than those mentioned above) will ensure an equivalent or higher standard.

Immediately after the Effective Date of the Contract the Contractor shall supply an indexed list of all standards, codes and associated standards referred to, to which the work is to be performed.

The quality control systems and plans shall be according to ISO 9000 and subject to approval of the Engineer.

This Section includes reference to publications for guidance on current practice on some relevant topics. The editions of approved Standards used shall be those current on the base date. The Contractor may be required to supply any of the Standards or publications listed in this section for the use of the Engineer’s Representative (with English language translations where appropriate).

List of Montenegro/National Standards

* Law on Spatial Development and Construction of Structures, (Off. Gazette of Montenegro, No. 51/08, 34/11, 35/13, 39/13 and 33/14 )
* By-Law on Preparation, scale and detail scope of Technical documentation (Off. Gazette of Montenegro, No. 35/13)
* The Rulebook on the Method of performing the review of Conceptual and Detailed Designs (Off. Gazette of Montenegro, no. 81/08)
* The Rulebook on the Content of the Study of Preparatory Construction Works (Off. Gazette of Montenegro, no. 80/08)
* Law on integrated pollution Prevention and Control (Off. Gazette of Montenegro, no. 80/ 05)
* The Law on Water (Official Gazette of Montenegro no. 27/07, 32/11 and 47/11)
* The Law on Environment Protection (Official Gazette of Montenegro no. 48/08)
* The by-law on the wastewater quality and the sanitary technical conditions for the discharge into the recipient and public sewerage system, methods and minimum number for wastewater quality analyses and content of the report on wastewater quality (Official Gazette of Montenegro, No. 45/08 & No. 09/10 and no. 26/12)
* The by-law on classification and categorization of surface and ground waters (Official Gazette of Montenegro, No. 2/07)
* Regulation on the conditions to be met by municipal sewage sludge, the quantity, scope, frequency and methods of analysis of municipal sewage sludge for application on land and conditions to be met by land planned for its implementation (Official Gazette of Montenegro, No. 89/09)
* Law on solid waste (Official Gazette of Montenegro, No. 64/11)
* Regulation on solid waste classification and solid waste catalogue (Official Gazette of Montenegro, No. 35/12)
* Law on Fire Protection (Official Gazette of the Republic of Montenegro nº 47/92)
* Law on Work Protection (Official Gazette of the Republic of Montenegro nº 79/04)

**Environment health protection and safety**

13.020 Environmental protection

13.030 Wastes

13.04. Air quality

13.060 Soil quality. Penology

13.100 Occupational safety. Industrial hygiene

13.110 Safety machinery

13.120 Domestic safety

13.140 Noise with respect of human beings

13.160 Vibration and shock with respect to human beings

13.180 Ergonomics

13.200 Accident and disaster control

13.220 Protection against fire

13.230 Explosion protection

13.240 Protection against excessive pressure

13.260 Protection against electrical shock

13.280 Radiation protection

13.300 Protection against dangerous goods

13.310 Protection against crime

13.320 Alarm and warning system

13.340 Protection equipment

**Electrical engineering**

29.020 Electrical engineering in general

29.050 Conducting materials

29.060 Electrical wires and cables

29.180 Transformers. Reactors

29.240 Power transmission and distribution networks

29.260 Electrical equipment for working in special conditions

**Electronics**

31.020 Electronic components in general

31.200 Integrated circuits

31.220 Electromechanical components for electronic and telecommunications equipment

31.240 Mechanical structure for electronically equipment

**Construction materials and building**

91.010 Construction industry

91.020 Physical planning. Town planning

91.040 Buildings

91.060 Element of building

91.080 Structure of building

91.090 External structure

91.100 Construction materials

91.120 Protection of and in buildings

91.140 Installations in buildings

91.160 Lighting

91.180 Interior finishing

91.190 Building accessories

91.200 Construction technology

91.220 Construction equipment

**Civil engineering**

93.010 Civil engineering in general

93.020 Earthworks, Excavations, Foundation construction, Underground works.

93.080 Road engineering

93.140 Construction of waterways and ports

93.160 Hydraulic construction

1.2. German DIN Standards

The German Standards referred to have been issued by Deutsches Institut für Normung, Burggrafenstrasse 4-10, 10787 Berlin, Germany.

List of German Standards referred, but not limited to:

DIN 488 Reinforcing steel

DIN EN 1992 Eurocode 2: Design of concrete structures

DIN 1045-2:2008 Concrete, reinforced and prestressed concrete structures - Part 2: Concrete - Specification, properties, production and conformity - Application rules for DIN EN 206-1

DIN 1045-3:2012-03 Concrete, reinforced and prestressed concrete structures - Part 3: Execution of structures - Application rules for DIN EN 13670

DIN 1045-4:2012-02 Concrete, reinforced and prestressed concrete structures - Part 4: Additional rules for the production and the conformity of prefabricated elements

DIN 1048 Testingconcrete

DIN EN 1991 Eurocode 1: Actions on structures

DIN 1164 Cement

DIN 1187 Unplasticised polyvinyl chloride (PVC-U), drainpipes

DIN 1212 Step irons for staggered manhole steps; brim shaped step irons

DIN 1229 Gully tops and manhole tops for vehicular and pedestrian areas

DIN 1388 Universal WC flush down type made of sanitary porcelain material

DIN 1390 Urinals of sanitary porcelain, wall hung

DIN EN 10217 Welded steel tubes for pressure purposes - Technical delivery conditions

DIN EN 10224 Non-alloy steel tubes and fittings for the conveyance of water and other aqueous liquids - Technical delivery conditions

DIN EN 10296 Welded circular steel tubes for mechanical and general engineering purposes - Technical delivery conditions

DIN 1910 Welding

DIN 1986 Drainage Systems on Private Ground

DIN 1988 Drinking water supply systems

DIN EN ISO 22475 Geotechnical investigation and testing - Sampling methods and groundwater measurements

DIN EN 1916 Concrete pipes and fittings, unreinforced, steel fibre and reinforced

DIN EN 1610 Construction and testing of drains and sewers

DIN 4034 Prefabricated concrete manholes, unreinforced, steel fibre and reinforced

DIN 4095 Planning, design and installation of drainage systems protecting structures against water in the ground

DIN EN ISO 17660 Welding - Welding of reinforcing steel

DIN EN 12620 Aggregates for concrete

DIN 4235 Compacting of concrete by vibrating

DIN EN 805 Water supply - Requirements for systems and components outside buildings

DIN 18121 Soil, investigation and testing – Watercontent

DIN 18122 Soil, investigation and testing - Consistency limits

DIN 18123 Soil, investigation and testing - Determination of grain-size distribution

DIN 18124 Soil, investigation and testing - Determination of density of solid particles

DIN 18125 Soil investigation and testing - Determination of density of soil

DIN 18126 Subsoil: Testing procedures and testing equipment, determination of density of non-cohesive soil, and maximum and minimum compactness

DIN 18127 Soil, investigation and testing - Proctor-test

DIN 18134 Soil – Testing procedures and testing equipment

DIN 18196 Earthworks and foundations - Soil classification for civil engineering purposes

DIN 18202 Tolerances in building construction - Buildings

DIN 18203 Tolerances in building construction

DIN 18330 Masonry works

DIN 18331 Concrete works

DIN 18332 Natural stonework

DIN 18333 Cast stone works

DIN 18334 Carpentry and timber construction works

DIN 18336 Waterproofing

DIN 18299:2012-09 General rules applying to all types of construction work

DIN 18338 Roofing works

DIN 18339 Sheet metal roofing and wall covering work

DIN 18350 Plastering

DIN 18352 Wall and floor tiling

DIN 18353 Laying of floor screed

DIN 18354 Asphalt flooring work

DIN 18355 Joinery

DIN 18361 Glazing

DIN 18363 Painting and coating work

DIN 18365 Flooring work

DIN 18379 Installation of air conditioning systems

DIN 18381 Installation of gas, water and drainage pipework inside buildings

DIN 18550 Plastering/rendering and plastering/rendering systems - Execution DIN 19531 Unplasticized polyvinyl chloride (PVC-U), socket pipes and fittings for discharge systems inside buildings

DIN 19555 Step irons for single-line installation - Step irons for setting in concrete

DIN 19597 Manhole tops class A 15, quadratic; covers

DIN 19695 Transport and storage of pipes, fittings and prefabricated manhole components made of concrete and steel reinforced concrete

DIN EN 545 Ductile iron pipes, fittings, accessories and their joints for water pipelines - Requirements and test methods

DIN EN 969 Ductile iron pipes, fittings, accessories and their joints for gas pipelines - Requirements and test methods

DIN 28603 Ductile iron pipes and fittings - Push-in joints - Survey, sockets and gaskets

DIN EN 10204 Metallic products - Types of inspection documents

DIN 52123 Testing of bitumen and polymer bitumen sheeting and felts

DIN 52143 Bitumen roofing felt with glass fleece base

DIN EN 31 Wash basins - Connecting dimensions

DIN EN 14411 Ceramic floor and wall tiles; definitions, classification characteristics and marking

For approval proposed Standards shall be translated into English language.

1.3 German DWA/ATV/DVGW Standards

The regulations referred to have been issued by the GFA-Gesellschaft zur Förderung der Abwassertechnik e.V., Theodor-Heuss-Allee 17, D – 53758 Hennef, Germany; but not limited to:

ATV – DVWK - A 124 Planung und Bau von Abwasserpumpanlagen, Juni 2000

ATV - A 127 Richtlinie für die statische Berechnung von Entwässerungskanälen und - leitungen

ATV - A 128 Standards for the Dimensioning and Design of Stormwater Structures in Combined Sewers, April 1992

ATV - A 166 Structures for central Stormwater treatment and –retention Constructive Design and Equipment, November 1999

ATV - DVWK Advisory Leaflet M 176Guidelines and Examples for the Design and equipping of Structures for central Stormwater treatment and -retention, February 2001

ATV - A 111 Guidelines for the Hydraulic Dimensioning and Performance Verification of Stormwater Overflows in Sewers, February 1994

ATV DVWK Advisory Leaflet M 177Dimensioning and Design of Stormwater Overflows in Combined Sewers, Juni 2001

The Standards referred to have been issued by the German Vereinigung des Gas und Wasserfachs

GW 310/II M Sicherung an Knickpunkten von Druckrohrleitungen

The Standards referred to have been issued by the German Bundesministerium für Verkehr (BMV), FGSV Verlag, Köln, Germany

ZTV Asphalt – StB 94 Zusätzliche Technische Vertragsbedingungen für den Bau von Fahrbahndecken aus Asphalt

1.4 EN and ISO Standards

The EN Standards referred to have been issued by the European Comité of Standardisation, but not limited to:

EN 124 Gully tops and manhole tops for vehicular and pedestrian areas; Design requirements, type testing, marking

EN 499 Classification of covered electrodes for manual metal arc welding of carbon steels, carbon-manganese steels and micro alloyed steels

EN 598 Ductile Iron Pipes, fittings, accessories and their joints for sewerage application

The ISO Standards referred to have been issued by the International Standards Organization, Case Postale 56, CH-1211, Geneva 20 - Switzerland

ISO 1106 Recommended practice for radiographic examination of fusion welded joints

ISO 2531 Ductile iron pipes, fittings and accessories for pressure pipelines

ISO 3452 Non-destructive testing-penetrate inspection-general principles

ISO 4179 Ductile iron pipes for pressure and non-pressure pipelines-Centrifugal cement mortar lining - General requirements

ISO 6600 Ductile iron pipes-Centrifugal cement mortar lining-Composition controls of freshly applied mortar

DIN EN ISO 12994 Part 1 until DIN EN ISO 12994 Part 8 Corrosion protection of steel by coating and protective layers

1.5. British Standards

The British Standards referred to have been issued by the British Standards Institution, 2 Park Street, London W1A 2BS. List of British Standards referred, but not limited to:

BS EN 10226 Requirements for pipe threads for tubes and fittings where pressure tight joints are made on the threads (metric dimensions)

BS 405 Requirements for uncoated expanded metal carbon steel sheets for general purposes

BS 476-10:2009 Fire tests on building materials and structures. Guide to the principles, selection, role and application of fire testing and their outputs

BS EN 476 General requirements for components used in drains and sewers

BS EN 10311:2005 Joints for the connection of steel tubes and fittings for the conveyance of water and other aqueous liquids

BS EN 10224:2002 Non-alloy steel tubes and fittings for the conveyance of water and other aqueous liquids. Technical delivery conditions

BS EN ISO 3834-1:2005Quality requirements for fusion welding of metallic materials. Criteria for the selection of the appropriate level of quality requirements

BS 750:2012 Specification for underground fire hydrants and surface box frames and covers

BS EN 845-1:2013 Specification for ancillary components for masonry. Wall ties, tension straps, hangers and brackets

BS EN 13658-1:2005 Metal lath and beads. Definitions, requirements and test methods. Internal plastering

BS EN 13658-2:2005 Metal lath and beads. Definitions, requirements and test methods. External rendering

BS EN 10255:2004 Non-alloy steel tubes suitable for welding and threading. Technical delivery conditions

BS EN 10223-2:2012 Steel wire and wire products for fencing and netting. Hexagonal steel wire netting for agricultural, insulation and fencing purposes

BS EN 10220:2002 Seamless and welded steel tubes. Dimensions and masses per unit length

BS EN 10216-1:2013 Seamless steel tubes for pressure purposes. Technical delivery conditions. Non-alloy steel tubes with specified room temperature properties

BS EN 10217-1:2002 Welded steel tubes for pressure purposes. Technical delivery conditions. Non-alloy steel tubes with specified room temperature properties

BS 3692:2014 ISO metric precision hexagon bolts, screws and nuts. Specification

BS EN 13748-1:2004 Terrazzo tiles. Terrazzo tiles for internal use

BS EN 13748-2:2004 Terrazzo tiles. Terrazzo tiles for external use

BS EN ISO 11600:2003+A1:2011 - Building construction. Jointing products. Classification and requirements for sealants

BS 4315-2:1970 Methods of test for resistance to air and water penetration. Permeable walling constructions (water penetration)

BS 4320:1968 Requirements for metal washers for engineering purposes. Metric series

BS EN 1092-1:2007+A1:2013 Flanges and their joints. Circular flanges for pipes, valves, fittings and accessories, PN designated. Steel flanges

BS EN ISO 14732:2013 Welding personnel. Qualification testing of welding operators and weld setters for mechanized and automatic welding of metallic materials

BS 4871-3:1985 Specification for approval testing of welders working to approved welding procedures. Arc welding of tube to tube-plate joints in metallic materials

BS 4872-1:1982 Specification for approval testing of welders when welding procedure approval is not required. Fusion welding of steel

BS EN 13914-1:2005 Design, preparation and application of external rendering and internal plastering. External rendering

BS 5499 Fire safety signs, notices and graphic symbols

BS EN 10296-1:2003 Welded circular steel tubes for mechanical and general engineering purposes. Technical delivery conditions. Non-alloy and alloy steel tubes

BS EN 10296-2:2005 Welded circular steel tubes for mechanical and general engineering purposes. Technical delivery conditions. Stainless steel

BS EN 10297-1:2003 Seamless circular steel tubes for mechanical and general engineering purposes. Technical delivery conditions. Non-alloy and alloy steel tubes

BS EN 10305-1:2010 Steel tubes for precision applications. Technical delivery conditions. Seamless cold drawn tubes

BS EN 10305-2:2010 Steel tubes for precision applications. Technical delivery conditions. Welded cold drawn tubes

BS EN 10305-3:2010 Steel tubes for precision applications. Technical delivery conditions. Welded cold sized tubes

BS EN 10305-4:2011 Steel tubes for precision applications. Technical delivery conditions. Seamless cold drawn tubes for hydraulic and pneumatic power systems

BS EN 10305-5:2010 Steel tubes for precision applications. Technical delivery conditions. Welded and cold sized square and rectangular tubes

BS EN 10305-6:2005 Steel tubes for precision applications. Technical delivery conditions. Welded cold drawn tubes for hydraulic and pneumatic power systems

BS 6362:1990, ISO 7598:1988 Specification for stainless steel tubes suitable for screwing in accordance with BS 21 'Pipe threads for tubes and fittings where pressure-tight joints are made on the threads'

BS 8213 Windows, doors and roof lights

CESWI Civil Engineering Specifications for the Water Industry, 6th Edition, UK Water Industry Research Ltd, June 2004, ISBN 1 898920 51 6

CESMM3 Civil Engineering Standard Method of Measurement, 3rd Edition, Institution of Civil Supervisors, ISBN 0 7277 1561 5

For approval proposed Standards shall be translated into English language, if not already available in English.