Initial Environmental Examination (Draft)

July 2018

MON: Proposed Additional Financing for Southeast Gobi Urban and Border Town Development Project

Prepared by the Ministry of Construction and Urban Development of Mongolia for the Asian Development Bank

CURRENCY EQUIVALENTS

(as of 20 July 2018)

Currency Unit	–	togrog (MNT)
MNT1.00	=	$0.000406
$1.00	=	MNT2,463.00

ABBREVIATIONS

ADB	-	Asian Development Bank (ADB)
BOD	-	biological oxygen demand
CEMP	-	Construction EMP
CITES	-	Convention on International Trade in Endangered Species of Fauna and Flora
COD	-	Chemical oxygen demand
DEIA	-	detailed environmental impact assessment
EHS	-	Environmental, Health and Safety
EIA	-	environmental impact assessment
EMP	-	environmental management plan
GEIA	-	General EIA
GRM	-	Grievance Redress Mechanism
IBAT	-	Integrated Biodiversity Assessment Tool
IEE	-	initial environmental examination
IEM	-	Independent environmental monitor
IFAS	-	integrated fixed film activated sludge
LEIC	-	loan implementation environment consultant
MCUD	-	Ministry of Construction and Urban Development
MNET	-	Ministry of Nature Environment and Tourism
MLSS	-	mixed liquor suspended solids
MNS	-	Mongolian National Standards
MNT	-	Mongolian tughrik
NOAA		National Oceanic and Atmospheric Administration
O&M	-	operations and maintenance
PCU	-	Public Complaints Unit
PMIS	-	management and implementation support
PMU	-	project management unit
PPE	-	Personal Protective Equipment
PSC	-	Project Steering Committee
PSG	-	PUSO Support Group
PUSO	-	Public Utility Service Organization
SCADA	-	supervisory control and data acquisition
SGUBTD	-	South Gobi Urban and Border Town Development
SPS	-	Safeguard Policy Statement
UNFCC	-	UN Framework Convention on Climate Change
WRSC	-	Water Services Regulatory Commission
WWTP	-	wastewater treatment plants

WEIGHTS AND MEASURES

°F	-	Degrees Fahrenheit

°C	-	Degrees Celsius
dBA	–	A-weighted decibel
km	–	kilometer
km2	–	square kilometer
LAeq	–	equivalent continuous level 'A weighting' - 'A'-weighting = correction by factors that weight sound to correlate with the sensitivity of the human ear to sounds at different frequencies
m	–	meter
PM10	–	Particulate Matter 10 micrometers or less
PM2.5	–	Particulate Matter 2.5 micrometers or less
µg/m3	–	Microgram per cubic meter

GLOSSARY

aimag	–	Provincial country division
soum	–	Sub-district division
Bag or bagh	–	Third level administrative subdivision sub-district
Khashaa or hashaa	–	Small fenced plot of land in the city

NOTE

(i) In this report, "$" refers to US dollars.

TABLE OF CONTENTS

APPENDICES

FIGURES

EXECUTIVE SUMMARY

A. Introduction and Purpose

1. Asian Development Bank (ADB) Grant 0204-MON: Southeast Gobi Urban and Border Town Development (SGUBTD) has financed urban environmental improvements in six urban settlements in Southeast Gobi of Mongolia, under the SGUBTD Project. The Government of Mongolia requested ADB additional financing to Grant 0204-MON, to support urgently needed wastewater treatment plants (WWTPs) and management improvement for four provincial (*aimag*) centers, including Dalanzadgad city (Umnugovi *aimag*), Sainshand city (Dornogovi *aimag*), Arvaikheer city (Uvurkhangai *aimag*) and Tsetserleg (Avarkhangai *aimag*). This first additional financing loan fully aligned with the objectives and activities of the SGUBTD project.

2. This initial environmental examination (IEE) is for a second additional financing project, to improve WWTPs in five further cities, which aligns with the Government of Mongolia's (the government) objectives to improve public utility services and networks in its provincial centers. This project includes the five cities of Chinggis (Khentii *aimag*), Mandalgovi (Dundgovi *aimag*), Murun (Khuvsgul *aimag*), Baruun Urt (Sukhbataar *aimag*) and Bulgan, (Bulgan *aimag*).

3. The key project outputs under the second additional financing will be:

   (i) **Part A1.** Priority wastewater management improvements including new WWTPs constructed in all project *aimags* to ensure all wastewater generated is treated and effluent meets national discharge standards, and enhanced *aimag's* ability to utilize reclaimed wastewater of up to (initially) 5,000 tonnes per day, where current utilization is zero;
   (ii) **Part A2.** The provision of vacuum trucks for septic tank and pit latrine evacuation and conveyance of septic sludge to the WWTP in each project *aimag* center and construction of faecal sludge reception facilities at all WWTPs;
   (iii) **Part B2.** Institutional reform and capacity development; tariff affordability analysis conducted, and subsidy mechanism established, new operational and financial management systems launched, and environmental monitoring to monitor effluent quality is regularized. Training provided on WWTP financial management, and operations and maintenance (O&M) for implementing agency staff. Public awareness events on public health and environmental management are provided.
   (iv) **Parts B1, B3 and B4.** Project management support for implementing and operating agencies, support to PUSOs, and support for assigned PUSO staff.

B. Key Findings

4. The environmental baseline study confirms that the local communities are the most sensitive receptors in the project area. The project locations are dominated by existing WWTP infrastructure and are in relatively flat topography in sparse grassland. No protected areas or habitats and species of conservation value were identified in the project area of influence.

5. The project sites are located in an environment which has a low population density and as such are able to be located appropriate distances from householdsThe majority of WWTP sites are distant enough from household areas that they are not within the area of influence

for amenity issues (noise and dust); the closest housing area is approximately 300m north in Murun. A number of the project sites are also adjacent to surface water bodies however effluent is not discharged directly into rivers and the rivers are not used for drinking water or household use and are largely frozen during the winter period. The operational aspects and facility maintenance are included in the EMP as essential measures to ensure the quality of the rivers does not deteriorate.

6. Impacts during construction will be localized and short-term and limited to the common impacts associated with any construction project and its associated groundworks. This includes the generation of noise, dust, pollutants and greenhouse gas emissions, traffic and waste. The consultation confirmed that residents are not generally concerned about these impacts. .

7. The most significant environment risks associated with the sub-projects are during the operation phase. WWTPs can cause amenity nuisance and environmental pollution if they are not managed and maintained effectively. This is confirmed by consultation which show residents currently suffer from odor impacts from poorly operated sites. Also pollution can include medium term risks to water quality from WWTP effluent discharges, potentially affecting soil quality, aquatic flora and fauna.

8. If effectively managed, the project facilities will bring about environmental improvements to the local project areas and ger area in Bulgan. Field visits and consultation with community residents show that the current environment is being contaminated with effluent and in warmer months the WWTPs are unpleasant, impacting on residents when the wind blows towards residential areas. The development of well operated wastewater treatment facilities will mean that the pollution of the environment should be reduced and therefore the risks to human health and water quality will be lowered.

9. The community consultations and household socio-economic survey undertaken for this IEE show widespread support for the sub-projects as the residents recognize the need for improved wastewater management.

C. Environmental Management Plan

10. The EMP aims to avoid impacts where possible and mitigate those impacts which cannot be eliminated to an acceptable and minimum level. The EMP includes detailed requirements for:

    (i) mitigation and monitoring measures;
    (ii) institutional arrangements and project responsibilities;
    (iii) EMP budget for implementation;
    (iv) capacity building and training requirements;
    (v) public consultation and information disclosure; and
    (vi) grievance redress mechanism (GRM) including clearly defined timescale and responsibilities.

11. The roles and responsibilities in relation to EMP implementation are summarized in Table 1. The specific functions at each stage in the project are detailed in the EMP.

Table 1: EMP Roles and Responsibilities Summary

Function	Role Related to Environmental Safeguards
Ministry of Construction and Urban Development (MCUD) The executing agency	• Overall policy, guidance and direction; • Responsible for project coordination and liaison with the Asian Development Bank (ADB); and • Overall project implementation and guidance and oversight for the Project Management Unit (PMU).
PMU under MCUD	• Provide guidance of the day-to-day activities of the project and assistance to public utility service organizations (PUSOs); • Procure services of project management and implementation support (PMIS), loan implementation environmental consultant (LIEC) and independent environmental monitor (IEM); • Endorse project documentation and submit to ADB for approval; • Submit the project progress reports including safeguard monitoring reports to ADB; and • Report the project implementation and annual environment management plan (EMP) monitoring reporting to ADB.
PUSO, PUSO Supporting Group (PSG)	• Conduct and supervise day-to-day activities of the project; • Monitoring the construction EMP implementation and grievance redress mechanism (GRM) implementation; • Responsible for monthly project progress report including status of EMP implementation status and issues to PMU; • Assign person-in-charge for EMP coordination; and • In-charge of facility operation and maintenance during operation phase.
LIEC—Provided under contract for PMIS consultants	• Environmental experts within the PMIS team; • Provide technical assistance to the PMU and PSGs on implementing the EMP; • Update the IEE and EMP as required and develop detailed sludge management plan with PUSO; • Provide training to the staff of the PMU and PSGs, PUSOs and contractors on EMP implementation; • Review bidding documents to ensure that the EMP clauses are incorporated; • Review construction EMPs and provide recommendations for improvement; • Assist the PMU in preparing internal environmental monitoring reports; • Advise on mitigation measures implementation and provide technical support; • Coordinate with independent environment monitor (IEM) and review the monitoring results; • Conduct annual EMP compliance review and support PMU in preparing the annual EMP report; • Conduct training events for PUSOs and contractors on EMP requirements and implementation; and • Organize, prior to project completion report (PCR) mission, a survey to assess community satisfaction with project implementation and EMP implementation performance. Draft environment sections of the PCR.
IEM	• Conduct at least two site visits to each construction site (five *aimags*) during the construction period to conduct an independent assessment of the project's compliance with the project EMP and the domestic environmental impact assessments (EIAs); • Conduct independent environmental monitoring according to the monitoring plan and relevant Mongolian standards;

Function	Role Related to Environmental Safeguards
	• Assess the contractors', PUSOs', PMIS, and PMU's compliance with their respective EMP implementation responsibilities as defined in the project administration manual (PAM); • Prepare and submit independent monitoring reports to PMU; • Evaluate EMP implementation effectiveness and recommend improvements; and • Participate at project completion mission and provide inputs to the PCR as requested by the PMU and ADB.

12. The key mitigation measures during construction will include

    (i) Good construction practices will be adopted to ensure minimal disturbance to affected persons from construction related nuisance, such as noise, dust and pollutant emissions.
    (ii) Access to properties will be maintained and encroachment avoided to allow people to continue their activities unimpeded.
    (iii) The contractor will submit site specific environmental management plans for the key activities which will also require the contractor to develop appropriate maps to ensure all stakeholders are clear on where activities will take place. These specific activities are:
        (a) spoil and borrow site management;
        (b) solid and liquid waste management;
        (c) community and occupational health and safety and emergency response; and
        (d) construction workers camp management (if required).

13. Mitigation and monitoring measures are also required for the operation phase. The importance of training in WWTP site management should be emphasized if the investments are to be sustainable, and operations are to be effectively maintained as per the design. Recognizing that operator performance is critical to environmental performance, a detailed long-term operator training plan and associated budget is provided in this project, under Part B2: institutional reform and capacity development. Effluent monitoring will also be conducted to check on facility performance.

14. A Grievance Redress Mechanism (GRM) will be established to receive and facilitate resolution of affected peoples' concerns and grievances about project social and environmental safeguards performance. It should address affected people's concerns and complaints promptly, using a transparent process that is readily accessible to all affected persons. It will contain multiple entry points to allow affected people to approach the organization or person they are most comfortable approaching.

D. Risks and Assurances

15. Risks and risk mitigating measures have been identified in the risk assessment and risk management plan. The Government, MCUD and the *aimag* governments have assured ADB that implementation of the project shall conform to all applicable ADB policies including those concerning anticorruption measures, safeguards, procurement, consulting services, and disbursement. These are set out in relevant project documents including the PAM.

E. Conclusion

16. The EMP aims to mitigate impacts on the natural environment and affected people to an acceptable level. The key parties for mitigation measure during implementation are the construction contractors and the operators. They will be supported by qualified national and international environmental consultants within the Project management and implementation support consultant teams. The implementation of this EMP will be closely monitored and reported on by the relevant stakeholders in the project.

17. The most significant impacts from the project will arise from facility operation. As a result, there is a comprehensive training and capacity building component to the project which is essential for ensuring the investment is both financially and environmentally sustainable and achieves anticipated outcomes.

18. Overall, the project is anticipated to bring environmental benefits to the populations of the project cities. It will serve to improve the current sewage management situation and will provide long term urban environmental improvements and promote sustainable city development.

I. INTRODUCTION

A. Background and introduction

1. Asian Development Bank (ADB) Grant 0204-MON: Southeast Gobi Urban and Border Town Development (SGUBTD) Project[1] has financed urban environmental improvements in six urban settlements in Southeast Gobi of Mongolia, under the SGUBTD Project. The Government of Mongolia (the government) requested ADB additional financing to Grant 0204-MON, to support urgently needed wastewater treatment plants (WWTPs) and management improvement for four provincial (*aimag*) centers, including Dalanzadgad city (Umnugovi *aimag*), Sainshand city (Dornogovi *aimag*), Arvaikheer city (Uvurkhangai *aimag*) and Tsetserleg (Avarkhangai *aimag*). This first additional financing loan fully aligned with the objectives and activities of the SGUBTD project.

2. This initial environmental examination (IEE) is for a second additional financing project, to improve WWTPs in five further cities, which aligns with the government's objectives to improve public utility services and networks in its provincial centers. This project includes the five cities of Chinggis (Khentii *aimag)*, Mandalgovi (Dundgovi *aimag*), Murun (Khuvsgul *aimag*), Baruun Urt (Sukhbataar *aimag*) and Bulgan, (Bulgan *aimag*).

3. For the SGUBTD project, the projected impacts are: "economic development and livability in *aimag* centers enhanced.[2]" For the overall project (including the additional financing), the impact is the same, but the geographic scope is extended.

4. The goals of the original and second additional financing project are: (i) to make a significant and measurable contribution to improving the urban environment of the project aimags; and (ii) a sustainable urban environment in the *aimag* centers. The outcomes for the SGUBTD project and both additional financing projects are improved urban governance, and expanded access to sustainable infrastructure and services in urban places in Southeast Gobi.

5. The project is classified as environmental category "B", requiring an IEE. This IEE report is prepared in accordance with ADB's Safeguard Policy Statement (SPS) 2009. The scope of this IEE covers Parts A1 and A2 of the project; given the nature of Parts B.

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[1] Approved on 19 April 2010.

3 Project's area of influence as defined in SPS 2009: (i) the primary project site(s) and related facilities that the borrower/client develops or controls; (ii) associated facilities that are not funded as part of the project (funding may be provided separately by the borrower/client or by third parties), and whose viability and existence depend exclusively on the project and whose goods or services are essential for successful operation of the project; (iii) areas and communities potentially affected by cumulative impacts from further planned development of the project, other sources of similar impacts; and (iv) areas and communities potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later or at a different location. The area of influence does not include potential impacts that might occur without the project or independently of the project

B. Structure of This Report

6. This IEE report is structured as follows:

(i) Executive Summary outlines important facts, major findings, and recommended actions of the IEE.
(ii) Policy, Legal, and Administrative Framework - presents the national and local legal and institutional framework within which the environmental assessment is carried out. It describes the environmental categorization by ADB and Ministry of Nature, Environment and Tourism (MNET) based on an environmental screening.
(iii) Description of the Project - provides a justification of the project based on a sector analysis; a detailed description of the project, including project location and components.
(iv) Description of the Environment (Baseline Data) - physical, biological, and socioeconomic conditions within the project area. ADB's SPS 2009 requires environmental assessments to address induced impacts and risks to (i) physical (ii) biological (iii) socioeconomic (iv) physical cultural resources in the context of the project's area of influence[3]; and (v) potential transboundary and global impacts, including climate change.
(v) Anticipated Environmental Impacts and Mitigation Measures - predicts and assesses the project's likely positive and negative direct and indirect impacts to physical, biological, socioeconomic, and physical cultural resources in the project's area of influence; identifies mitigation measures and any residual negative impacts that cannot be mitigated.
(vi) Analysis of Alternatives - examines alternatives to the proposed project site, technology, design, and operation, including the no project alternative.
(vii) Information Disclosure, Consultation, and Participation - the process undertaken during project design and preparation for engaging stakeholders, including information disclosure and consultation with affected people and other stakeholders and addressing the comments raised in consultation.
(viii) Grievance Redress Mechanism (GRM) – presents the GRM established to handle grievances and complaints arising during project implementation. It defines GRM entry points, timeframe and institutional responsibilities of the GRM.
(ix) Conclusion. Provides an assessment on the environmental soundness of the project.
(x) Environmental Management Plan (EMP) – the EMP defines the mitigation measures, performance indicators, environmental monitoring requirements, institutional responsibilities, training activities related to environmental

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management, reporting requirements, and a mechanism for feedback and adjustment. The detail on the EMP is provided in a separate Appendix appropriate for future bid documentation purposes.

(xi) Appendices.

II. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

A. Environmental Assessment Requirements

7. The project is subject to the environmental requirements of both Mongolia and ADB. These requirements are defined in the next two sections.

1. Environmental Assessment Requirements of ADB

8. Safeguard requirements for all projects funded by ADB are defined in ADB SPS 2009. SPS 2009 establishes an environmental review process to ensure that projects undertaken as part of programs funded through ADB loans are environmentally sound, are designed to operate in compliance with applicable regulatory requirements, and are not likely to cause significant environmental, health, or safety hazards. SPS 2009 is underpinned by the ADB Operations Manual, Bank Policy (OM Section F1/BP, October 2013). The policy promotes international good practice as reflected in internationally recognized standards such as the World Bank Group's Environmental, Health and Safety (EHS) Guidelines. The EHS Guidelines contain discharge, effluent, air emissions, and other numerical guidelines and performance indicators as well as prevention and control approaches that are normally acceptable to ADB and are generally considered to be achievable at reasonable costs by existing technology. When host country regulations differ from these levels and measures, the borrower/client is to achieve whichever is more stringent.

9. SPS 2009 environmental assessment requirements specify that:

(i) at an early stage of project preparation, the borrower/client will identify potential direct, indirect, cumulative, and induced environmental impacts on and risks to physical, biological, socioeconomic, and cultural resources and determine their significance and scope, in consultation with stakeholders, including affected people and concerned nongovernment organizations. If potentially adverse environmental impacts and risks are identified, the borrower/client will undertake an environmental assessment as early as possible in the project cycle;
(ii) The assessment process will be based on current information, including an accurate project description, and appropriate environmental and social baseline data;
(iii) Impacts and risks will be analyzed in the context of the project's area of influence;
(iv) Environmental impacts and risks will be analyzed for all relevant stages of the project cycle, including preconstruction, construction, operations, decommissioning, and post-closure activities such as rehabilitation or restoration; and
(v) The assessment will identify potential transboundary effects as well as global impacts.

10. Other requirements of SPS 2009 include:

(i) Alternatives analysis. SPS 2009 states that this is only for projects which have ''significant adverse environmental impacts that are irreversible, diverse, or unprecedented'' i.e., category A projects and therefore is not required for this category B IEE however is included here for completion;

(ii) Environmental management plan. The borrower/client will prepare an EMP that addresses the potential impacts and risks identified by the environmental assessment;
(iii) Consultation and participation. The borrower/client will carry out meaningful consultation with affected people and other concerned stakeholders, including civil society, and facilitate their informed participation;
(iv) Information disclosure. Environmental information on the project, including the IEE and other safeguards information will be disclosed in accordance with ADB's Public Communications Policy (2011) and SPS (2009);
(v) Grievance redress mechanism. The borrower/client will establish a mechanism to receive and facilitate resolution of affected people's concerns, complaints, and grievances about the project's environmental performance; and
(vi) Monitoring. The borrower/client will monitor and measure the progress of implementation of the EMP.

11. **ADB Categorization of this project.** The project classification of environment category B has been confirmed during project preparation.

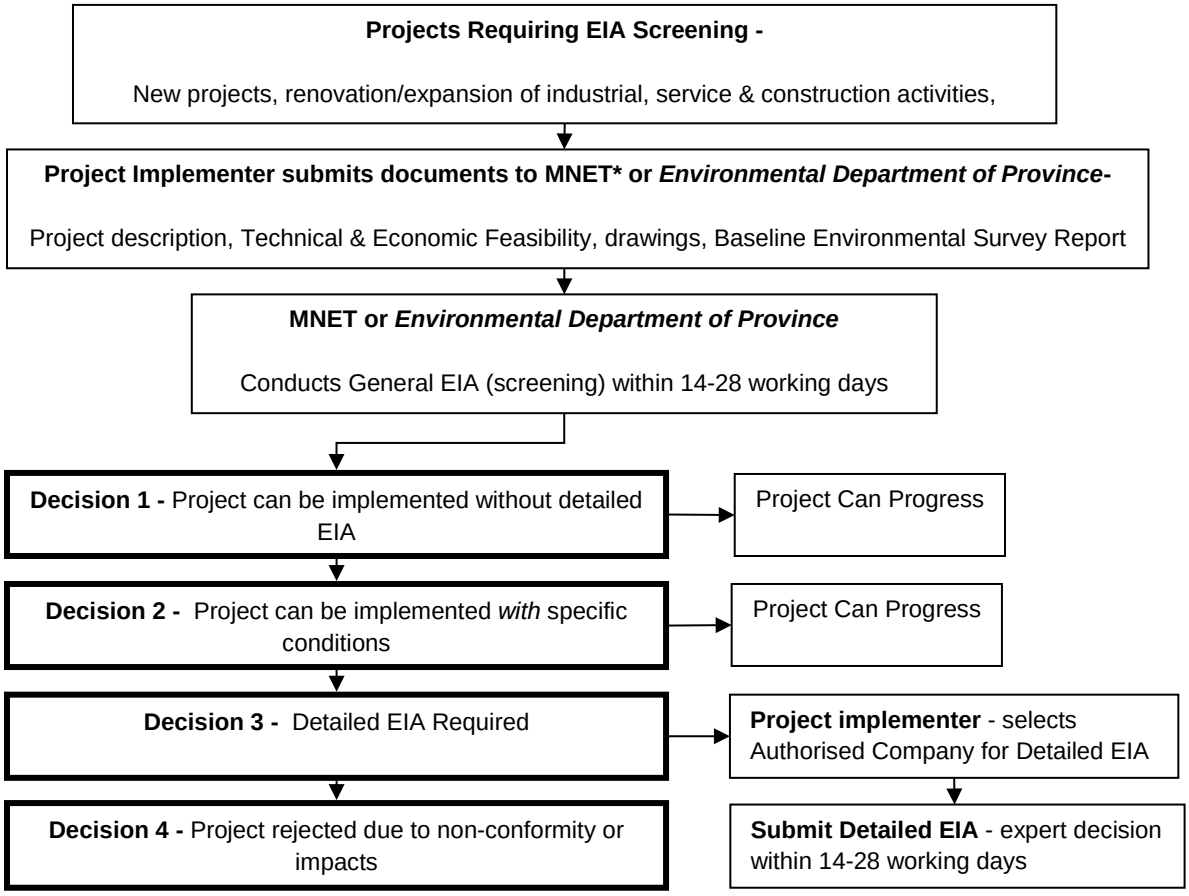
2. Environmental Assessment Requirements of Mongolia

12. The Environmental Impact Assessment (EIA) requirements of Mongolia are regulated by the Law on EIA (1998, amended 2002 and amended 2012). The terms of the law apply to all new projects, as well as rehabilitation and expansion of existing industrial, service or construction activities and projects that use natural resources.

13. The most recent amendment to the law was adopted in May 2012 and was brought into force in January 2014, implemented through a new Environmental Impact Assessment Regulation. The 2012 amendment introduces a requirement for Strategic Environmental Assessment for policy documents and increases emphasis on public participation during a general EIA.

14. The purpose of the EIA law is environmental protection, the prevention of ecological imbalance, the regulation of natural resource use, the assessment of environmental impacts of projects and procedures for decision-making regarding the implementation of projects. The EIA process in Mongolia is summarized in Figure 1.

Figure 1: EIA Process in Mongolia



*Ministry of Environment and Tourism
Source: Asia Foundation of Mongolia. Adapted from Vol. 1 (2001) Compendium of Laws: A Mongolian Citizen's Reference Book. Ulaanbaatar.

15. There are two types of EIAs defined by the Environmental Protection law of Mongolia:

(i) **General EIA (GEIA - screening)** - to initiate a General EIA, the project implementer submits to Ministry of Nature Environment and Tourism (MNET) (or Environmental department of corresponding province or *aimag* in Mongolian) the following: Finalized Project Design or an approved Feasibility Study, Baseline Environmental Survey Report, a letter of *soum* governor which requests General EIA, technical details, drawings, and other information. The GEIA may lead to one of four conclusions: (i) no detailed EIA is necessary, (ii) the project may be completed pursuant to specific conditions, (iii) a Detailed EIA is necessary, or (iv) project cancellation. The GEIA is free and usually takes up to 14–28 working days

(ii) **Detailed EIA** (DEIA) – the scope is defined by the GEIA. The Detailed EIA report must be produced by a Mongolian company which is authorized by MNET with a special license to conduct DEIA. The developer of the DEIA should submit it to the MNET (or Environmental department of corresponding province). An expert of MNET who was involved in conducting the GEIA should make a review of the Detailed EIA within 18–36 working days and present it to MNET (or Environmental department of corresponding province). Based on the conclusion of the expert,

MNET (or *aimag* government) takes a decision about approval or disapproval of the project.

(iii) The DEIA must contain the following chapters: (a) project alternatives; (b) analysis of adverse impacts and their consequences; (c) recommendations for minimizing, mitigation and elimination of impacts; (d) Ecological loss assessment (e) Risk assessment on human health and environment; (f) Environmental Management Plan; (g) Environmental Monitoring Program. The DEIA report must be consulted on with local bag residents at Citizens' meeting and obtain approval letter from the *bag* governor along with stamped meeting minutes.

16. The Project sites have been subject to a DEIA in accordance with Mongolian law; the DEIAs were all approved by MNET by 14 March 2018.

B. Mongolia's Environmental Policy and Laws

17. Mongolia has enacted a comprehensive policy and legal framework for environmental assessment and management. It has policies, legislation and strategies in place to manage the protected areas such as national parks, to satisfy its international obligations, and to protect the quality of the environment for the health and well-being of its citizens. The hierarchy of policies and legislative provisions for environmental management in Mongolia comprises the Constitution, international treaties and environment and resource protection laws.[4]

18. The main policy documents are the National Biodiversity Program 2015–2025, the State Environmental Policy of 1997, the National Plan of Action to Combat Desertification, and the National Plan of Action for Protected Areas, all developed under the MNET auspices, and a set of environmental laws that were amended in May 2012. In addition, other guidance documents with important environmental repercussions were developed under the auspices of other ministries and these include the Roads Master Plan, the Power Sector Master Plan, the Tourism Master Plan, and the Renewable Energy Master Plan. Other documents, such as the annual Human Development Reports have increasingly incorporated environmental aspects.

19. A fundamental principle of the Mongolian state environmental policy is that economic development must be in harmony with the extraction and utilization of natural resources and that air, water and soil pollution will be controlled. In April 1996, Mongolia's National Council for Sustainable Development was established to manage and organize activities related to sustainable development in the country. The country's strategy is designed for environmentally friendly, economically stable and socially wealthy development, which emphasizes people as the determining factor for long-term sustainable development.

20. The health of Mongolia's natural ecosystems and populations of wild species is of both national and global importance. The country forms an important part of the global ecosystem where the ecoregions of the Siberian taiga, the Eurasian steppe, the high Altai Sayan, and the Gobi Desert converge. In recognition of its global responsibilities, Mongolia has acceded to a number of international environmental conventions which places obligations on

[4] UNDP. 2008. Institutional Structures for Environmental Management in Mongolia. Ulaanbaatar and Wellington.

signatory governments. The key conventions are in Table 2.

Table 2 International Environmental Conventions Signed by Mongolia

Convention	Year of Accession
Convention on Biological Diversity	1993
UN Framework Convention on Climate Change (UNFCCC)	1994
Kyoto Protocol	1999
UN Convention on Combating Desertification	1996
Convention on the Protection of Wetlands of International Importance (Ramsar)	1998
Vienna Convention for the Protection of the Ozone Layer	1996
Montreal Protocol (regulating substances that deplete the ozone layer)	1996
Convention on International Trade in Endangered Species of Fauna and Flora (CITES)	1996
Convention on the Transboundary Movement of Hazardous Waste (Basel)	1997
Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade	2000
Stockholm Convention on Persistent Organic Pollutants	2004
World Heritage Convention	1990
Convention on the Conservation of Migratory Species of Wild Animals	1999
Minamata Convention on Mercury	2015

21. The Government of Mongolia undertook a major environmental law reform in 1990 including the law of land, protected areas, water, forest, wildlife, and native flora resources. A further reform was undertaken in 2012, shown in Table 3.

Table 3: Current Laws and Amendments

Name of the Law	Amended names of the laws	Year Adopted	Years of amendment
The Constitution of Mongolia		1992	
Law on Environmental Protection		1995,	2006, 2008, 2012
Law of Land		2002	
Law on Land Cadastre and Mapping		1999	
Law on Land Fees		1997	
Law on Land Possession		2002	
Law on Special Protected Areas		1994	
Law on Buffer Zones		1997	
Law on Water		2004	2012
Law on Water and Mineral Water Resource Fee	Law on Natural Resource Fee	1995	2013
Law on Forests	Law on Forest	1995	2012
Law on Prevention of Steppe and Forest Fires	Law on Forest	1996	2012
Law on Reinvestment of Natural Resource Use Fees for Conservation	Law on Natural Resource Fee	2000	2012
Law on Natural Plants		1995	
Law on Protection of Plants		1996	
Law on Fauna		2000	2012
Law on regulation of export and import of endangered species (flora, fauna)		2002	
Law on Underground Resources		1994	

Name of the Law	Amended names of the laws	Year Adopted	Years of amendment
Law on Mineral Resources		1997, 2006	
Law on Petroleum		1991	2014
Law on Air		1995	2012
Law on Hydrometeorology		1997	
Law on Protection from Toxic Chemicals		1995	2006
Law on Environmental Impact Assessment		1998, 2002	2012
Law on Tourism		1998	2000
Law on Solid Waste	Law on Waste	2003	2012
Law on prohibiting export and transportation of Hazardous Waste	Law on Waste	2000	2012
Law on Protection of Cultural Heritage		2014	

22. **Law on Environmental Protection**. The Law on Environmental Protection (2012) is an overarching law for all environmental legislation. It is the principal law that regulates activities associated with the protection of the environment with special emphasis on 'Natural Resource Reserve Assessment' and 'Environmental Impact Assessment'. It governs the land and subsoil, mineral resources, water resources, plants, wildlife and air, and requires their protection against adverse effects to prevent ecological imbalance. The environmental protection law regulates the inter-relations between the state, citizens, economic entities and organizations, with a guarantee for the human right to live in a healthy and safe environment.

23. The law aims for an ecologically balanced social and economic development, the protection of the environment for present and future generations, the proper use of natural resources, including land restoration and protecting land and soil from adverse ecological effects. There are provisions that enable the development of state and local rights on environmental protection; environmental protection rights and obligations of citizens; environmental carrying capacity; to specify the maximum level of natural resources use; to provide for ecological training and education; to specify state environmental guidelines and principles and to provide for environmental assessment, databases and research and financing. National policy to protect ecologically significant aspects of the environment and to restore natural resources is prepared under the Law on Environmental Protection

C. Environmental Quality Standards

24. Table 4 gives relevant environmental quality standards for this IEE and the DEIA. The detail of the specific parameters are provided in APPENDIX 2 and where appropriate, comparisons with international standards are given. The more stringent standard shall be applied for project compliance.

Table 4: Relevant Mongolian National Standards

Environmental Media	National Standard in Force
Ambient air	MNS 4585: 2007
Noise	MNS 4584:2007
Soil	MNS 5850:2008
Drinking water (groundwater)	MNS 900:2016
Effluent wastewater	MNS 4943: 2011
Ambient surface water	MNS 4586:1998

25. For wastewater reuse, the Mongolian effluent standards will be met (MNS 4943: 2011). In addition, World Health Organisation (WHO) Guidelines[5] for the safe use of wastewater will be met. These guidelines specify health targets of ≤1 helminth egg per liter (l) for agricultural use. The guidelines state that 'this level of health protection could be met by treatment of wastewater'. Stabilization ponds, because of the retention time, can be used as a surrogate to assure compliance with the ≤ 1 egg/l, therefore the chosen technology for the project will meet WHO standards because of the use of stabilization ponds, primary and secondary treatment.

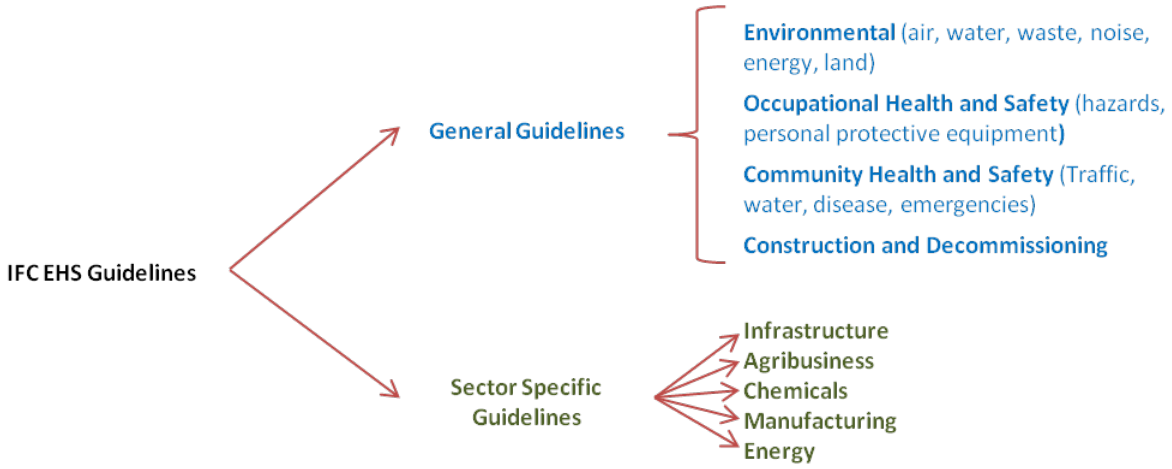
26. In addition to the numerical Mongolia National Standards in Table 4, Mongolia also has an **occupational health and safety standard** (MNS 5002:2000). Article 16 of the National Constitution of Mongolia states that every employee has the right to 'suitable conditions of work'. The Government adopted a National Program for occupational Safety and Health Improvement in 2001 and national standards are also adopted such as the National Standard on occupational Health and Safety MNS 5002:2000 which support the Law on Labor Safety and Hygiene (2008) which sets out policies, rules and regulations on occupational safety and health, and the most common requirements for workplace safety.

27. ADB requires that each environmental assessment takes into consideration the International Finance Corporation (IFC) / World Bank Group Environmental, Health and Safety (EHS) Guidelines.[6] The structure of the guidelines is shown in Figure 2. The infrastructure guidelines include specific recommendations for wastewater treatment. The guidelines do not specify performance standards in terms of effluent quality but instead require the selected technology to meet 'applicable national requirements or internationally accepted standards.'

[5] World Health Organisation Guidelines for the safe use of wastewater, excreta and greywater; Volume Wastewater use in agriculture

[6] World Bank EHS Guidelines World Bank Group, 2007. Environmental, Health, and Safety General Guidelines. Washington, DC available on https://www.ifc.org.

Figure 2: IFC Environment Health and Safety Guidelines



Source: IEE Preparation Team.

D. Other Strategies and Policies

3. Water and Wastewater Sector Approach

28. Under the Water Law, the Government has the authority to determine the intrinsic environmental value of water resources for each region or river basin. Currently, governmental resolution No. 302 dated 26 October 2011 sets out the environmental value for each river basin in amounts ranging from MNT800 to MNT2,651 per cubic meter for surface water, and MNT1,510 to MNT9,440 per cubic meter for sub-surface water (groundwater).

29. In the wastewater sector, to implement the "polluter pays" principle in terms of water resource protection, the Water Pollution Fees Law introduces fees payable by entities and organizations that pollute water resources, and sets out the maximum and minimum amount of water pollution fees per polluting substance type. The Government will set the specific fees payable in each water drainage basin taking into account the volume and quality of the water resources within it.

30. The government is pursuing an ambitious reform agenda in the water and wastewater sector, assisted by ADB. Based on the newly amended Law of Mongolia on Municipal Water Supply and Wastewater Treatment Operation (amendments) Article 9 (2011), the Water Services Regulatory Commission (WSRC) was established and made operational from June 2012. The head of the Commission and the members were appointed by Prime Ministerial Resolution No.56 of May 30, 2012, with duties to: (i) take control of water supply and sewerage system service tariff; (ii) set water supply and sewerage system service tariff; (iii) give approvals for system tariff; (iv) make resolutions on tariff and carry out analysis; (v) approve communication and regulation of water supply and sewerage entities (Public Utility Service Organization - PUSOs); and (vi) approve any other such resolution as may be necessary.

31. The Commission has investigated the issue of water supply and sewerage tariffs and has proposed a system of tariff reform which will progressively increase tariffs, first to recover full operational and maintenance costs, and thereafter to also cover the costs of depreciation. The recommendations include: (i) a structure which provides for both fixed and variable tariffs; and (ii) that there be immediate substantial increase in tariff, and thereafter progressive increases in tariff to support the sustainable operation of water and wastewater management systems. The WSRC has effectively weakened the role of the *aimag* governments in preventing the PUSOs from introducing and imposing tariffs at levels necessary for them to be fully self-financing. Consequently, in general, the financial position of the PUSOs has significantly improved over the past two years.

III. DESCRIPTION OF THE PROJECT

A. Introduction

32. The Asian Development Bank (ADB) Grant 0204-MON[7] approved on 19 April 2010, has been financing water supply, sewerage, heating supply systems, roads, storm water drainage improvement, master plan preparation, and capacity development for six urban settlements in Southeast Gobi of Mongolia. This is the original South Gobi Urban and Border Town Development (SGUBTD Project). The Government of Mongolia requested ADB for additional financing to Grant 0204-MON to support urgently needed wastewater treatment facilities and management improvement for four provincial (*aimag*) centers, including Dalanzadgad city (Umnugovi *aimag*), Sainshand city (Dornogovi *aimag*), Arvaikheer city (Uvurkhangai *aimag*) and Tsetserleg (Avarkhangai *aimag*). This was an additional financing loan fully aligned with the objectives and activities of the SGUBTP project.

33. This second additional financing project also is designed to improve wastewater treatment plants (WWTPs) in five further cities, which aligns with the Government's objectives to improve public utility services and networks in its provincial centers. This project includes the cities of Chinggis (Khentii *aimag*), Mandalgovi (Dundgovi *aimag*), Murun (Khuvsgul *aimag*), Baruun Urt (Sukhbataar *aimag)* and Bulgan, (Bulgan *aimag)*.

B. Rationale

34. The rationale for the project is:

    (i) the existing wastewater management systems are under strain, and performance in the sector is compromised by obsolete facilities and equipment; this puts the systems at risk of failure;
    (ii) the *aimag* centers are identified by Government as the targets for future economic growth; lack of adequate wastewater facilities could compromise future investment in these cities; and
    (iii) the current treatment plants do not satisfy discharge standards for either organic pollutants or nutrients, even when functioning well. This leads to pollution of surrounding areas or of receiving streams.

4. Status of Existing WWTPs

35. The status of the existing WWTP sites is summarized below:

    (i) The pond systems are generally in a poor state of repair, and if operational are generally not operated in the designed configuration.
    (ii) Problems are experienced in the winter when the wastewater freezes and retention volumes in the pond systems are insufficient to accommodate the design flow, resulting in ponds being over-topped. Odor problems and poor treatment efficiency are experienced year-round, but particularly during the spring thaw,

[7] ADB. 2010. Report and Recommendation of the President to the Board of Directors: Proposed Grant to Mongolia for the Southeast Gobi Urban and Border Town Development Project. Manila.

when the stored biological oxygen demand (BOD) is released from the frozen wastewater and the natural treatment systems are thus overloaded.

(iii) The State Inspection Agency, which is responsible for inspection of waste treatment facilities, is constantly reporting on the failure of the existing treatment plants to reach the required discharge standards. While the current operations do not present a significant health or environmental risk, this is likely to change with increasing wastewater flows.

36. It is clear that the current facilities are generally in a poor state of repair and are based on a technology choice that is not suitable for Mongolian climatic conditions. This means that the facililties are not adequate to accommodate increasing wastewater flows. Previously, insufficient attention has been paid to the importance of wastewater treatment and achieving effluent quality standards, and consequently maintenance has been neglected.

C. Project Impact, Outcome and Outputs

37. The design and monitoring framework sets out the project impact, outcome, outputs and inputs, and specifies the performance indicators and means of verification, and the key risks and assumptions.

5. Project Impacts

38. For the current project, the projected impacts are: “economic development and livability in aimag centers (mining, and border towns in Southeast Gobi) enhanced.” (In accordance with Infrastructure Plans for the Southern Gobi, Government Action Plan 2012–2016)

39. For the overall project (including the additional financing), the impact is the same, but the geographic scope is extended to include the aimags of Bulgan, Dundgovi, Khentii, Khuvsgul and Sukhbaatar.

40. The goals of the project are: (i) to make a significant and measurable contribution to improving the urban environment of the project aimags; and (ii) a sustainable urban environment in Baruun Urt, Bulgan, Chinggis City, Mandalgovi and Murun.

6. Project Outcomes

41. For the current project, the outcomes are improved urban governance, and expanded access to sustainable urban infrastructure and services in Southeast Gobi. For the overall project (including the additional financing), the outcomes are the same, but the geographic scope is extended to include the aimags of Bulgan, Dundgovi, Khentii, Khuvsgul and Sukhbaatar.

7. Project Outputs

42. The project outputs under the additional financing will be:

(i) **Part A1.** Priority wastewater management improvements including new WWTPs constructed in all project *aimags* to ensure all wastewater generated[8] is treated and effluent meets national discharge standards, and enhanced ability for *aimags* to utilize reclaimed wastewater of up to (initially) 5,000 tonnes per day, where current utilization is zero;

(ii) **Part A2.** The provisions of vacuum trucks for septic tank and pit latrine evacuation and conveyance of septic sludge to the WWTP in each project aimag centre and construction of faecal sludge reception facilities at all WWTPs;

(iii) **Part B2.** Institutional reform and capacity development; tariff affordability analysis conducted, and subsidy mechanism established, new operational and financial management systems launched, and environmental monitoring to monitor effluent quality is regularized. Training provided on WWTP financial management, and operations and maintenance (O&M) for implementing agency staff. Public awareness events on public health and environmental management are provided.

(iv) **Parts B1, B3 and B4.** Project Management Support for implementing and operating agencies, support to project PUSOs, and support for assigned PUSO staff.

8. Project Inputs

43. Investment funding from ADB in the amount of US$ 19.40 million equivalent, with balance of funds required from the Government and project aimags, to fund: (i) new wastewater treatment plants; (ii) replacement of pumps and critical repairs to the pump stations in Murun; (iii) support to institutional reform and capacity development for PUSOs; and (iv) support to project management and operation.

9. Project Environmental Benefits

44. In addition the positive project outcomes including general urban environmental improvements, the project will have further resource benefits:

(i) **Water resource efficiencies**. The project will offer the *aimag* authorities the ability to utilize up to 2,000 tonnes per day of reclaimed water. Current utilization of treated effluent is zero and during project preparation the *aimag* authorities have expressed interest in collaborating with nurseries/growers to use the reclaimed water.

(ii) **Nutrient efficiencies**. The *aimag* authorities will have a well digested sludge product at the end of the wastewater treatment process. This product is also suitable for use by nurseries/growers as a soil conditioner or growing medium and therefore the nutrient benefits within the sludge can be utilized.

[8] The influent will include< 10% industrial wastewater in all cases, and in most > 5%. This is mainly from food processing and wool washing facilities. The small number of animal skin processing operations have their own treatment plants. Given the chosen technology and influent from industry, the engineering team does not foresee any issues with industrial effluent.

D. Detailed Description of the Project

45. To achieve the objectives outlined above, the Project will comprise two parts:

    (i) Part A and B: wastewater management and septic tank sludge management improvements; and
    (i) Part B: institutional reform and capacity development and project support.

46. The project components are described below and a location of the project is given in Figure 3:

Figure 3: Project Location

47. 

Source: Google Earth, PPTA Team 2018.

10. Part A1: Priority wastewater management improvements

48. **Wastewater Treatment Process Components**. Two design consultant companies have been engaged to carry out design work for treatment plants, all of which adopt the Integrated Fixed Film Activated Sludge (IFAS) process technology. Naran Rashaan LLC has carried out designs for treatment plants at Chinggis City (Khentii *aimag)*, Mandalgovi (Dundgovi *aimag*), Murun (Khuvsgul *aimag*) and Bulgan, (Bulgan *aimag*) all rated at 3,000 cum/d capacity. Hydro Design Project LLC has carried out the design for the treatment plant for Baruun Urt (Sukhbaatar *aimag*) also with a rated capacity of 3,000 cum/d.

49. The designs differ slightly in their configuration, and in the selection of the type of media (artificial algae) used in the aeration tanks. However, in general the process is as follows:

    (i) Installation of a collector main – generally with either 350 or 500 mm diameter, between the old WWTP and the new one;

(ii) Inlet chamber and screening chamber with mechanical screens (coarse – 18 mm and fine – 6 mm);
(iii) Grit and sand sedimentation channel and removal system and associated pumps;
(iv) Influent equalization tank;
(v) Primary sedimentation tank;
(vi) Biological reactor tank and media (artificial algae), including blowers, diffusers and other aeration equipment, and associated structures. The biological treatment involves several stages (different tank compartments), and variations in bubble size, to aid denitrification, nitrification and removal of organic material;
(vii) Secondary sedimentation tank;
(viii) Effluent stabilization or equalization reservoir;
(ix) Disinfection unit;
(x) Tertiary treatment or maturation in bio (waste stabilization) ponds;
(xi) Sludge pumps and sludge concentration facilities, and sludge filter press; and
(xii) Sludge drying beds.

50. In addition, ancillary facilities for the WWTP will include:

(i) Administration building, including offices and laboratory;
(ii) Heating boiler;
(iii) Heating, water supply and waste water network lines;
(iv) Electricity substation and electricity supply line;
(v) Automation equipment – Supervisory control and data acquisition (SCADA) system; and
(vi) Site fencing, access road, guard house and landscaping.

51. These ancilliary facilities are considered part of the project primary facilities under SPS 2009 and as such are considered within the scope of this IEE.

52. Key features of the proposed IFAS treatment process are as follows:

53. **Screenings**. Contaminated solid waste (screenings) will be stored on site and then disposed of to the municipal landfill facility. Volumes removed for disposal will vary but generally be a few tens of kilograms per day wet weight.

54. **Grit Removal**. Grit and sand will be settled and pumped to drying beds. The quantity removed will vary between sites but will generally be a few tens (or at most hundreds) of kilograms per day wet weight. The screening chamber and grit removal channels will be contained within a preliminary treatment building. Grit and sand will be disposed of at the municipal landfill facility.

55. **Equalization Tank**. The discharge rate of wastewater arriving at the treatment plants will fluctuate significantly, both diurnally and between seasons (as a result of the inclusion of wastewater from the hot water supply in winter). Consequently, an influent equalization tank with a capacity of about 4 hours of average flow will be installed following the preliminary treatment. This tank will incorporate an air mixing system to ensure the wastewater is maintained in constant motion to avoid the onset of septic conditions.

56. **Primary Sedimentation and Sludge Production**. A primary sedimentation tank will precede the biological treatment units providing a retention time of approximately two hours of average flow. Sludge withdrawn from the primary sedimentation unit will be pumped to

the sludge treatment facility.

57. **Biological Treatment.** The biological treatment process involves multiple stages in order to maximize treatment efficiency. The stages are designed to optimize the nitrification, denitrification and organics removal processes. To increase the intensity of activated sludge within the biological reactor, plastic media (or artificial algae) are used in most of the biological reactor tanks. The fixed media (or artificial algae) provide surfaces onto which the activated sludge attaches. This intensifies the oxidation process by increasing oxidation rates and decreasing the amount of return sludge required, thus reducing operation costs. An average mixed liquor suspended solids concentration of approximately 6-8 gram per liter (g/l) is attained as a result of which the aging of activated sludge is increased, leading to an enhanced nitrification process contributing to more complete biological treatment.

58. **Aeration** is provided by compressors delivering compressed air to diffusers located in the biological treatment tanks. Bubble size is specified according to requirements of the treatment process taking place in the tanks, and the timing, intensity and type of aeration can be varied to optimize treatment.

59. **Secondary Sedimentation and Sludge Production**. Following biological treatment the secondary sedimentation process allows separation of the mixed liquor suspended solids (MLSS) from the supernatant. At this stage remaining phosphorus is removed through the addition of a coagulant at 15-20 milligram per liter (mg/l0 concentration. This process should deliver effluent with biological oxygen demand (BOD) concentration in the range of 3-5 mg/l, and a nitrogen as ammonium concentration of <0.5 mg/l.

60. Excessive activated sludge from secondary sedimentation will be stabilized in the equalization pond and be pumped for excess sludge processing.

61. **Sludge Processing Unit.** The sludge treatment system for excess sludge will comprise a concentrator, filter press and sludge drying beds. Drying bed area required for each WWTP is of the order of 3,000 sq m, including need for storage during winter. Under Mongolian climatic conditions and in view of pre-treatment in a sludge press which significantly reduces moisture content, seepage and its drainage is will not an issue as percolation levels are low and evaporation levels very high. Drying times vary by season, averaging approximately 30 days.

62. The anticipated daily excess sludge volume generated is expected to be of the order of 20 cum/day at design loading. Excess sludge is dewatered in the concentrator and then pumped to the filter press where it is further dewatered to provide sludge of 80 percent moisture content. Prior to introduction to the filter press, a flocculent is added to the sludge to assist in concentration. Sludge beds will be provided for up to 6 months of sludge production. Dried sludge may be sold as soil conditioner or growing medium for nurseries or may be disposed of in the city's waste facility. At this stage the sludge is fully digested and is safe for nursery uses.

63. Excess supernatant extracted from the sand removal and sludge drying process will be returned to the preliminary treatment works.

64. **Disinfection Facility**. Disinfection of treated wastewater will be carried out through the addition of sodium hypochlorite into the disinfection reservoir, which is located in the production building. The disinfected wastewater will be transferred to the bio-pond by gravity

pipeline.

65. **Effluent Polishing in Bio-ponds.** Effluent polishing will be carried out in oxidation (waste stabilization) ponds providing both additional treatment, and storage in the case of reuse. The ponds also serve as an emergency retention and treatment system in the event of plant malfunction or problems with chlorination. The retention time is 30 days, and pond length to depth ratios are generally about 4:1 meter (m) and depth 1.5 m.

66. **Potential Effluent Reuse**. The last step of the treatment process will provide an effluent quality well in excess of that required for a range of reuses. Possible reuses (depending on location and local conditions) may include, i.e., (i) irrigation of grass areas and other public open spaces, (ii) irrigation for agriculture, (iii) cement mixing for construction, (iv) car washing, (v) flushing water for public toilets, (vi) heating boilers, (vii) watering of roads and public areas for dust suppression, and (viii) cooling water or other water requirements for industries. The majority of *aimags* in the project has expressed an interest in reuse of water for plant nurseries and therefore are confident that reuse will take place.

67. Table 5 shows the final effluent quality anticipated following full treatment.

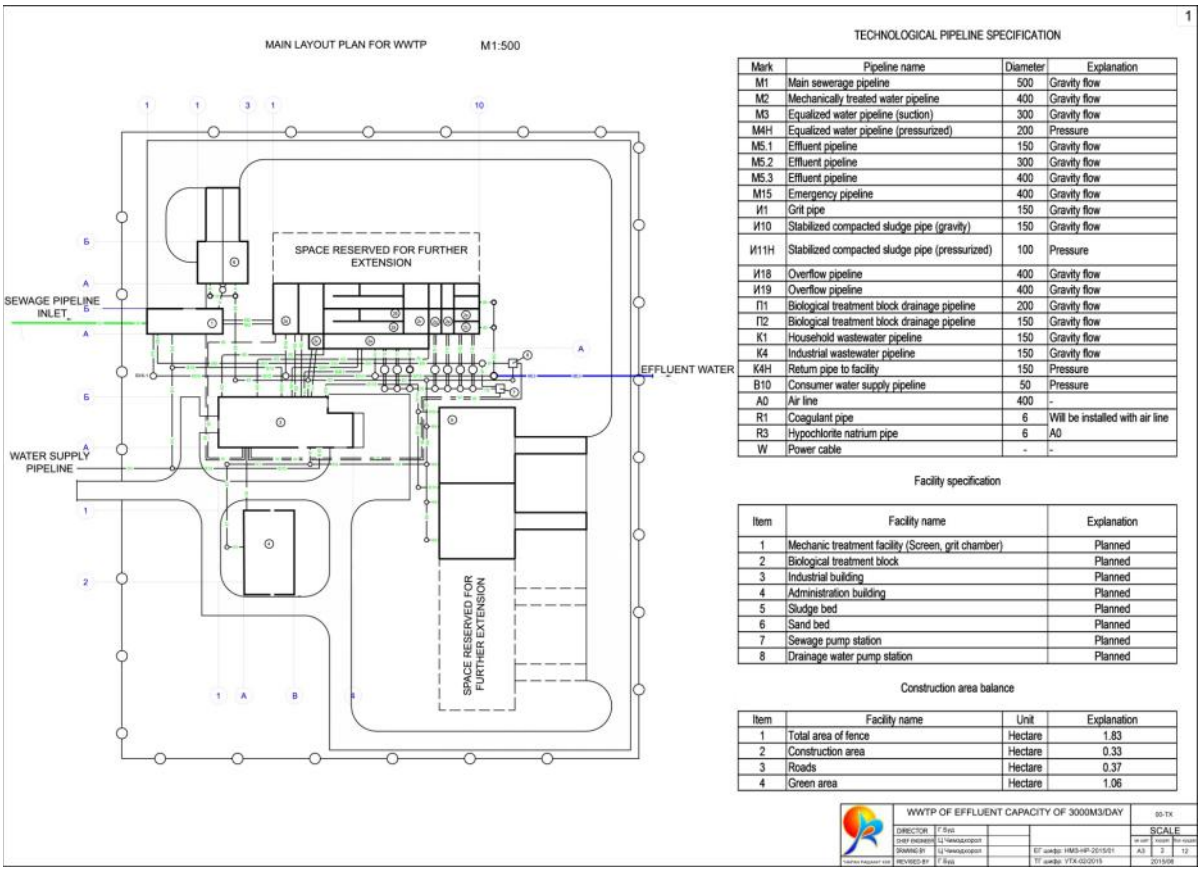
Table 5: Design Effluent Quality

No.	Indicators	Wastewater (mg/l)	Treated Water (mg/l)
1	Suspended solid	240	5
2	Biochemical Oxygen Demand BOD	180-220	10
3	Ammonium Nitrate	22.75	0.39
4	Phosphorus (as phosphate)	6	0.2

68. Bio-ponds will not discharge effluent for the majority of the year as they are frozen (Approximately October to April) and June to August inflow is less than evaporation and infiltration. During the spring thaw and under autumn heavy rainfall conditions the pond systems may discharge polished effluent either onto the unpopulated areas of steppe or into an existing dry channel. Effluent will not discharge directly into water courses. As a result, a permit for effluent discharge is not required and has not been required for the SGUBTD Project.

69. A typical IFAS WWTP layout is shown in Figure 4.

Figure 4: Typical Site Layout for IFAS WWTP



70. **Potential Sludge Reuse.** The dried sludge will be disposed of in the sub-project city landfill area. At this stage the sludge will be fully mineralized and will not contain active pathogens and will only be disposed of when it is dry enough to transport i.e. not effluent will be present. This is also the current situation so there will be no change in current sludge disposal practices.

71. Dried sludge production is in the order of 150 Kg per day rising to 500 Kg per day over the life of the facilities. It will be moved using covered vehicles in spring, summer and autumn using existing roads.

72. At the Detailed Engineering Design stage, the project team will available discuss sludge disposal techniques with landfill site operators and confirm that the appropriate approach is currently being used.

73. Due to the low level of industry the sludge is almost entirely domestic in nature and consequently has the potential for reuse as an organic fertilizer and soil conditioner. Efforts to stimulate the market for sludge reuse in this way, such as in municipal parks and nurseries, will be made by the PMU during project implementation.

74. **Use of chemicals**. The WWTPs will use coagulants, which will be determined by operators based on costs in local markets potential aluminum coagulants include aluminum sulfate, aluminum chloride and sodium aluminate; suitable iron coagulants include ferric sulfate, ferrous sulfate, ferric chloride and ferric chloride sulfate. Other chemicals used as

coagulants include hydrated lime and magnesium carbonate. These are salts which are routinely transported by trucks. Chlorine will also be used, likely in its sodium hypochlorite form.

11. Part A2: Septage Management

75. The project will provide vacuum trucks for septic tank and pit latrine evacuation and conveyance of septic sludge to the WWTP in each project aimag centre and construction of faecal sludge reception facilities at all WWTPs; this involves funneling sludge into the facility via a screen. Screenings are then treated as per the main WWTP facility. In the absence of ger area sealed pits, the trucks will service septic tanks in schools, hospitals and other public buildings.

76. The septic tanks and pit latrines to be served by the vacuum trucks are primarily in public buildings and some are in private residences. They are owned and maintained by the organization in which they are located or by the private householder. There are no issues/risks anticipated.

77. The vacuum truck scheduling and routing will be wholly managed by the PUSO and will be governed by their requirements.

12. Part B2: Institutional Reform and Capacity Development

78. The project will provide support, including training, to the project PUSOs to assist in improving the efficiency and effectiveness of the organizations and their ability to manage the wastewater treatment plants. This includes tariff affordability analysis, and subsidy mechanism established, new operational and financial management systems launched, Environmental monitoring to monitor effluent quality is regularized. Training provided on WWTP financial management, and O&M for implementing agency staff. Public awareness events on public health and environmental management are provided.

13. Parts B1, B3 and B4: Project Management Support

79. Specific management support for implementing and operating agencies, support to project PUSOs, and support for assigned PUSO staff. A full description of the scope of support is included in the Draft Final Report (2018) for this project. This includes advisory support and assistance in:

- SCADA development
- Electrical engineering and chemical engineering for operations and maintenance
- Microbiology matters including environmental monitoring both during construction and during the initial operation and maintenance of the plants (first 6 months).

14. Project Sites and Networks

80. The locations of each project including the new site and buffer zone, as required by the Government and the city's sewerage network are provided in Figure 5 to Figure 9. The cities of Murun, Bulgan and Chinggis will site the new WWTP within the boundary of the existing WWTP. For Mandalgovi and Baruun Urt, the new WWTP will be outside the existing site boundary.

Figure 5: Murun city, Khuvsgul *aimag* WWTP Site and Network

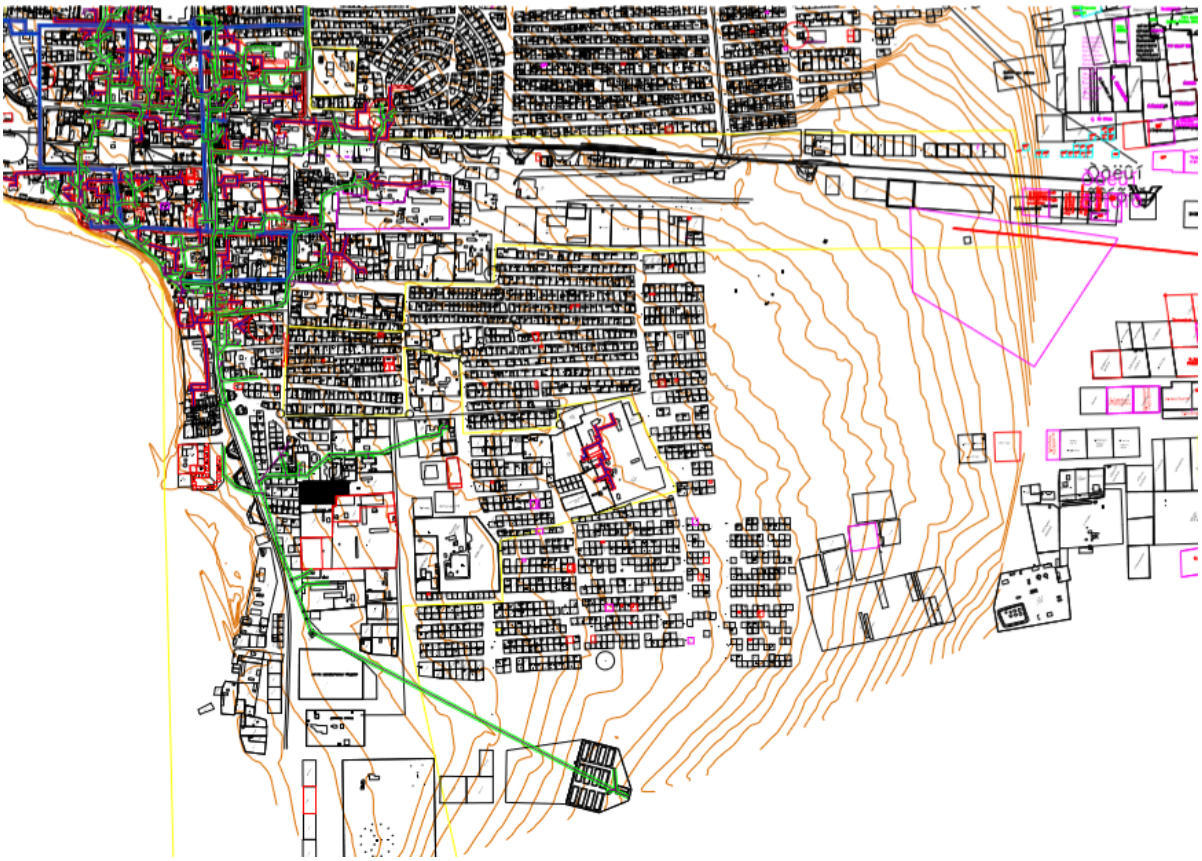


Figure 6: Baruun Urt city, Sukhbataar *aimag* WWTP Site and Network

New Site

Buffer Zone


ЦЭВЭРЛЭХ
БАЙГУУЛАМЖ

Figure 7: Bulgan city, Bulgan *aimag* WWTP Site and Network

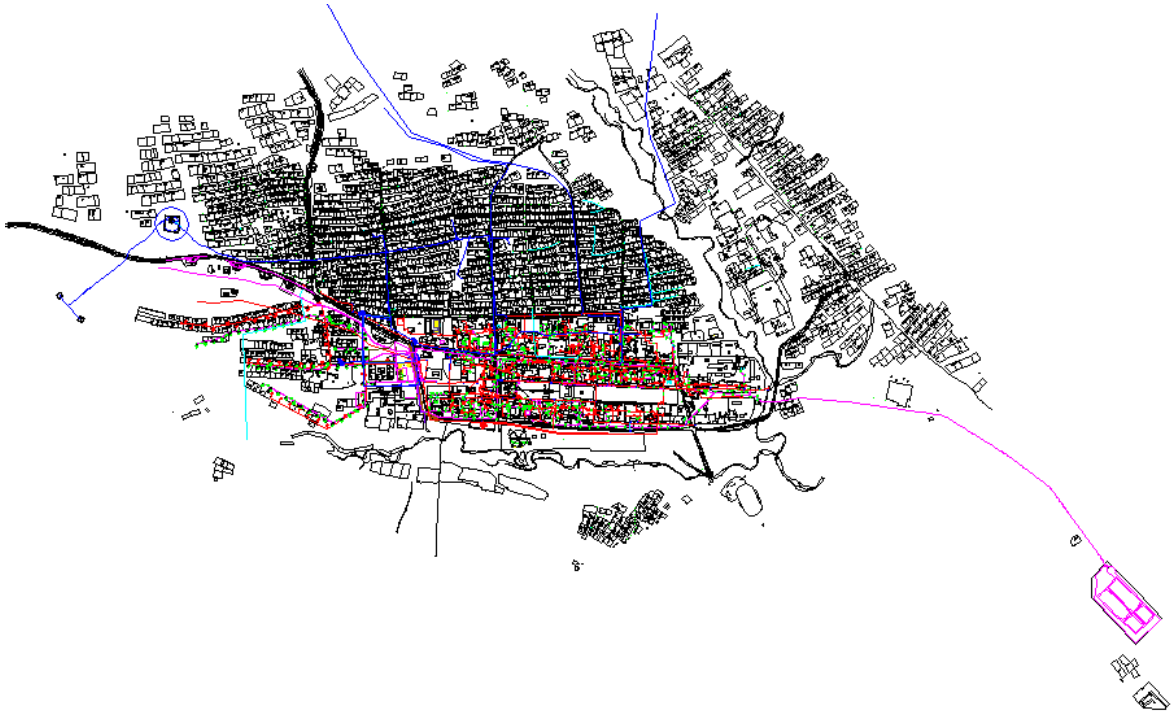


Figure 8: Chinggis city, Khentii *aimag* WWTP Site and Network

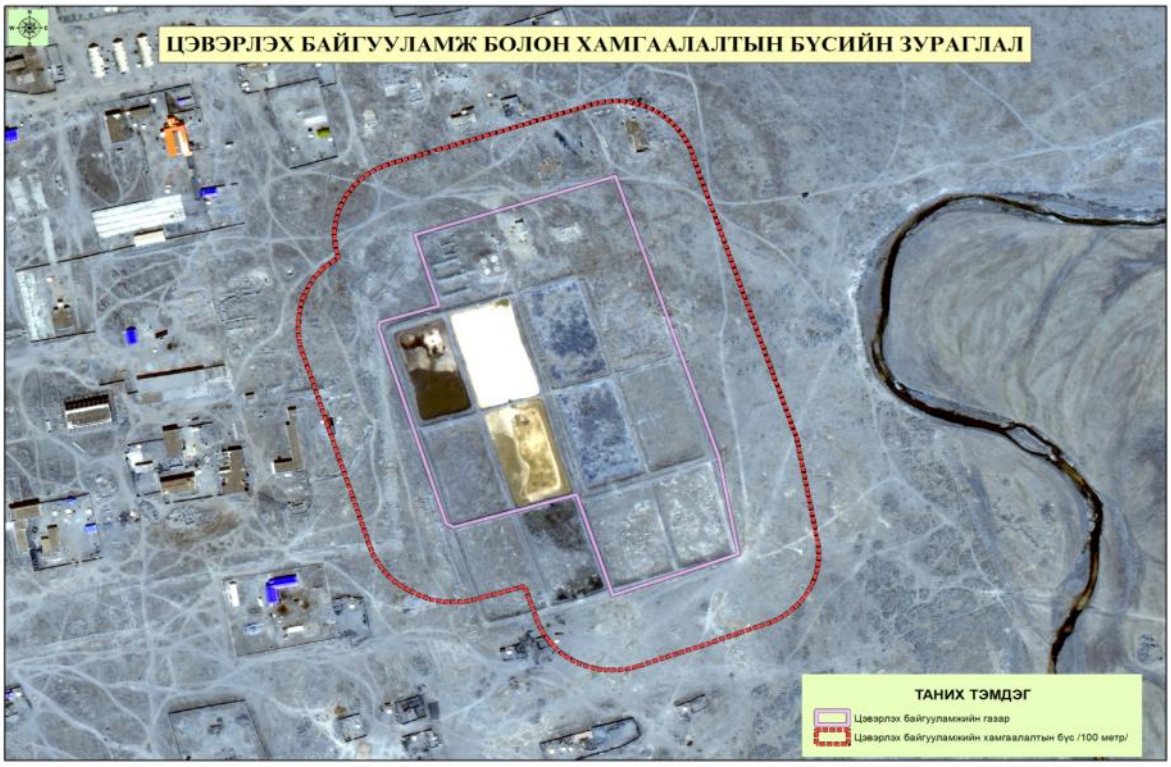


Figure 9: Mandalgovi City, Dundgovi *aimag* WWTP Site and Network


АРИУТГАХ·ТАТУУРГЫН·
ШУГАМ·СҮЛЖЭЭНИЙ·
ӨНӨӨГИЙН·БАЙДЛЫН·
СХЕМ·БАТӨЛӨВЛӨЖ·
БҮЙ·ЦЭВЭРЛЭХ·
БАЙГУУЛАМЖИЙН·
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81. **Fate of Existing Facilities.** The existing WWTP ponds in Murun, Bulgan and Chinggis will be integrated into the new WWTP, used for effluent polishing or as sludge drying beds. Ponds which are not used will be drained, if they contain water, via the WWTP facility, and returned to pasture or other appropriate uses. For Mandalgovi and Baruun Urt, the existing WWTPs will be decommissioned by allowing the ponds to evaporate then returning the area to pasture. The existing ponds are a shallow 1:3 gradient and area fenced so is not considered a risk to community safety. As set out in the EMP, the existing facilities will not be decommissioned until adequate testing of the new facilities has been completed, allowing a continual service to be provided. The PUSO is responsible for the management of the existing facilities that remain upon project completion.

82. **Construction Practices and Permafrost**. All construction is carried out in accordance with Mongolian construction standards and is specified in the contract documentation. Mongolian construction standards are based on Russian standards and make full provision for construction in permafrost areas.

IV. DESCRIPTION OF THE ENVIRONMENT

A. Project Area of Influence

83. All sub-project site options were visited for the preparation of this IEE, with particular attention paid to:

    (i) sensitive natural environmental receptors such as water bodies, biodiversity and wildlife habitats;
    (ii) sensitive human receptors;
    (iii) cultural and heritage sites; and
    (iv) potential health and safety issues.

84. According to SPS 2009, the area of influence encompasses:

    (i) **Primary project site(s) and related facilities**: These include the proposed new WWTP sites in the project cities; sewer lines between existing sewer system and the new WWTPs, ancillary facilities required as part of WWTP operations, borrow pits, disposal areas, and construction camps.
    (ii) **Associated facilities**: Associated facilities are not funded as part of the project but whose viability and existence depends exclusively on the project. No associated facilities are anticipated for this project
    (iii) **Existing Facilities**. SPS 20009 states that for projects involving facilities and/or business activities that already exist, the borrower/client will undertake an environment and/or social compliance audit, including on-site assessment, to identify past or present concerns related to impacts on the environment, involuntary resettlement, and Indigenous Peoples. Existing facilities are the five current WWTP sites.

85. Under SPS 2009, an environmental compliance audit is required on the existing facilities. The purpose is to understand the current conditions and potential risks from the existing WWTPs. A sample Environmental Compliance Audit is in Appendix 1 and where necessary Corrective Action shall be taken. There is no specified time for the Environmental Compliance Audit to be undertaken according to SPS 2009 and ADB's Operations Manual. Therefore for this project the EMP sets a requirement for the audit to be undertaken during the detailed engineering design phase.

86. Areas and communities potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later or at a different location: It is not anticipated that the WWTPs and related improvements will cause any unplanned developments.

87. The area of influence for the project also depends on the environmental media being considered. Local impacts with a narrow area of influence are those impacts arising from noise, dust and amenity issues. A larger area of influence results from impacts which contribute to global issues such as the embodied carbon associated with the manufacture, supply and use of concrete, and the carbon emissions associated with material transport. For the purposes of this IEE, the area of influence for amenity issues (noise and odor) is taken to be 300 m, based on noise levels, as follows:

    (i) WHO Community Noise Limits: One Hour LA_{eq} 55 dBA (Outside; residential

receptor, day time limit)

(ii) Construction Noise: Backhoe excavator 80 dBA at 15m and concrete mixer 79 dBA at 15 m. Source: Construction Noise Handbook (www.fhwa.dot.gov), US Department of Transport.

(iii) Noise attenuation factor: a conservative 6 dBA each time the distance from the point source is doubled. Source: US Occupational Safety and Health Administration (www.osha.gov/dts/osta/otm/new_noise/). Note that in soft vegetated environments such as at a vegetated river bank, the noise attenuation will be significantly increased meaning the area of influence could be narrowed. However this would not be the case where vegetation is removed.

(iv) Calculation: At 320 m noise at receptor is approximately 55 dBA.

88. Impacts on water quality for any effluent plume are dependent on a range of factors including receiving water body volume and flow rate, air and water temperature and strength of effluent. A definitive quantification of the distance over which any effluent plume will be mixed with the receiving water body requires modeling. However for this IEE, the area of influence for impacts on water will be limited given the WWTP design to meet effluent standards.

15. Greenhouse Gas Emissions

89. Under SPS 2009, a project is required to quantify greenhouse gas emissions associated with the project if the emissions exceed the threshold of 100,000 tons of carbon dioxide equivalent (CO_2e) per year, for all project sites. The United States Environmental Protection Agency (USEPA) has developed a methodology for calculating emissions from WWTP.[9] The methodology gives an example for a sludge treatment process and throughout which is comparable to the project WWTP. The example is a throughput of 4,000 m^3 per day for an activated sludge process. The methodology shows this facility would be responsible for 3,320 ton CO_2e. Therefore for the five project sites, the USEPA example indicates that the project would be under the 100,000 ton per year CO_2e.

16. Receptor Summary

90. Based on the following sections of this IEE describing the environmental baseline, the receptors are noted at the project sites as shown in Table 6:

Table 6: Receptor Summary

Project Site and GPS	Key Receptors	
Baruun Urt 46°39'27.38"N, 113°18'49.96"E	Housing Area	2.8 km North West
	Surface Water	Drainage channel existing site
	Cultural site	None present within 1 km
	Health / Education	Urban centre services 3 km North West
	Protected Area	None present within 1 km
	Flora/Fauna	Grassland at site

[9] USEPA (2010) Greenhouse Gas Emissions Estimation Methodologies for Biogenic Emissions from Selected Source Categories: Solid Waste Disposal / Wastewater Treatment / Ethanol Fermentation https://www3.epa.gov/ttnchie1/efpac/ghg/GHG_Biogenic_Report_draft_Dec1410.pdf

Project Site and GPS	Key Receptors	
Chinggis 47°19'33.94"N, 110°41'13.32"E	Housing Area Surface Water Cultural site Health / Education Protected Area Flora/Fauna	Single dwellings edge of buffer zone Kherlen River 500m to east and south None present within 1 km Urban centre services 1.7 km West None present within 1 km Grassland at site
Mandalgovi 45°43'52.16"N, 106°17'2.89"E	Housing Area Surface Water* Cultural site Health / Education Protected Area Flora/Fauna	3 km North Mandliin Nuur 7 km None present within 1 km Urban centre services 3 km North None present within 1 km Grassland at site
Bulgan 48°47'18.80"N, 103°33'38.29"E	Housing Area Surface Water Cultural site Health / Education Protected Area Flora/Fauna	1.5 km North West River to west, 0.5km None present within 1 km Urban centre services 3 km North None present within 1 km Grassland at site
Murun 49°36'49.39"N, 100°10'46.65"E	Housing Area Surface Water Cultural site Health / Education Protected Area Flora/Fauna	300m North Delgermurun River to west, 1.5km None present within 1 km Urban centre services 3 km North None present within 1 km Grassland at site
*Note channel shown in Figure 9 from existing WWTP is confirmed to be not an ephemeral stream but only contains effluent from the existing WWTP		

GPS = global positioning system, km = kilometer, m = meter.
Note: Channel shown in Figure 8 from existing WWTP is confirmed to be not an ephemeral stream but only contains effluent from the existing WWTP.

B. Geography, Topography and Geology

91. **Administration**. Administratively, Mongolia is divided into 21 *aimags* (provinces) and the capital city Ulaanbaatar. *Aimags* are divided into soums which are further divided into bags (sub-districts). The project cities are found in the following five *aimags*: Murun city, Khuvsgul *aimag*; Baruun Urt city, Sukhbataar *aimag*; Bulgan city, Bulgan *aimag*; Chinggis city, Khentii *aimag*; and Mandalgovi City, Dundgovi *aimag*.

92. **Location, Topography and Soil**. The project cities of Chinggis (Khentii aimag) and Baruun-Urt Sukhbaatar *aimag*) are located same in the eastern part of Mongolia, at elevations of 1000-1500 m above sea level. The territory of Khentii *aimag* belongs to middle and far eastern Khentii mountain region and the Sukhbaatar *aimag* belongs to Southern flat, grassland region of Mongolia and includes the steppe, grassland and dry steppe Natural zone.

93. Bulgan city (Bulgan *aimag*) and Murun city (Khuvsgul *aimag)* are located in the same Northern part of Mongolia, at elevations of 1260-1500 m above sea level, which belongs to semi-high mountainous region of the Orkhon and Selenge rivers' basin in the Khangai-Khentii mountainous region. The lowest point in this region is 750 m above sea level at the Selenge-murun river meadow

94. Mandalgobi city (Dundgovi *aimag*) is situated in the south of the country about 240 kilometers or 150 miles from capital city Ulaanbaatar. It consists largely of semi-arid steppe

and low hills.

95. During the preparation of the IEE, no site-specific data on soil were available for the project sites and soil analysis was not undertaken by the DEIA teams.

C. Climate and Meteorology

96. **Climate change** impacts on this project are considered to be low, as determined by ADB.[10] According to the estimation made by the National Institute of Meteorology of Mongolia, mean annual air temperature between 1991-2015 has increased by 1^0C comparing to that between 1961-1990. Table 7 shows the predicted temperature and precipitation forecasts under a range of greenhouse gas emission scenarios for which the Institutes combined the results from 10 climate models.

Table 7: Mongolian seasonal climate changes under different emission scenarios

Emissions scenario	Season	Short-Med term change 2016-2035		Long term change 2081-2100	
		Temperature ^{0}C	Precipitation %	Temperature ^{0}C	Precipitation %
RCP2.6	Winter	2.3	10.1	2.5	15.5
	Spring	2.3	9.2	2.4	11.7
	Summer	2.2	6.2	2.5	5.1
	Autumn	2.1	7.6	2.4	7.6
RCP4.5	Winter	2.1	12.3	3.7	28.7
	Spring	2.0	7.8	3.4	17.4
	Summer	2.1	1.1	3.5	7.8
	Autumn	2.0	8.1	3.4	11.7
RCP8.5	Winter	2.2	14.0	6.3	50.2
	Spring	2.2	9.8	5.6	28.6
	Summer	2.2	2.4	6.0	8.7
	Autumn	2.2	6.4	6.1	24.1

Source: Mongolia 2nd National Communication under the United Nations Framework Convention Climate Change (UNFCCC).

97. **Temperature and precipitation**. Mongolia has an extreme continental climate with marked differences in seasonal and diurnal temperatures and low precipitation. Precipitation is highest in the north, including Murun (average of 200 to 350 mm per year) and lowest in the south, which receives 100 to 200 mm annually. In project sites, 95-97% of precipitation falls during the warm season, including 75-80% in the summer. In winter, the precipitation ranges from 1 to 3 mm, whereas in July it ranges from 100 to 120 mm. At an average, it rains 40-70 days a year, snow falls on 25-30 days, and land is covered with snow for 140-170 days. The country averages 257 cloudless days a year, and it is usually at the center

[10] ADB (April 2016). Report and Recommendation of the President to the Board of Directors. Proposed Loan for Additional Financing and Administration of Technical Assistance Grant Mongolia: Southeast Gobi Urban and Border Town Development Project. Manila.

of a region of high atmospheric pressure.

98. Chinggis and Baruun-Urt experience a cold semi-arid climate with long, very dry, very cold winters and short, very warm summers.

99. Murun city is located in the Delgermurun river valley and Bulgan city is in the basin of Orkhon river. Bulgan and Khuvsgul aimags have a subarctic climate with long, dry, very cold winters and short, cool summers.

100. Mandalgovi has a cold semi-arid climate bordering on a cold desert climate with warm summers and very cold winters. Most precipitation falls in the summer as rain and winters are very dry. Temperatures in the summer may top 32°C or 90°F, while winter temperatures may dip below −30 C or −22 F and precipitation is low.

101. Table 8 to Table 11 to show key meteorological data for the project sites.

Table 8: Average air temperature and precipitation of Baruun-Urt city.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Average high °C (°F)	−16.3 (2.7)	−12.0 (10.4)	−1.2 (29.8)	10.7 (51.3)	19.2 (66.6)	24.5 (76.1)	26.2 (79.2)	24.4 (75.9)	17.9 (64.2)	9.2 (48.6)	−4.1 (24.6)	−13.4 (7.9)	7.09 (44.78)
Daily mean °C (°F)	−21.5 (−6.7)	−18.1 (−0.6)	−8.2 (17.2)	3.0 (37.4)	11.4 (52.5)	17.6 (63.7)	20.0 (68)	18.0 (64.4)	10.8 (51.4)	1.7 (35.1)	−10.3 (13.5)	−18.8 (−1.8)	0.47 (32.84)
Average low °C (°F)	−26.2 (−15.2)	−23.2 (−9.8)	−14.5 (5.9)	−4.0 (24.8)	3.9 (39)	11.2 (52.2)	14.0 (57.2)	12.0 (53.6)	4.5 (40.1)	−4.2 (24.4)	−15.5 (4.1)	−23.2 (−9.8)	−5.43 (22.21)
Average precipitation mm (inches)	1.8 (0.071)	1.5 (0.059)	2.6 (0.102)	6.7 (0.264)	13.1 (0.516)	35.3 (1.39)	61.2 (2.409)	50.6 (1.992)	21.2 (0.835)	5.9 (0.232)	2.7 (0.106)	1.8 (0.071)	204.4 (8.047)
Average precipitation days (≥ 1.0 mm)	0.7	0.5	0.6	1.5	2.3	6.8	8.1	7.5	3.5	1.5	0.7	0.6	34.3

Source: NOAA, Baruun-Urt city climate normal (1961-2000)

Table 9: Average air temperature and precipitation of Chinggis city.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Average high °C (°F)	−15.0 (5)	−10.4 (13.3)	0.2 (32.4)	10.8 (51.4)	19.2 (66.6)	24.0 (75.2)	25.4 (77.7)	23.5 (74.3)	17.7 (63.9)	9.3 (48.7)	−3.9 (25)	−12.6 (9.3)	7.35 (45.23)
Daily mean °C (°F)	−22.4 (−8.3)	−19.2 (−2.6)	−8.9 (16)	2.3 (36.1)	10.6 (51.1)	16.4 (61.5)	18.5 (65.3)	16.5 (61.7)	9.4 (48.9)	0.6 (33.1)	−11.6 (11.1)	−19.8 (−3.6)	−0.63 (30.86)
Average low °C (°F)	−27.9 (−18.2)	−26.9 (−16.4)	−16.6 (2.1)	−5.8 (21.6)	2.2 (36)	9.2 (48.6)	12.0 (53.6)	10.1 (50.2)	2.8 (37)	−5.9 (21.4)	−17.7 (0.1)	−25.4 (−13.7)	−7.49 (18.53)
Average precipitation mm (inches)	1.2 (0.047)	2.6 (0.102)	2.5 (0.098)	7.9 (0.311)	15.0 (0.591)	42.2 (1.661)	65.4 (2.575)	49.4 (1.945)	23.4 (0.921)	8.2 (0.323)	3.3 (0.13)	2.4 (0.094)	223.5 (8.798)
Average precipitation days (≥ 1.0 mm)	0.5	0.4	0.8	1.7	2.7	6.3	10.1	8.5	4.1	2.3	1.1	0.9	39.4

Source: NOAA, Chinggis city climate normal (1961-2000)

Table 10: Average air temperature and precipitation of Bulgan city.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Average high °C (°F)	−12.4 (9.7)	−9.2 (15.4)	0.7 (33.3)	9.7 (49.5)	18.0 (64.4)	22.1 (71.8)	22.7 (72.9)	21.1 (70)	16.1 (61)	8.3 (46.9)	−2.7 (27.1)	−10.4 (13.3)	7 (44.61)
Daily mean °C (°F)	−20.5 (−4.9)	−18.1 (−0.6)	−8.5 (16.7)	1.0 (33.8)	9.1 (48.4)	14.2 (57.6)	15.9 (60.6)	13.9 (57)	7.2 (45)	−0.8 (30.6)	−10.8 (12.6)	−17.8 (0)	−1.27 (29.73)
Average low °C (°F)	−26.5 (−15.7)	−24.9 (−12.8)	−16.2 (2.8)	−6.6 (20.1)	0.1 (32.2)	6.0 (42.8)	9.5 (49.1)	7.2 (45)	0.3 (32.5)	−7.6 (18.3)	−17.4 (0.7)	−23.8 (−10.8)	−8.32 (17.02)
Average precipitation mm (inches)	1.4 (0.055)	2.0 (0.079)	3.1 (0.122)	10.9 (0.429)	22.7 (0.894)	52.6 (2.071)	71.3 (2.807)	63.8 (2.512)	32.5 (1.28)	12.4 (0.488)	3.8 (0.15)	1.9 (0.075)	278.4 (10.96 2)
Average precipitation days (≥ 1.0 mm)	0.4	0.5	1.3	3.0	4.0	8.4	12.9	10.4	4.9	2.9	1.3	0.7	50.7

Source: NOAA, Bulgan city climate normal (1961-2000)

Table 11: Average air temperature and precipitation of Murun city.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Average high °C (°F)	−14.5 (5.9)	−9.3 (15.3)	0.8 (33.4)	9.9 (49.8)	18.2 (64.8)	22.9 (73.2)	23.4 (74.1)	21.9 (71.4)	16.7 (62.1)	7.6 (45.7)	−3.7 (25.3)	−12.1 (10.2)	6.82 (44.27)
Daily mean °C (°F)	−22.7 (−8.9)	−18.3 (−0.9)	−8.0 (17.6)	1.4 (34.5)	9.7 (49.5)	15.2 (59.4)	16.2 (61.2)	14.4 (57.9)	7.9 (46.2)	−0.7 (30.7)	−11.4 (11.5)	−19.8 (−3.6)	−1.34 (29.59)
Average low °C (°F)	−28.8 (−19.8)	−25.8 (−14.4)	−15.9 (3.4)	−6.4 (20.5)	1.2 (34.2)	7.5 (45.5)	10.1 (50.2)	7.6 (45.7)	0.4 (32.7)	−8.0 (17.6)	−18.0 (−0.4)	−25.6 (−14.1)	−8.47 (16.76)
Average precipitation mm (inches)	1.3 (0.051)	1.0 (0.039)	0.8 (0.031)	7.0 (0.276)	15.3 (0.602)	42.6 (1.677)	59.6 (2.346)	54.1 (2.13)	17.5 (0.689)	5.3 (0.209)	1.9 (0.075)	1.4 (0.055)	207.8 (8.18)
Average precipitation days (≥ 1.0 mm)	0.5	0.5	0.5	1.4	2.9	6.8	10.2	8.0	3.7	1.3	0.3	0.4	36.5
Mean monthly sunshine hours	168.4	199.0	252.6	250.0	294.5	291.5	274.3	274.1	249.0	224.9	168.1	154.5	2,800.9

Source: NOAA, Murun city climate normal (1961-2000)

Table 12: Average air temperature and precipitation of Mandalgobi city.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Average high °C (°F)	−11.3 (11.7)	−7.4 (18.7)	0.8 (33.4)	10.9 (51.6)	19.4 (66.9)	24.1 (75.4)	25.5 (77.9)	23.8 (74.8)	17.9 (64.2)	9.5 (49.1)	−2.0 (28.4)	−9.0 (15.8)	8.52 (47.33)
Daily mean °C (°F)	−17.5 (0.5)	−14.7 (5.5)	−6.6 (20.1)	2.6 (36.7)	11.2 (52.2)	16.7 (62.1)	18.7 (65.7)	17.0 (62.6)	10.2 (50.4)	1.7 (35.1)	−8.7 (16.3)	−15.8 (3.6)	1.23 (34.23)
Average low °C (°F)	−23.3 (−9.9)	−20.7 (−5.3)	−13.0 (8.6)	−4.2 (24.4)	3.9 (39)	10.0 (50)	13.2 (55.8)	11.3 (52.3)	4.7 (40.5)	−4.1 (24.6)	−14.9 (5.2)	−21.4 (−6.5)	−4.88 (23.23)

Average precipitation mm (inches)	4.0 (0.157)	1.4 (0.055)	1.8 (0.071)	3.3 (0.13)	10.5 (0.413)	24.6 (0.969)	39.8 (1.567)	43.0 (1.693)	15.8 (0.622)	4.8 (0.189)	2.1 (0.083)	1.1 (0.043)	152.2 (5.992)
Average precipitation days **(≥ 1.0 mm)**	0.1	0.5	0.5	0.9	1.6	3.5	6.7	6.0	2.1	0.8	0.6	0.4	23.7

Source: NOAA, Mandalgobi city climate normal (1961-2000)

102. **Wind**. The dry environment exacerbates the frequent dust storms occurring in Mongolia each year. The wind erosion depends on the climatic factors, soil properties, landscape characteristics and availability of vegetation. In the project sites, wind blows mostly from the north and northwest and average wind velocities are usually lower than in other parts of Mongolia. Monthly wind velocities average 1.6 – 4.4 m/s, with an average of 7 to 9 days per year where wind velocities exceed 10 m/s. The highest wind velocities reach 10-25 m\sec in April and October.

103. **Permafrost**. Mongolia belongs to the South Transition Zone in terms of global permafrost zonation. The zone is characterized by relatively thin permafrost layers and scattered permafrost distribution. Mongolia is further divided into four permafrost sub-zones:

(i) Subzone 1. continuous and non-continuous subzone
(ii) Subzone 2. scattered distribution
(iii) Subzone 3. rare occurrence
(iv) Subzone 4. seasonal frost.

104. The key features of the four subzones are shown in Table 13 and Figure 10 shows the permafrost zonation in Mongolia. In terms of the project cities this means:

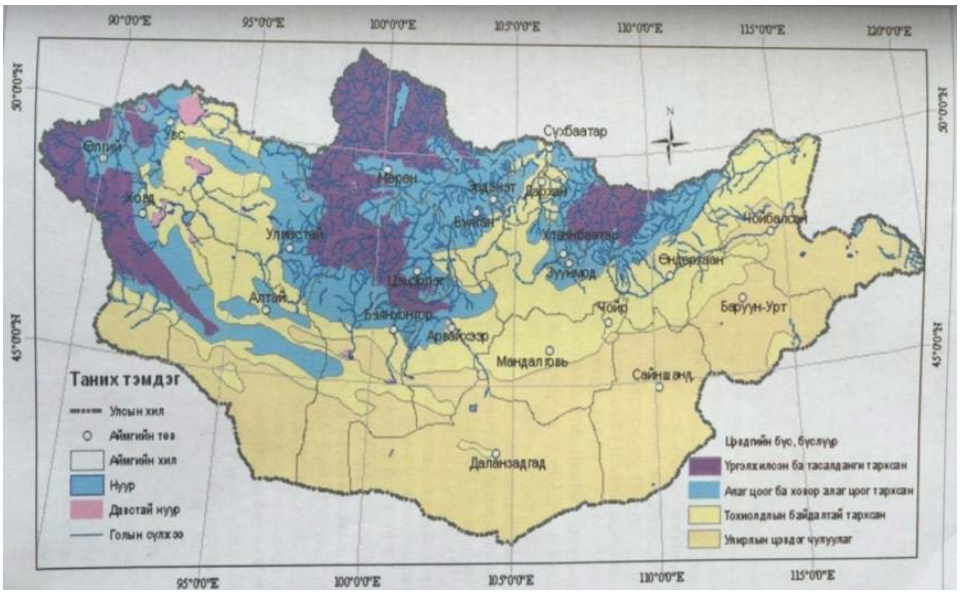
(i) Murun city, Khuvsgul aimag and Bulgan city, Bulgan aimag are in sub-zone 2, meaning there is scattered distribution of permafrost, which will be dependent on local conditions.
(ii) Chinggis city, Khentii aimag and Mandalgovi City, Dundgovi aimag are in sub-zone 3, indicating that permafrost is a rare occurrence in the area.
(iii) Baruun Urt city, Sukhbataar aimag is in sub-zone four, subject only to a seasonal frost.

Table 13: Permafrost Sub-zones in Mongolia

Subzone number	Elevation of distribution area, m	% of the subzone area compared to territory of Mongolia	Average thickness of the permafrost layers, m	
			At depressions and low lands	At water basins
1	1200-2800	11.2	20	500-1000
2	700-2600	11.4	5-50	5-20
3	600-1900	29.4	5-10	-
4	600-1800	37.0	-	-

Source: G. Davaa, Surface Water Resource and regime in Mongolia, Admon Printing 2015.

Figure 10: Permafrost Zonation in Mongolia



Source: G. Davaa, Surface Water Resource and regime in Mongolia, Admon Printing 2015.

D. Hydrology, Surface water and Ground water

105. **General Hydrological Baseline.** Mongolia straddles a major continental watershed aligned east-west across the country. North of the divide, drainage is to the Arctic Ocean via the Lena River and Lake Baikal, and to the Pacific Ocean via the Amur and Yenisei rivers. South of the divide drainage terminates in dry lakes and saltpans with no outlet to the sea.

106. The potential water resources of the country are estimated to be about 36.4 km^3. Of this, the surface water resources are 22.0 km^3 and the usable groundwater resources are 12.6 km^3. About 78% of the river run-off is formed on 36% of the territory in northern, western, and north-eastern mountainous areas and 22% is formed on 64% of the territory in the south of the country. On an average, the annual amount of water resources per capita is 17,300 m^3. However, it ranges from 4,500 m^3 per capita in the Gobi area to 46,000 m^3 per capita in northern and central areas.

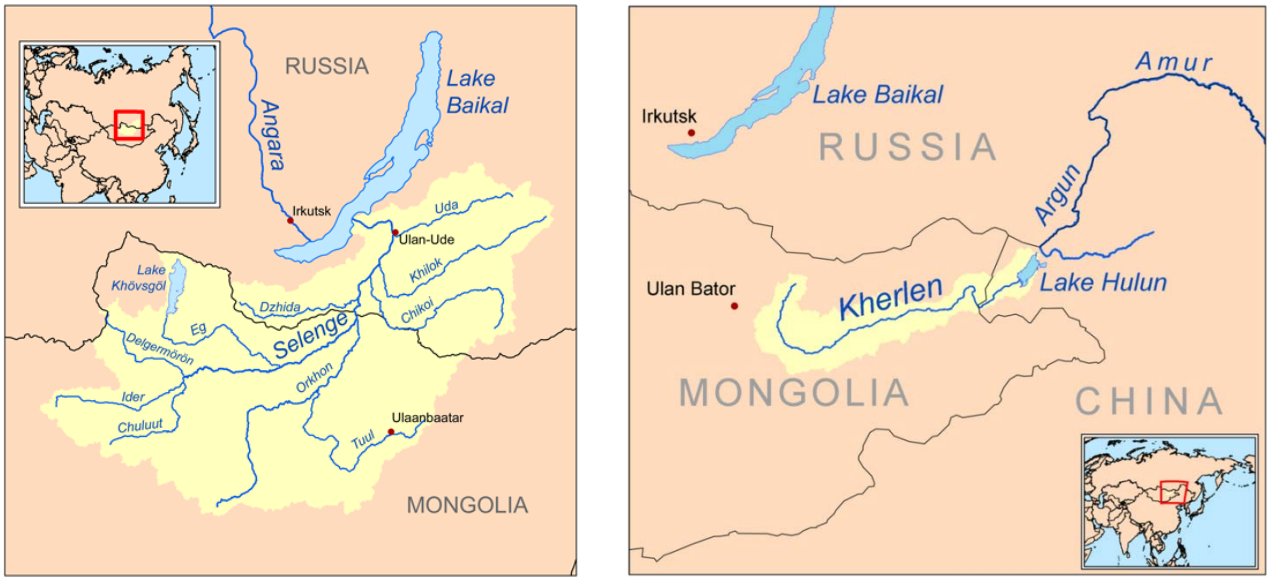
107. **Surface water**. The project sites are located in the Orkhon, Delgermurun and Kherlen rivers' basins. The Orkhon river flows along the eastern side of Bulgan city within 20 km. Orkhon river is the largest tributary of Selenge River, which originates 1124 km from the Khangai Mountains with water catchment area of 132,835 km^2, which is 47% of the area for water catchment of Selenge river. The upstream of the Orkhon river starts from the Khangai Nuruu National Park. The Orkhon river freezes in November and stays frozen about 130 days during the year. The average depth is 3.5 m and the flow velocity reaches 2.5 m/s.

108. The Delgermurun river in Khuvsgul aimag in northern Mongolia, together with the Ider river, it is one of the main sources of the Selenge river. It runs 1.5km west of the Murun city site. The upstream of Delgermurun river is in the Ulaan Taiga mountain range located near the Mongolian Russian border. The Delgermurun river is frozen 128–175 days per year. It is 445 km long and is the largest river in the Selenge river system. The Delgermurun river is 25-40 m wide in the upstream part, and 50-100 m wide in the lower reaches with an average 0.5-2.5 m depth and flow velocity is 0.2-2 m/s. The largest tributary rivers of the Delgermurun river are Taris river (75 km), Beltes river (92 km), and the Bugsei river (110 km).

109. In Chinggis city, the Kherlen River (500 m from project site) is 1,254 km long river and drains an area of 116,400 square km. The river has its origin in the south slopes of the Khenti mountains, near the Burkhan Khaldun mountain in the Khan Khentii Strictly Protected Area, about 180 km northeast of Ulaanbaatar city. This area is the watershed between the arctic (Tuul river) and pacific (Kherlen, Onon rivers) basins and named Three river basins. The Kherlen river flows in a mostly eastern direction through the Khentii aimag. It also crosses the eastern Mongolian steppe past Ulaan Ereg and Choibalsan, entering China at $48^0$3' N $115^0$36'E, emptying into Hulun nuur lake after 164 km.

110. The principal recharge mechanism for these rivers is the rainwater in summer and autumn therefore, water levels fluctuate considerably.

Figure 11: Orkhon, Delgermurun and Kherlen river basins



Source: Institute of Hydro Meteorology and Environment Monitoring, Mongolia

111. **Ground Water**. Groundwater exists in unconfined aquifers (alluvial sediments of late quaternary to recent period) at depths between 4 - 30 m. The static water level in the river valleys is from 2-6 m in winter and 0.5 - 5 m in summer, if there are no wells in operation. Extraction of groundwater can cause the static water level to drop from 10 - 13 m in winter and from 15 - 19 m in summer.

112. The total groundwater resource (A and B category)[11] in Kherlen River basin is 10,410m / day or 120.5 l/s in the Khentii aimag, which B category resource is calculated as 5180 m^3/day or 60.0 l/sec and A category resource is calculated as 5230 m^3/day or 60.5 l/s. The aquifer thickness is 40-50 m, the yield is 4.0-9.4 l/sec.

113. In the Kherlen River valley, renewable groundwater resources range from 20 to 200 mm per year. The rechargeable groundwater resources in the surrounding area of Chinggis city estimated at 160 millimeters per year.

114. The total groundwater resource (Category A and B) in the surrounding area of Bulgan city is calculated as 4907.52 cubic meters per day (m^3/day) or 52.0 litres per second (l/sec). The aquifer average thickness of this area is 24 m, the yield is 3.0-6.5 l/sec; the water level can drop 2.6 - 5.5 m in summer due to extraction.

115. The total groundwater resource in basin of Delgermurun river (23,017 km^2) is calculated as 435 million m^3 and the resource available for extraction is 229 million m^3 with the yield of

[11] According to the "Guideline for defining types and category of underground water resource" approved by the order # A 28 dated in January 2012 by Minister of Environment and Green development of Mongolia, the ground water resource divided in 2 types such as i) exploitation resource and ii) hypothetical resource. The exploitation resources have 3 categories : Category A- is reliable resource, category B is substantial resource, category C is potential resource. Hypothetical resource is category "P"

7.0-15.0 l/sec; the water level can drop 3.5 - 5.6 m in summer due to extraction.

E. Air Quality

116. The National Agency for Meteorology, Hydrology and Environmental Monitoring (NAMEM) is responsible for environmental monitoring of water, air, acid deposition, soil, environmental radiation, dust-deposition and sulfur gases to control the environmental quality. The laboratories in main cities make permanent measurements on air, water, soil quality and radiation. Air quality is routinely measured in Mongolia by air quality monitoring stations in major cities including Ulaanbaatar, Darkhan and Erdenet.

117. Table 14 shows the results for air quality monitoring or spot sampling measurement of sulfur dioxide and nitrogen dioxide at locations within the project areas. It can be shown that the Mongolian national standard and WHO standard was breached consistently for Baruun-Urt and in Bulgan city from 2017. Note no information is known about the exact locations of the sampling points and the conditions in which the samples were taken.

Table 14: Spot sampling measurement of sulfur dioxide and nitrogen dioxide 2014-2017.

Name of monitoring point	Date of sampling	Time of sampling	SO2 mg/m3	NO2 mg/m3
Murun city of Khuvsgul *Aimag*	2016.12.26	2144-2204	24	64
	2017.01.27	2020-2040	27	71
Mandalgobi city of Dundgobi *Aimag*	2015	average	7	13
	2016	average	7	12
	2017	average	7	16
Bulgan city of Bulgan *Aimag*	2016	average	10	17
	2017.02.03	1030-1100	102	151
Baruun-Urt city of Sukhbaatar *Aimag*	2015	January	118	62
	2016	January	124	75
	2017	January	98	78
Standard MNS4585:2016			50	50
WHO Ambient Air Quality Guidelines reflected in World Bank guideline of EHS			50	40

Source: Monitoring result of Environmental Monitoring Laboratories of Department of Hydrology, Meteorology and Environmental Monitoring in Baynkhongor, Bulgan, Dornod, Gobisumber, and Orkhon *aimags*, 2016.

F. Noise

118. Noise can affect sensitive receptors, primarily humans in the context of the project sites. Noise may also impact on animals and birds. Mongolian standards on noise are presented in Appendix 2. Given the rural nature of the project sites, outside the urban core, no consistent noise monitoring data was available to inform this study. However, given observations around the WWTP locations, no major noise emitting activities were observed as there is no significant manufacturing, industry or mining close to the sites.

G. Natural Disasters

119. Mongolia is vulnerable to a wide variety of natural hazards,[12] including floods, droughts, earthquakes, storms, and other extreme weather events. Additionally, Mongolia experiences dzuds, which occur when extreme winter conditions, particularity heavy snow cover, prevent livestock from accessing pasture or receiving adequate hay and fodder, who have already been weakened by summer drought. In 2010, Mongolia was hit by a severe "dzud," in which nearly 25% (9.7 million) of the country's livestock died. Floods and earthquakes are the natural disasters of potential relevance to the project and thus further discussed below.

120. **Flooding**. Localized flooding can be caused in most areas of the country, especially in built-up areas through heavy rain events because of poor surface water drainage. This flooding is ephemeral and the water subsides rapidly. More than 75% of precipitation in the project sites occurs in July and August. Serious floods, mainly caused by the Delgermurun river, occurred in 1915, 1939, 1959, 1966, 1967, 1971, 1973, 1982 and 2003. In 1966, the Tuul water level reached 3.2 meters with a flow of 1500-1800 cubic meters per second and the flood killed over 100 people.

121. Flooding is not a risk to project sites. In Chinggis city and Murun city, where proximity to rivers means that the plants are elevated above historic flood levels; neither the Chinggis or Murun plants have ever flooded and the other sites are not at risk of flooding. Also, the climatic conditions (low levels of precipitation) and a freeboard of 0.5-1m in all ponds and sludge beds mean flood risks are very low for the sites.

122. **Earthquakes**. Mongolia has experienced four major earthquakes (MSK>8[13]) and many more moderate earthquakes (MSK 5.3-7.5) in the last century. The seismic activity in Mongolia is related to its location between the compressive structures associated with the collision of the Indian-Australian plate with the Eurasian plate and the extensional structure associated with the Baykal rift system. The multi-organizational Global Seismic Hazard Assessment Program classifies the project aimags as "low" to "moderate" earthquake risk areas.

H. Physical Cultural Resources

123. In all project sites the proximity to any physical cultural receptors were noted by the PPTA. The results showed that there are no observed physical cultural resources at the project sites. Where these resources are present, they are within the urban centers, such as temples or monuments. The project sites are primarily approximately 3 km from the urban centers, with Chinggis city being the closest at approximately 1.7 km.

124. The list of important heritage, cultural and religious sites of Mongolia and its provinces was revised most recently in 2008 by the Centre for Cultural Heritages of Mongolia. In this list,

[12] https://www.gfdrr.org/mongolia
[13] The Medvedev–Sponheuer–Karnik scale, also known as the MSK or MSK-64, is a macroseismic intensity scale used to evaluate the severity of ground shaking on the basis of observed effects in an area of the earthquake occurrence

total of 460 objects were registered and out of them 175 have to be under State protection and 285 have to be under provincial protection. There are no heritage, cultural and religious sites in or close to the project sites.

125. Mongolia is rich in archaeology and the presence of tombs cannot be ruled out in the sites of Chinggis city and Mandalgovi, where the project sites are not directly within the existing site boundary, particularly given the tombs are not easily identifiable with any snow cover on the ground; the DEIA took place in winter. An example tomb is shown in 180 km from Mandalgovi near Choir city of the Govisümber aimag (46°29'44.68"N, 108°20'45.68"E). This will be re-confirmed at the detailed design stage.

Figure 12: Example tomb

Source: PPTA Team for ADB Eastern Regional Road Project (2017)

I. Ecological Resources

126. Based on information contained within the DEIAs available for the project sites, the ecological resources of the potentially impacted environment i.e. flora, fauna, and specially protected areas are limited. The sub-project sites are in areas which have very little vegetation or exposed ground, therefore limiting the habitats for fauna. However, there are a limited number of bird species observable in the Bulgan, Baruun-Urt, Mandalgobi, Chinggis and Murun cities, such as crows and sparrows, common to many urban environments.

127. The project will not encroach on legally protected sites; the closest protected area is the Undurkhan Mountain Nature Reserve 15 km from the Chinggis city. This park is outside the city and not within the project's area of influence. There are no rare, threatened, or endangered species within the construction boundaries of the sub-projects.

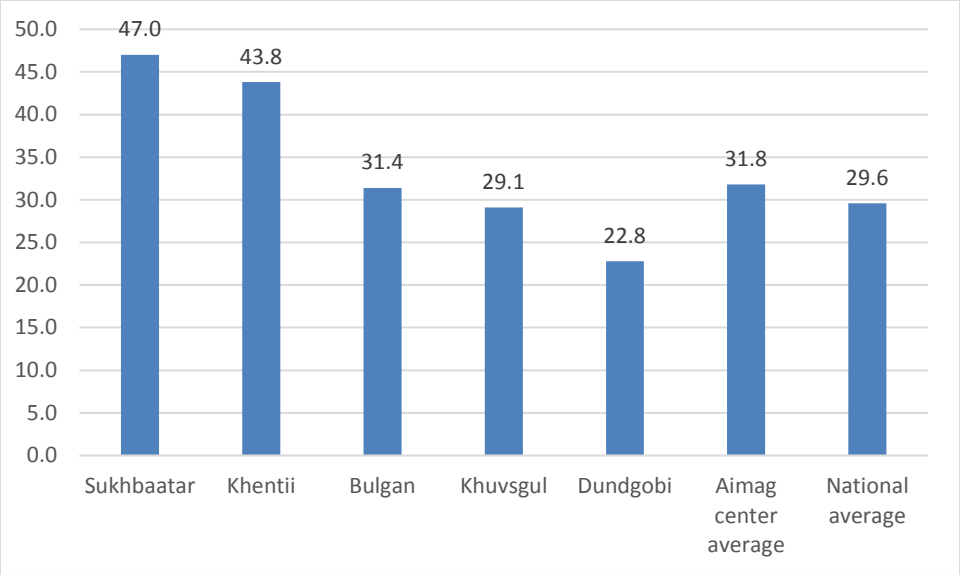
128. The Integrated Biodiversity Assessment Tool (IBAT) was used to identify biodiversity features and species which are located within 1 km, 5 km and 10 km from the project sites. The IBAT found no Protected Areas or Key Biodiversity Areas within 10 km of the sites. The IBAT suggests that given the type of habitat, a number of IUCN Vulnerable and Endangered species are **potentially** found close to the area of interest. This includes mammals and birds such as *Moschus moschiferus* (Siberian Musk Deer), *Rangifer tarandus* (Reindeer), *Otis tarda* (Great Bustard) and *Numenius madagascariensis* (Far Eastern Curlew).

129. Given the highly disturbed nature of the sites i.e. they are existing wastewater treatment sites, it is not anticipated that these species are present within the sites themselves but may be present within the wider area of influence.

J. Socio-Economic Conditions

130. **Poverty**. The national average poverty headcount was 29.6% in 2016, and the poverty level was much higher in rural areas (34.9%) than in the urban (27.1%). The project aimags, with an aggregate urban population of about 111,540 represent examples of rapidly growing second tier cities and together make up some 5.4% of national urban population as for end of 2017. In 2016, among the five aimags Sukhbaatar (47.0%), Khentii (43.8%) and Bulgan (31.4%) experienced higher poverty than the aimags of Khuvsgul (29.1%) and Dundgobi (22.8%) compared to national average poverty headcount, as shown in Figure 13.

Figure 13: Poverty headcounts, by selected *aimags*, as of 2016



Source: National Statistical Office of Mongolia

131. **Employment**: The national average unemployment rate was 10.0% in 2016, and the unemployment was higher for men (11.6%) than women (8.2%). In 2016, among the five aimags, Khentii aimag (12.9%) experienced higher unemployment rate than the aimags of Dundgobi (5.1%), Bulgan (8.2%), Khuvsgul (8.5%) and Sukhbaatar (9.9%) and compared to national average unemployment rate. As at end of 2017, there were 3,436 unemployed people within the project cities actively seeking job and registered with labor divisions and the labor exchange office. The majority of employed people are working in the public sector, including schools, kindergartens, hospitals and local government organizations.

132. **Health**. Incidence rate of selected infectious and parasitic diseases per 10,000 population in the national level was 336.3 in 2016. Aimags of Sukhbaatar (354.4) and Khentii (319.5) experienced higher incidence rate than the aimag average (293.5) and the aimags of Bulgan (192.5), Dundgobi (212.8) and Khuvsgul (286.9) had a lower incidence rate.

133. **Public Infrastructure and Environment.** The household socio-economic survey identified the social infrastructure and environmental concerns of the project communities. As shown in Table 15.

134. The majority of Baruun-Urt city's citizens consider poor quality of water supply (75% of

respondents) the most significant social infrastructure issue. In Mandalgobi city (Saintsagaan soum), poor quality of water supply was also the top issue for most residents (70%).

135. Chinggis city (Kherlen soum) citizens named issues of air pollution (76%) as the most challenging issue, and this was also the most significant issue in Bulgan city (48%) and Murun (65%).

Table 15: Social infrastructure and environmental issues - percentage citizens encountering the issue

Social infrastructure and environment issues / Soum	Baruun-Urt	Kherlen (Chinggis City)	Saintsagaan (Mandalgobi city)	Bulgan	Murun	Total
Poor quality of water supply	74.7%	38.0%	70.0%	28.0%	41.3%	50.4%
Poor sanitation situation	44.7%	36.7%	54.7%	36.0%	20.7%	38.5%
Air pollution	56.0%	76.0%	61.3%	48.0%	64.7%	61.2%
Soil pollution and erosion	38.7%	60.7%	38.0%	44.7%	40.7%	44.5%
Not enough lighting	39.3%	39.3%	45.3%	42.7%	44.0%	42.1%
No sidewalk	36.0%	45.3%	60.7%	36.7%	38.0%	43.3%
Inadequate public transportation	34.7%	38.0%	41.3%	34.0%	30.7%	35.7%
Inefficient police service	31.3%	22.0%	20.7%	16.0%	21.3%	22.3%
No public open place/park	42.7%	52.0%	72.7%	40.7%	44.0%	50.4%
Weak education service	21.3%	28.0%	27.3%	31.3%	20.0%	25.6%
Weak health service	38.7%	45.3%	43.3%	41.3%	48.0%	43.3%

Source: Household socioeconomic survey, 2018.

136. In terms of the communities' view on required infrastructure improvements, clear trends are shown in all cities, shown in Table 16. The cities' residents identified water supply and sanitation as the key infrastructure items they want improved across all project cities.

Table 16: Priority public infrastructure improvements

Public infrastructure / soum	Baruun-Urt	Kherlen (Chinggis City)	Saintsagaan (Mandalgobi city)	Bulgan	Murun	Total
Water supply	27.3%	12.0%	25.3%	14.7%	17.3%	19.3%
Sanitation system	26.0%	27.3%	18.0%	28.0%	26.7%	25.2%
Heating system	18.0%	16.7%	18.0%	17.3%	20.0%	18.0%
Drainage	7.3%	21.3%	3.3%	6.0%	8.7%	9.3%
Solid waste management	6.7%	8.7%	10.0%	18.0%	18.0%	12.3%
Electricity	2.7%	1.3%	8.0%	4.0%	0.7%	3.3%
Construction of sidewalks	7.3%	4.7%	8.7%	2.7%	4.7%	5.6%
Construction of road network	4.0%	6.0%	8.0%	8.7%	2.7%	5.9%
Others	0.7%	2.0%	0.7%	0.7%	1.3%	1.1%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Source: Household socioeconomic survey, 2018

137. **Water and sanitation**. For the apartments, the main water supply is the mains piped water

supply system with only cold water for cities of Mandalgobi (92.0%), Bulgan (88.0%) and Murun (82.7%). The mains piped water supply with both cold and hot water is main water supply for apartments in Baruun-Urt (68.0%) and Chinggis (76.0%) cities. For the ger area households, water vending kiosks and water delivery trucks are the primary water suppliers. Households do not use surface water as a household water supply.

138. 90% of ger area households have a simple pit latrine and 8% a ventilated improved pit latrine, located outside dwelling in the khashaa plot. The ger households primarily discharge their wastewater into their toilet facility (43%) or have a specific wastewater hole (45%). Table 17 shows that the majority of ger area households in Chinggis, Mandalgobi and Bulgan cities dig a new pit latrine when the current one becomes full.

Table 17: Pit latrine emptying

Public infrastructure / soum	Baruun-Urt	Kherlen (Chinggis City)	Saintsagaan (Mandalgobi city)	Bulgan	Murun	Total
Emptying truck (vacuum pump)	2.7%	5.3%	20.0%	12.2%	2.7%	8.4%
Emptying by hand ourselves	1.3%	1.3%	-	-	-	0.5%
Dig new one	57.3%	72.0%	70.0%	81.1%	30.7%	62.1%
Put chemical agents	30.7%	18.7%	4.3%	6.8%	17.3%	15.7%
Manual emptying by hired labor	1.3%	1.3%	-	-	-	0.5%
Other	6.7%	1.3%	5.7%		49.3%	12.7%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Source: Household socioeconomic survey, 2018.

V. ALTERNATIVES ANALYSIS

139. The “Without Project Alternative” or “No Action Alternative” addresses the likely consequences of not undertaking the proposed action. For this project, the failure to develop and improve the existing sewerage infrastructure may be an impediment to development of the *aimag* centers as livable cities and may give rise to pollution of the surrounding environment as a result of failing equipment at the existing WWTPs. The new WWTPs will ensure that the urban environment is 'future proofed' and that new developments both in terms of industry and expansion of the towns, do not affect negatively on the environment as a result of increased volumes of wastewater. Therefore, it can be determined that the “No Action Alternative” is not a reasonable option if the future environmental quality in these aimag cities is to be maintained and improved.

140. **Location Alternatives.** The major operational cost of WWTPs is the energy cost. In order to reduce operational cost, WWTPs are typically located in lowland areas outside of the cities so the sewage can flow toward the WWTP by gravity. Alternative locations of each WWTP were considered at the aimag centers. The final locations for all four WWTPs were chosen on the basis of the aimag’s planning (land use) requirements and elevations of surrounding areas of the aimag centers.

141. **Technology Alternatives.** A long list and short list options appraisal was undertaken during project preparation.

142. **Long list options.** Based on broad international practice in wastewater treatment technologies in cold and temperate climates, a long-list of possible treatment technologies

was drawn up for first-stage evaluation. This list excluded a number of technologies which are in use in more temperate climates but which would not function in the extreme cold experienced during the long and deep winters experienced in the project cities, or are excluded for other operational reasons, such as being insufficiently tested at scale under the conditions operating in the project cities. The list was evaluated based on a range of criteria including effluent quality, cost and odor/vector impacts.

143. Short list options. This first stage process leaves four basic technologies which are considered to offer the best alternatives for application in the project cities.

(i) the membrane bio-reactor system (MBR);
(ii) the activated sludge process (ASP) in its various forms – modified in accordance with the specific treatment requirements;
(iii) the sequencing batch reactor system; and
(iv) fixed film activated sludge processes which includes the integrated fixed film activated sludge process (IFAS) and moving-bed bio-reactor process (MBBR).

144. A summary of the alternatives analysis is shown in Table 18. The options analysis does not present a clear winner in terms of optimal solution. However, further detailed analysis of the potential for use of the MBR system reinforced the original conclusion. The analysis indicated that while the degree of treatment achieved can be very high, the system suffers from the disadvantages under Mongolian conditions where there are occasional system failures - for instance due to power cuts and the micro filters become clogged and require constant cleaning resulting in high maintenance costs.

145. In summary, it is proposed that the IFAS system be adopted as the treatment process in each of the project *aimags*. This has the additional benefit of being the technology proposed for the new ADB-supported treatment plant in Darkhan. There is benefit in the cities in Mongolia adopting treatment processers which are similar so that: (i) experience of operation can be built up and learning applied across cities; and (ii) costs of operation and maintenance can be reduced through the use of common types of materials and equipment. In addition, it is robust enough to cope with industrial effluent which is an evaluation criterion, therefore will be able to handle increases in industrial effluent, if industry further develops in the future, within the *aimags*.

Table 18: Technology Options Appraisal

Item	Evaluation Criteria	Membrane Bioreactor (MBR) System	Modified Step-feed process Activated Sludge Plant	Standard Sequencing Batch Reactor System	Integrated Fixed-film Activated Sludge Process (IFAS)
1	**Estimated total capital costs (Capital works, equipment and other costs) for a plant treating 3,000 cum/day in US$ million**	3.50	3.15	2.60	2.80
2	**Estimated annual operational cost (Power, staff, chemicals and other) in US$ million per annum**	0.250	0.130	0.250	0.160
3	**Estimated total economic lifetime costs over 25 years in MNT per M^3 treated**	11,800	10,500	11,500	10,100
4	**Financial lifetime cost in MNT per M^3 treated**	3,087	3,329	3,168	3,372
5	**Economic Internal Rate of Return (EIRR)**	9.5	10.7	13.1	13.7
6	**Financial Internal Rate of Return (FIRR)**	1.8	2.4	3.1	3.6
7	**Operational simplicity or complexity, e.g., need for PC-based SCADA control system, number of moving parts and complexity and exposure of appurtenances**	The system is compact and offers a minimum of external pipework. The system is generally highly automated and requires a high level of operational skill.	The opportunity exists to minimize the need for external pipework by planning the configuration of reactors to minimize number of structures. The	The system is reasonably compact and so does not involve a great deal of external pipework. The system works in an automatic mode and is controlled by a relatively	The system is modification of conventional ASP with additional steps and can be configured so as to minimize external pipework. The system can operate in

Item	Evaluation Criteria	Membrane Bioreactor (MBR) System	Modified Step-feed process Activated Sludge Plant	Standard Sequencing Batch Reactor System	Integrated Fixed-film Activated Sludge Process (IFAS)
			process is complex and requires a degree of automated control, although treatment is reasonably robust in cases where control is not as finely managed (is sub-optimal).	complex PC-based SCADA system. There is a risk of automatic system failure, in which case the effluent quality is likely to be significantly adversely affected. Backup systems are needed	either an automated or a manual mode. Since the timing of phases is not as critical as in other options, treatment efficiency can be maintained in cases where operational controls are not so carefully managed
8	**Successful operation proven elsewhere in Mongolia, or at least in the region, and in similar climatic, economic and technical environments, and similar flow rates**	The MBR system has not been used previously in Mongolia for the treatment of wastewater. In general, the system is not widely used for municipal wastewater treatment in developing country environments.	No step-feed ASPs working on Mongolia, but there are a number of modified activated sludge processes operating with significant variation in treatment efficiency. Team visited WWTPs at Sukhbaatar in Selenge and Zuunmod in Tov where a modified activated sludge systems were operating: the first not well, but the	Small SBR plants are operation in Mongolia, but the pilot plant at the Darkhan treatment plant experienced some operational problems with the pilot through freezing during winter. While widely used in more economically advanced and warmer environments, SBRs have yet to find widespread use in the region, or in Mongolia	The IFAS system is widely used in Russia in its “three-sludge” form, but is not well known in this form elsewhere. It is a modification of an activated sludge-type process which is widely adopted elsewhere and has been adopted in Mongolia for smaller plants. Some elements included in plants at Sukhbataar and Zunmod.

Item	Evaluation Criteria	Membrane Bioreactor (MBR) System	Modified Step-feed process Activated Sludge Plant	Standard Sequencing Batch Reactor System	Integrated Fixed-film Activated Sludge Process (IFAS)
			second providing a high level of treatment. Thus due to variability in operation and not design issues.	(except for relatively small private plants)	
9	**Probable treatment efficiency (BOD, COD, SS & NH_4 removal) in climatic extremes likely to be experienced in the project *aimags***	BOD=10.0mg/l COD=20mg/l SS=10.0mg/l NH4=0.4mg/l	BOD=20.0mg/l COD=50mg/l SS=50.0mg/l NH4=6.0mg/l	BOD=20mg/l COD=50mg/l SS=50mg/l NH4=6.0mg/l	BOD=6.0mg/l COD=15mg/l SS=6.0mg/l NH4=0.4mg/l
10	**Sludge handling characteristics – minimization of sludge problems**	In operation of the MBR system the dry sludge produced is about one half of that produced from the activated sludge process.	Sludge volumes produced from this process are less than for conventional ASP but relatively high.	The volume of dry sludge produced from the system is about two thirds of that produced from the conventional ASP.	The volume of dry sludge produced from the system is about one half of that produced from the conventional ASP.
11	**Shock-loading resilience – particularly to chemical agents likely to be present in (pre-treated) industrial wastewaters**	The system is not robust in treating wastewaters with variable characteristics. This could complicate and threaten the efficiency of the treatment process	The system is robust in treating wastewaters with variable characteristics provided they meet with the standards for discharge to public sewers	The system has the benefit that it can adjust the intensity of treatment to deal with variability in inflow characteristics.	The system is robust in treating wastewaters with variable characteristics provided they meet with the standards for discharge to public sewers
12	**Energy efficiency, (construction and operational phases**	Energy costs are high. Annual	Annual electricity consumption	Annual electricity consumption	Annual electricity consumption

Item	Evaluation Criteria	Membrane Bioreactor (MBR) System	Modified Step-feed process Activated Sludge Plant	Standard Sequencing Batch Reactor System	Integrated Fixed-film Activated Sludge Process (IFAS)
	and opportunities for energy recovery (e.g. methane biogas recovery)	electricity consumption amounts to about US$ 0.14 mil.	amounts to about US$ 0.127 mil.	amounts to about US$ 0.102 mil.	amounts to about US$ 0.107 mil.
13	**Suitability for incremental expansion**	Relatively easily extended by the construction of additional parallel treatment streams if designed for modular expansion.	Relatively easily extended by the construction of additional parallel treatment streams if designed for modular expansion, although pipework complexity.	Relatively easily extended by the construction of additional parallel treatment streams if designed for modular expansion.	Relatively easily extended by the construction of additional parallel treatment streams if designed for modular expansion.
14	**Operational resilience in extreme winter climate**	System minimizes the need for exposed interconnecting pipework	There is a moderate amount of underground pipework which risks operational problems in winter, but not if well located.	Minimal interconnecting pipework but pilot plant at Darkhan suffered freezing problems in the winter, but these may have been due to small size	System minimizes the need for exposed interconnecting pipework.
15	**Likely creation of odour or other nuisance**	No odour if working properly.	No odour if working properly.	No odour if working properly.	No odour if working properly.
16	**Constructability**	Complicated by the need for installation of complex equipment.	Relatively straightforward, although more complex than IFAS	Straightforward for structural elements, less so for mechanical equipment and controls	Relatively straightforward

Item	Evaluation Criteria	Membrane Bioreactor (MBR) System	Modified Step-feed process Activated Sludge Plant	Standard Sequencing Batch Reactor System	Integrated Fixed-film Activated Sludge Process (IFAS)
17	**Suitability for risk reduction through B&OA or BOT modality**	Nature of works required would not lend it to BOT modality easily due to rehab of structures.	Would be suitable for BOT-type modality (although design now separate)	Would be suitable for BOT-type modality (although design now separate)	Would be suitable for BOT-type modality (although design now separate)
18	**Major Risks associated with each option:**	• Need for replacement of cartridges adds to operational cost. • Where there are occasional system failures - for instance due to power cuts - the micro filters become clogged and require constant cleaning resulting in high maintenance costs. • To operate micro filters, vacuum pumps are required and these are considerably more expensive to operate than	• Susceptible to reductions in treatment efficiency under high or low loading rates. • Configuration of structures and interconnecting pipework means that new WWTP cannot readily be extended. • Extensive inter-connecting pipework increases risk of winter freezing • Step-feed process adds to complexity and cost	• Operational complexity increases risks of operational failure or treatment problems • Treatment efficiency susceptible to wide variations in flow unless large balancing tank in front of reactor • External experts required for the maintenance of sophisticated technical equipment • Flexibility in arranging phases requires sophisticated computer-based	• Relatively untried technology increases operational risks, although based on well-tried principles • Need for optimal treatment conditions requires the use of relatively sophisticated computer-based control system.

Item	Evaluation Criteria	Membrane Bioreactor (MBR) System	Modified Step-feed process Activated Sludge Plant	Standard Sequencing Batch Reactor System	Integrated Fixed-film Activated Sludge Process (IFAS)
		using secondary sedimentation tanks for clarification.		control system, demanding extensive external support and training of the operating staff on commissioning: high cost & risk of failure	
19	**Risks associated with contracting out works**	Contractors may be reluctant to undertake works, or to guarantee works, because of complexity of system	Well known system and should attract wide interest from contractors	Well known system and should attract wide interest from contractors	Relatively well-known process so should not restrict international contractor interest and responsiveness
20	**View of Expert Technical Committee on Water and Wastewater Treatment and Steering Committee**[14]	Should be considered in evaluation as this is a state-of-the art technology providing very high treatment efficiency.	This process is well understood but could be developed further based on Mongolian experience and conditions.	This system may face operational problems as not used before at this scale in Mongolia	This system is preferred as it is relatively simple modification of ASP and thus the most suitable for Mongolian conditions
21	**View of experts from ADB's SDCC**[15]	Not considered.	Step-feed arrangement relatively costly in terms of both	Concern that operational complexity could	Not well known but technology appears sound as based on

[14] Views expressed by the expert committee on the Darkhan WWTP proposed options
[15] Views expressed by ADB's Sustainable Development and Climate Change (SDCC) Department on the Darkhan WWTP options which were similar.

Item	Evaluation Criteria	Membrane Bioreactor (MBR) System	Modified Step-feed process Activated Sludge Plant	Standard Sequencing Batch Reactor System	Integrated Fixed-film Activated Sludge Process (IFAS)
			capital and operating costs. New facility optimizes new technology and minimizes risk, but creates potentially more negative impacts due to footprint and need to deal with decommissioned existing structures	compromise performance New facility optimizes new technology and minimizes risk, but creates potentially more negative impacts due to footprint and need to deal with decommissioned existing structures	ASP technology. New facility optimizes new technology and minimizes risk, but creates potentially more negative impacts due to footprint and need to deal with decommissioned existing structures

ADB = Asian Development Bank, ASP = activated sludge process, BOT = build, operate, transfer, IFAS = integrated fixed-film activated sludge, MBR = membrane bioreactor system, SCADA = supervisory control and data acquisition, SDCC = Sustainable Development and Climate Change.
Source: Draft Final Report.

VI. ANTICIPATED IMPACTS AND MITIGATION MEASURES

A. Environmental Impact Screening

146. The following discussion on environmental impacts screens the potential impacts according to the following factors and recommends mitigating activities on this basis:

(i) **"Receptor"**: the resource (human/natural environment/economic/social) which is potentially going to receive and have to cope with an impact.
(ii) **"Sensitivity"**: ability to cope with an impact and/or its importance to the country of Mongolia. It is generally accepted that human health is always a high sensitivity receptor, however in terms of environmental/natural resources, the sensitivity varies according to the receptor e.g. scrubland with no significant biodiversity is considered less sensitive than a mature forest which supports ecosystems and livelihoods.
(iii) **"Magnitude"**: the size of the potential impact. Impacts may be short term and considered low magnitude (e.g. noise or temporary reduction of income during a short construction project) or high magnitude (e.g. the poor disposal of large quantities of hazardous waste into a water course).

147. Where an impact may occur, if there is no receptor on which is potentially going to receive the impact, then mitigating actions will not be required. This follows the source-pathway-receptor model, whereby in order for there to be an impact, the pollutant or issue (source) needs to be present, the pathway to a receptor is needed (such as fissures in rocks, or water for human consumption) and a receptor must be present to receive the impact, such as humans, flora or fauna.

B. Positive Impact and Environmental Benefits

148. The project outputs will have a clear benefit for the local population in terms of environmental improvements. The problems associated with the current WWTP arrangements will be greatly reduced or eliminated, with effective design and operation of new facilities. Improvements in odor, water quality and effluent standards will be seen and the beneficiaries will include those residents within the sewer network and those who are affected by the impacts on the environment from the current WWTPs.

C. Environmental Impact and Mitigation Measures in Design Phase

149. Impacts associated with the project locations and design focus on the following key areas:

(i) Planning to ensure locations of the WWTPs are consistent with cities' plans and downstream locations to minimize sewage pipe length and save energy in future operation;
(ii) Planning to ensure the current sewage treatment ponds will remain operational until the new WWTPs are operational; and
(iii) Disturbance of permafrost: The project sites have varying degrees of likelihood of the presence of permafrost. If engineering work including pipe installation is to take place in permafrost, it can melt over time leading to land subsidence and potential pipeline rupture or cracks in buildings inside the WWTPs.

150. **Mitigation measures and actions during design and pre-construction**. The mitigation of impacts from these design issues are as follows:

(i) Careful selection of project sites by design teams and in order to maximize gravity flow opportunities and ensuring the sites are not unacceptably close to receptors.
(ii) Collaboration between project implementation team, contractors and PUSO to develop a continuity plan to ensure sewage is managed at all times before and during commissioning of new facility.
(iii) Geo-technical survey and desk review of site to confirm presence/lack of permafrost.

D. Environmental Impact and Mitigation Measures during Construction

151. **Impacts on Soil Resources**. The projects are in pasture areas which are a valuable resource and require the protection of topsoil if the pasture growth is continue. Potential impacts on soil may arise from:

(i) **Borrow sites and spoil**: Borrow sites will be needed to provide fill for ground works. Spoil will be generated through general groundwork and the excavation of trenches for pipes between existing network and the new plants.
(ii) **Soil erosion**: Excavation of borrow pits, stockpiles and spoils from earthworks during pipe excavation and ground works for the WWTPs may cause soil erosion. The factors that are expected to contribute to accelerated erosion in the project area are any exposed soil during periods of rainfall from June to August.
(iii) **Soil contamination**: Localized contamination of soil in the construction phase may result from the inappropriate transfer, storage, and disposal of petroleum products, lubricants, chemicals, hazardous materials, liquids and solid waste. These impacts are particularly associated with construction site chemical storage, and during refueling of plant and equipment.

152. **Mitigation of impacts on soil.** Measures will include:

(i) Site specific Spoil and Borrow Site Management Plan (Sub-Plan A) will be developed and approved by the relevant Municipal authority.
    (a) All borrow sites will have approval of relevant aimag authorities;
    (b) Spoil will not be disposed of on fertile pasture land.
    (c) A map of all borrow sites will be developed and maintained with copies held by the Contractor and PMU;
    (d) Measures to rehabilitate the borrow sites will be detailed and will include contouring of the slopes within each borrow site and replanting sites with native species;
    (e) Top soil present on construction sites will be removed and stockpiled in a labeled area for use on rehabilitation of the site post-construction or rehabilitation of borrow sites;
(ii) Good construction practice will be engaged to minimize soil erosion. Practices will include:
    (a) Minimizing the area of soil clearance;
    (b) Construction in the should be mainly restricted to the dry season where possible
    (c) Cover soil stockpiles;

(d) Use of temporary berms or other appropriate temporary drainage provisions at construction sites to prevent water eroding cut faces, stockpiles and other exposed areas of soil.

(iii) Soil contamination will be minimized through sound management of liquid chemicals, fuels and other fluids which can contaminate soil. Measures include:

(a) Storing chemicals/hazardous products and waste on impermeable surfaces in secure, covered areas with clear labeling of containers and with a tray or bund to contain leaks;
(b) Establish emergency preparedness and response plan which includes response to spills.
(c) Provide spill cleanup measures and equipment at each construction site
(d) Conduct training in emergency spill response procedures
(e) Ensure fuel is stored in a bunded tank and vehicle refueling takes place on hard standing away from sensitive receptors, such as surface water.

153. **Impacts from waste arisings**. The generation of waste inherently means valuable resources have been used inefficiently and also the disposal of waste can have adverse environmental impacts through its improper disposal. Waste streams will include inert construction wastes (e.g. soil, spoil, concrete) and municipal type wastes (construction workers' food and packaging wastes from construction consumables). Hazardous wastes may include fuel containers, oil filters, oily rags and empty chemical containers.

154. **Mitigation of impacts from solid and liquid waste arisings**. Measures will include

(i) Solid and Liquid Waste Management Plan (Sub-Plan B) implementation which will include measures/ assurances that the contractor will:

(a) Follow the waste hierarchy and demonstrate how waste will be prevented and recycled and will show effective management of materials on site through good house-keeping and work planning.
(b) Clear arrangements for storage and transportation of all hazardous and non-hazardous waste to an authorized and approved disposal point (approved by aimag authorities).
(c) Recyclables to be separated at source and given/sold to recycler (plastic, metal, card, paper as a minimum).
(d) All solid waste to be stored in containers with lids.
(e) Prohibit burning of waste at all times.
(f) Provide all vehicles/drivers with plastic bags for waste collection and prevent any unauthorized waste disposal.

155. **Impacts on Occupational Health and Safety.** Construction workers are necessarily exposed to a many potential hazards whilst working on a construction site, using hazardous chemicals, heavy plant and machinery and the movement of materials. Also emergencies may arise on construction site. Typical emergency situations may include injury/accidents, spillages or fire. The effective management of emergency situations can have a significant bearing on the likelihood that they impact on the construction workers.

156. **Mitigation of impacts on Occupational Health and Safety.** the mitigation measures will include implementation of an Occupational Health and Safety and Emergency Response (Sub-Plan C) which will include measures such as:

(i) **Management of Occupational Health and Safety risks**:

(a) Assurance that all workers are equipped with and use Personal Protective Equipment (PPE).
(b) Specifications for the PPE to be used on site and the contractors' approach to enforcement of its use by workers
(c) Sufficient signage giving occupational health and safety warnings and information disclosure within all construction sites – sub-plan to include example warnings.
(d) Details of worker education/training and awareness seminars for construction hazards will be given. A construction site safety program will be developed and distributed to workers.
(e) Details of daily toolbox meetings (safety briefings)
(f) Details of the site accident record book which will be maintained where all major or minor accidents and incidents are recorded with actions taken.
(g) Details of a Health and Safety qualified engineer and adequate first aid who/which will be on site.
(h) Provision will be made for safety precautions when using 220 to 240V Electric Power tools if the workers are likely to be working within wet or flooded environments

(ii) **Management of Emergencies** – provision of an Emergency Response Plan which will set out detailed Preventative Measures for all types of incidents covered in the Emergency Plan. This will include:

(a) Prevention of Injury and Accidents – to include Personal Protective Equipment requirements for construction workers, training requirements
(b) Prevention of Spillage - All construction fluids such as oils, and fuels will be stored on hard standing with sealed drainage with a capacity of 110% of the largest fuel container, will include procedures on refueling and maintaining vehicles.
(c) Prevention of Fire – to include measures for Ignition Sources including prevention of smoking on construction site, management of flammable materials and liquid.
(d) Other Incidents – prevention measures relevant to other issues considered relevant by the contractor

(iii) The Contractor will develop **Emergency Response Procedures** prior to construction. The procedures will cover actions to be taken in case of:

(a) Worker injury (e.g. construction or traffic accident)
(b) Spillage (e.g. fuel spillage)
(c) Fire (e.g. fuel or chemicals storage area); and
(d) Any other incidents anticipated by the contractor

157. **Impacts on environment from worker camps or daily facilities**. A worker camp may be required, deepening on the availability of local labor and staffing numbers required. A worker camp may impact on a range of environmental receptors if poorly managed including water quality, pasture land and land quality, particularly if it is abandoned without restoration.

158. **Mitigation of impacts from worker camps/facilities.** Measures will include:

(i) Construction Workers Camp Management Sub-Plan D (if a camp is required). Measures will include a requirement for:

(a) A map showing camp lay out, welfare facilities, and first aid kit locations.

(b) Accommodation facilities including pit latrines for male and female workers, adequate drainage to prevent flooding, security including a no weapons policy and waste disposal areas.
(c) Discharge of sewage and wastewater to existing WWTP and siting pit latrines minimum of 200m from any groundwater borehole or surface water source
(d) Schedule of HIV Aids education awareness to be given to workers.
(e) Training on relevant laws for foreign labor (including hunting, fishing and traffic rules);
(f) Plan of how camp areas will be restored to original condition after construction completed.

(ii) If a construction camp is not required, the contractor will not require a Management Plan but will:

(a) Provide adequate waste disposal facilities including garbage cans for workers.
(b) Provide welfare facilities including water for washing, drinking and include facilities for male and female workers.
(c) Provide toilets for male and female construction workers with a cleaning schedule.

(iii) The contractor will give priority to local labor force and retain evidence for inspection of how local labor recruitment efforts were undertaken

159. **Impact on air quality**. Moderate temporary air quality impacts during the construction stage of the project could be anticipated because of fugitive dust generation at construction sites. Minor increases in the level of nitrogen oxides (NOx) and sulfur oxides (SOx) from construction plants and machinery are expected. Air quality impacts during construction are likely to result from the following sources:

(i) Emissions from construction machinery and equipment, movement of haulage trucks to all construction sites;
(ii) Fugitive dust from excavation activities and WWTP earthworks and borrow sites
(iii) Fugitive dust from concrete batching plants and asphalt plants if required;
(iv) Fugitive dust from movement of spoil
(v) Dust created by strong wind from unprotected cut faces.

160. The key receptors for air quality impacts are people who would need to be near the construction works before an impact will occur; the impacts will be localized. The closest housing receptors to the site is Murun, 300m North of the new WWTP site however herders could choose to move closer to the construction sites with their livestock. Receptors may also be located close to borrow sites.

161. **Mitigation of impacts on air quality.** Measures will include:

(i) **Stockpiles management**. Temporary stockpiles will be protected to reduce dust emissions. If a stockpile is within 150m of human receptors (such as during trench excavation), additional precautions must be taken including using a reusable stockpile cover to prevent wind lifting and dispersing.
(ii) **Construction site management**: Water will be sprayed on construction sites and material handling routes where fugitive dust is generated, if the dominant wind direction is towards a residential area.

(iii) **Transport of materials**: Trucks carrying loose construction materials will be covered with tarpaulins. Speed limits will be observed at all times and reduced where required by *aimag* authorities.

(iv) **Construction vehicles and machinery:** Maintained to a high standard to minimize emissions (note that local standards do not exist for vehicle emissions).

(v) **Manufacturing plants**: Plants for the production of concrete or asphalt will be located at least 500 m from the nearest dwelling and located downwind.

162. **Noise**. The major sources of noise pollution near the project area are the removal and replacement of existing surface materials during earthwork. Other noise sources will include the general movement of construction vehicles, concrete-mixing equipment, rollers during re-surfacing, and the use of generators. Construction activities are expected to produce noise levels up to 90 dB(A) within 5m of the construction machinery as shown in Table 19.

Table 19: Construction Machinery Noise Levels (dB(A))

Machine Type	Distance to Machinery									
	5 m	10 m	20 m	40 m	60 m	80 m	100 m	150 m	200 m	300 m
Loader	90	84	78	72	68.5	66	64	60.5	58	54.5
Vibratory Road Roller	86	80	74	68	64.5	62	60	56.5	54	50.5
Bulldozer	86	80	74	68	64.5	62	60	56.5	54	50.5
Land Scraper	90	84	78	72	68.5	66	64	60.5	58	54.5
Excavator	84	78	72	66	62.5	60	58	54.5	52	48.8
Roller	87	81	75	69	65.5	63	61	57.5	55	51.5
Mixing Equipment	87	81	75	69	65.5	63	61	57.5	55	51.5

Source: U.S. Federal Highway Administration

163. At the proposed WWTP sites, no human receptors other than construction workers will be this close to the machinery, and construction workers will use appropriate Personal Protective Equipment (PPE). The use of PPE is included in the Occupational H&S Sub-Plan. The closest receptor to the sites is at Murun (300m to residential area); however herders and temporary shelters may move in and around the construction / borrow sites areas during construction. Therefore the following mitigation measures are required.

(i) Operate high-noise activities between 8am-6pm only and reach an agreement with nearby businesses and residents regarding the timing of heavy machinery work, to avoid any unnecessary disturbances;

(ii) Provide advance warning to businesses and residents on timing of noisy activities. Seek suggestions from community members to reduce noise annoyance

(iii) Vehicles transporting construction materials or wastes will not use their horn when passing through or nearby sensitive locations, such as residential communities, schools and health care facilities

(iv) Ensure noise monitoring is undertaken at construction site boundaries and near sensitive receptors, especially in Murun (residential area)

164. **Surface Water**. Construction activities have the potential to cause significant short and long term impacts to surface water through construction works, particularly in dry areas such as the Gobi where dilution effects may be limited. Impacts can occur from: stormwater runoff

and erosion, accidental spills, inappropriate disposal of domestic wastewater generated on site or at worker camps and construction wastewater, washing aggregates and washing construction equipment and vehicles, oil-containing wastewater from machinery repairs and poor waste management.

165. Given the nature of the construction work and the groundwater conditions, no impacts on groundwater are anticipated.

166. **Mitigation of impacts on surface water** will include:

(i) Adherence to all Construction EMP sub-plans which impact on water quality
(ii) Establish a Water Protection Zone buffer 300m from the water edge at Chinggis, Bulgan and Murun where rivers are present within 0.5-1.5 km from the site. No construction activities will take place in the protection zone; this includes material storage, vehicle washing, waste storage, machinery repairs, latrines.

167. **Community Health and Safety**. Community H&S may be affected by the presence of construction sites, where people may gain access unauthorized access to the sites. Traffic and heavy vehicle movements along haul roads will be required and borrow sites which may be in areas used for livestock grazing. Damage to roads may be caused by construction traffic.

168. **Mitigation of impacts on Community Health and Safety** will include:

(i) Appropriate fencing, protective barriers, buffer zones and/or signs as required will be provided around all construction sites including barriers where needed on access roads.
(ii) Appropriate fencing/protective barriers if required, to prevent access by members of the public and livestock to any borrow site excavations
(iii) Warning signs if mud is likely on asphalt public roads. Mud will be removed at the end of each day. Other spillages on public roads will be removed immediately.
(iv) Signage and speed controls if public roads are to be affected by construction traffic e.g. on haul roads
(v) Adherence to speed restrictions at all times for all vehicles.
(vi) Contractor to agree haul routes with local authorities in advance and repair any damaged routes.

169. **Impacts on the environment from decommissioning**. Minimal impacts are anticipated on water or soil from decommissioning the existing facilities however supervision will be required to ensure that any solid waste (such as mineralized sludge) or wastewater remaining in the ponds is managed as follows:

(i) Mineralised sludge will be disposed of to the appropriate aimag landfill site or retained on site to support growth of vegetation if the sludge beds if appropriate
(ii) Wastewater in any ponds will be drained via the wastewater treatment plant with any residual water left to evaporate.

E. Environmental Impact and Mitigation Measures during Operation

170. If operating according to the design, the WWTP will not cause environmental impacts, although some, such as odor, are inevitable. However, in order for the site operation to be

effective, the PUSO is expected to develop appropriate operation and maintenance (O&M) procedures to ensure the budget for O&M is available and that the staff are knowledgeable about the role they need to play in O&M. The O&M procedures will cover all operational aspects of the site including:

(i) All stages of wastewater treatment
(ii) Sludge management
(iii) Site maintenance including a preventative maintenance program
(iv) Environmental analysis (effluent, sludge, water analysis)
(v) Solid waste management (containment, storage, transport, disposal) and
(vi) Other aspects appropriate to the site operation.

171. **Occupational Health and Safety.** The operators are at risk of a range of H&S risks as associated with the WWTP operations, including the use of chemicals, worker injury and accidents such as trips or falls.

172. **Use of Chemicals.** The use of sodium hypochlorite for disinfection requires specific measures; other chemicals such as coagulants chosen by the operator, may also require special handling and the operator will be required to follow the Material Safety Data Sheet for each chemical. Sodium hypochlorite is classified[16] for health hazards as follows: i) Skin Corrosion/irritation and 2) Serious Eye Damage/Eye Irritation; and for Environmental hazards as 1) Acute aquatic toxicity, Cat 1 and 2) Chronic aquatic toxicity, Cat. 2.

173. Based on Material Safety Data Sheet[17] requirements for sodium hypochlorite, the following measures should be used to mitigate risk to operating staff:

(i) Do not keep the container sealed and handle and open container with care.
(ii) Ensure adequate ventilation
(iii) Use personal protective equipment; avoid contact with the skin and the eyes.
(iv) Do not breathe vapors or spray mist; use respirator with appropriate filter if vapors or aerosol are released.
(v) Emergency eye wash fountains and emergency showers should be available in the immediate vicinity.
(vi) Hygiene measures: Keep away from food, drink and animal feeding stuffs, smoking, eating and drinking should be prohibited in the application and storage area, wash hands before breaks and at the end of workday, take off all contaminated clothing immediately.

174. **Site Based H&S**. The mitigation measures associated with worker accidents include the development of comprehensive site specific H&S procedures to:

(i) Comprehensive program of H&S training for staff
(ii) Undertake risk assessments for high risk processes and roles and appropriate mitigation measures

[16] CLP Regulation (for "Classification, Labeling and Packaging") is a European Union regulation from 2008, which aligns the European Union system of classification, labeling and packaging of chemical substances and mixtures to the Globally Harmonized System
[17] https://www.fishersci.co.uk/chemicalProductData_uk/wercs?itemCode=10691164&lang=EN

(iii) Use of appropriate PPE including measures to enforce its use and PPE for specific situations including handling chemicals;
(iv) Electrical safety testing of WWTP equipment prior to use
(v) Undertake health assessments (annual medical) for workers and analysis of results to identify trends
(vi) Emergency Procedures – actions required under emergency situations including worker accident, fire, chemical spill and other measures as required by the operator.

175. **Odor**. The WWTP will inevitably lead to the generation of nuisance odors, but the sites have been chosen to be as far from practicable from housing (key odor receptors) and include a 150m buffer. In addition mitigation measures for odor include:

(i) Quarterly meetings with residents and / or their representatives to identify odor or nuisance issues;
(ii) Movement of any sludge materials off site on days of low wind speed
(iii) Develop and implement boundary odor monitoring procedures and record the results. Reference procedures may include those developed by the Environment Agency (UK) or EPA (USA).
(iv) A buffer zone will be set up around the WWTP in accordance with Article 4.20 of the Construction Norms and Standards: 40-01-14 (150m buffer).
(v) No households are located within the buffer zone of the WWTP

F. Cumulative and Indirect Impacts

176. SPS 2009 requires that the IEE includes ''areas and communities potentially affected by cumulative impacts from further planned development of the project, other sources of similar impacts, any existing project or condition, and other project-related developments''.

177. Based on the analysis of impacts from the preceding sections of this IEE, there are not anticipated to be any negative cumulative or indirect impacts. The development of an effective WWTP and installation of latrines will result in environmental benefits and is not predicted to give rise to indirect impacts, other than those which are discussed in this IEE.

G. Project Risks and Mitigation Measures.

178. The risks associated with implementation of the project to achieve the anticipated project outcomes and objectives are as follows:

(a) Technology choice: The projects cities are located in harsh climates which may affect the WWTP performance.

(b) Insufficient project management skills and experience compromise project quality. Project cities and PUSOs have limited project management and supervision capacity and no experience in managing and supervising construction work and equipment installation of the size and level of sophistication required by the project.

(c) The operation of the wastewater treatment plant: Project PUSOs are accustomed to operating simple sewage stabilization ponds and the new treatment systems are more advanced and sophisticated demanding greater operational skills. Poor operation would result in increased operational costs and reduced treatment

effectiveness and therefore pose an environmental risk.

179. The mitigation measures associated for the project risks are as follows:

(a) Sound technology choice due to thorough alternative technology evaluation by experienced engineers with a track record in working within the climatic conditions presented by this project. Confidence in construction approach will achieved through site supervision and consulting inputs such as that provided by the Loan Implementation Environmental Consultant.

(b) Construction quality of the WWTPs will be monitored by the supervision engineers within The PMIS team.

(c) To ensure that PUSOs are capable of operating the new WWTPs, the construction contracts will include a period of operational assistance and training to operational staff. In addition this project includes management support and capacity building (Part B).

VII. INFORMATION DISCLOSURE AND PUBLIC CONSULTATIONS

A. Public Consultations during Project Preparation

180. **Consultation Process**

181. During the project formulation stage, PUSO and Working groups at aimag level conducted a project scoping exercise and reconnaissance survey of the existing system. Accordingly, during public consultation sessions between project aimags' government representatives, individuals, and groups from the community have been held, to make stakeholders aware of the proposed project. In addition, the community were also informed about the Grievance Redress Mechanism (GRM), as defined in this IEE.

182. The consultant team along with aimag level Support Group members and PUSOs conducted group discussions with the communities in the subproject areas to sensitize them about project activities, associated impacts and obtain recommendations, from February 20 to March 8 2018. Table 20 gives a summary of public consultations conducted in the project affected area and the response in the EMP to the concerns expressed, where appropriate.

183. Consultations were carried out with various stakeholders such as MCUD officials, Government of Mongolia officials, relevant land departments and the sub divisional magistrate of the project *aimags*. As part of the assessment, approximately 105 representatives from surrounding households, entities, apartments/buildings have been consulted.

184. The participants in the consultation attended voluntarily and the community consulted was requested to air their opinions freely, on the project, its impact, and suggestions for mitigating adverse impacts. When asked about their key concerns with the project, the overriding view was that no major environmental issues were raised.

Table 20: Summary of Consultation Findings

#	Issues Discussed	Summary Responses and Suggestions from the Participants	EMP Response
1	How much understanding did you get about project activities of establishing new WWTP nearby your living/working area?	Almost 100% of participants would support the new construction and expansion of WWTPs. They expressed that they received information on proposed project and its activities. Establishing new WWTP in vicinity of their homes is an important necessity to reduce current soil pollution and bad odor. The old WWTPs have exceeded per their design capacity and their technology has older, producing bad smell. The residents of these areas wished to have more improved technology and capacity to WWTP in their area.	None required
2	Will this construction of WWTP make any negative impact to your apartment complex? If	90% of participants were explaining that there won't be any negative impacts on them regarding the noise and dust caused by the construction works since our residential area is located more than 200 meters away from	Health and Safety requirements are specified in the EMP

#	Issues Discussed	Summary Responses and Suggestions from the Participants	EMP Response
	yes, what kind of impacts?	the WWTP construction area. Since the distance between construction site and community living area is large, no negative impact would be expected when constructing a WWTP. Some participants expressed that although no negative effects are expected, safety norms and standards should be followed. At meeting in Mandalgobi and Baruun-Urt city, 90.0% answered “no impacts” to homes due to construction; 3.4% answered there would not be significant negative effects. 6.6% answered there would be some negative effects.	
3	What benefits do you perceive from this construction?	More apartment buildings and households living in Ger Khashaa[18] plot areas will be provided with an opportunity to connect to sewage water system due to increased capacity and technology of WWTP. Many households wanted to be connected to sewage system, to be provided with centralized water and heating for opportunity to start upgrading living condition, and also will a better living condition if the new WWTP are constructed with new technology.	None required
4	Would you have any problem with WWTP if construction company makes access road in your parking area, dig any pipeline etc. for repair for diversion? If yes, what kind?	Participants see the construction as a temporary difficulty and are willing to cope with any problem for development of sewage system in the future. They felt that the construction company should be accountable for the works and the environment should be rehabilitated after the installation of utilities facilities/pipes etc. is completed. After the construction, road must be repaired if damage occurred from trucks and other machinery. Possible difficulties such as power shortages and closing of roads can take place when construction company install utilities. At the meeting 83% of the participants answered “it can be managed temporarily”, “it is ok during summer time” and a “big issue is being solved” expressing that there would not be any conflicts. 4% answered there would be issues. 13% did not answer the question.	Requirements to rehabilitate construction areas on completion
5	Construction activities will make some dust and noise during the	Dust may cause issues for households living close to the construction site during spring season, because of the windy season.	Dust and noise controls measures

[18] Summer ger dwelling usually in the countryside

#	Issues Discussed	Summary Responses and Suggestions from the Participants	EMP Response
	construction? What kind of mitigation measures would you request to improve mitigation?	Therefore, construction company should take care e.g. spraying water on road and construction sites during construction period. Apartments and Ger area are located more than 200-250m distance from construction site. It would be better if construction work is conducted after children and elder people are off to their summer camp area. Other than this, there will not be a problem. Infants might have difficulties sleeping due to noise as well as dust from construction site. So, construction work must be finished at scheduled hours.	
6	Will you have a problem if the construction company required to work during the night to bringing construction material? In this case, what measures should be implemented?	Most of participants expressed that since it's a necessary development work and there should be no problems. Offices and service establishments around the areas work during the day time, so they won't be having any difficulties. Transportation of building materials won't inconvenience the residents, as even now many construction activities are on-going without consideration of residents' comfort. The construction will be far away from residential area and special fencing are available. They expressed that the construction work must be completed within the time specified.	None required
7	Will you have a problem if the construction company required to work during the night to carry construction requiring extreme vibration and noise such as concreting, cutting, digging etc.? If yes, what measures can be taken for mitigating the problem?	No hindrance since the construction site of WWTP is far from households and construction area is large. Working hours need to finish before the night. The majority of the residents reside at their summer camp house during that time, so there should be no problem there. They expressed willingness to work in harmony with construction company if it works with proper procedures.	None required
8	How would you react to construction company transporting waste and construction material through your apartment/ger area or parking area? Do you agree with this or would you demand specific condition?	Most residents living close to old WWTP were suffering from a bad smell during summer time when the wind direction turned to the Ger area, but they don't like to complain about it. Heavy and large vehicle could cause some traffic issues, proper transportation vehicles needs to be used by the construction company. Disposal and the removal process of all the wastes should be carried out daily. Damage caused by the construction work should be restored afterwards. Open transport of wastes and failing to follow the waste removal procedures can cause some negative impacts. If all the waste removal procedures are carried out properly, there is	Measures on solid waste management and transport of waste

#	Issues Discussed	Summary Responses and Suggestions from the Participants	EMP Response
		no problem. All the accidents while transporting materials must be avoided. If the construction company performs well and responsibly, they don't have any negative comments.	
9	What do you concern about Health & Safety of residents and children during the construction?	There are no concerns because there is plenty of space where WWTPs will be constructed and it has safe distance from their residences. However, there might be some cases where livestock or animals might fall into excavations, which would require proper fencing for preventing such incidents. For children, the construction company must set up safety zone parameter, put warning signs. Since the main construction work will be carried out during the summer (May to October), they feel that there may not be any problems during this time. They recommended that proposals in tandem with residents and governors must be taken up by the construction company regarding warnings, safety precautions to ensure safety and health of people.	Community health and safety measures
10	Would you like to participate in safety monitoring and controlling activities?	Most of participants want to be involved if they are free during that time. Service establishment employees expressed that they won't be involved on this matter. Governor's office expressed their readiness to provide professional support such as giving guidelines and evaluation through their civil servants during the construction work.	None required
11	Any shops/commercial establishments and industrial activity disturbed by this construction?	Main comment was that construction work such as blocking the road by heavy vehicles, digging and excavating holes and trenches should not affect the business of the area. A problem will not be caused to the shops, business and service centers that are located far from WWTPs.	None required
12	Any other critical environment related issue and concern by the residents for the during construction and operation stage?	Main concern was that the environment in the area should be rehabilitated after construction. The area should be sprinkled with water to prevent from causing allergies to the people during the construction. Green area should be established. In one meeting 70% of the participants answered "trees should be planted around the WWTP", 20% answered "nothing to be considered". Vegetation and establishment of green area must be carried out satisfactorily and felt that it should be carried out by professional people, not a construction company. Construction wastes should be removed in a timely manner. Signs with pictures that can	Requirements to rehabilitate construction areas on completion Community health and safety measures Measures on solid waste management and transport of waste

#	Issues Discussed	Summary Responses and Suggestions from the Participants	EMP Response
		be understood by children/elders should be placed around construction waste area. Soum Government Administration expressed interest in cooperating with the construction company regarding provision of construction materials such as sand, cement and water. Heavy equipment might damage the surface of the soil. They do not have a paved road except for the main road.	
13	If you have any problem caused by this construction, whom would you like to contact? (Construction company, PUSO, City administration, Environment department etc.)	70% of the participants answered "construction company". 4% answered "administration of the Soum". 20% answered "PUSO". They felt that the Construction company and local administration organizations, bag administration, educational department and other applicable organizations such as Environment or Construction Inspectors of *Aimag* Specialized Inspection Agency should give clear information on the issue. They should inform the administration of the province, governor of the bag and/or the construction company.	GRM dissemination
14	Do you know that you can make a complaint to Project Implementation Unit of EA, if above mentioned bodies do not answer and make proper decision to you complaint?	75% of the participants answered "no", because they do not know that PIU can handle the issue. 5% answered "yes". 20% did not answer. They were hoping that Construction company and *Aimag* Government can make proper decision and reaction to the complaint, if they do not, they can make complaint to PIU and Specialized Inspection Agency. Also, facilitator explained GRM of the project implementation	GRM dissemination

185. As a result of the consultations, the specific recommendations from the affected people are given in Table 21. Where appropriate, these recommendations are reflected in the EMP and mitigation measures for the sub-projects.

Table 21: Summary of Consultee Recommendations

	Issue	Responsible Party Suggestions
1	Introducing of EMP to communities surrounding the construction sites for improving their knowledge about their responsibilities and participation in monitoring is important	Civil works contractors, PUSO (use advertising budget of EMP
2	Traffic Management The Construction company to ensure proper road safety for resident's during construction. To conduct transportation using a dedicated road in order to ensure safety of the citizens; To park the vehicles in the dedicated parking space If Ger area street road must be used for transportation, the least populated street shall be used	Civil works contractors adhere to EMP

	Issue	Responsible Party Suggestions
3	Noise Not to conduct works that emits loud noise during night time after 21:00PM.	Civil works contractors to adhere to EMP and also to citizen council requirements
4	A Committee of citizens, PUSO and Aimag Government for inspecting the quality of the construction and process of following safety procedures during construction.	Aimag Government and PUSO
5	New WWTP must meet applicable standards and use quality construction materials. Water treatment and sludge management system should be taken into serious consideration. Complete external landscaping and maintenance must be done e.g. fence, road, street lighting and equipment	Architect, MCUD, PUSO and Civil works contractors

186. **Locations and participants**. Consultation meetings were held at 30 locations involving 105 representatives from affected area in total and the aimag Government Working Group or PUSO Support Group, staff of the PUSO assisted to organize consultations. Table 22 gives the number of participants and location of the public consultations.

Table 22: Consultation Locations and Participants

No	Name of cities	Number of Locations	Number of Participants in Consultations		
			Total	Male	Female
1	Murun, Khuvsgul	5 places	23	11	12
2	Bulgan, Bulgan	8 places	22	10	12
3	Baruun-Urt, Sukhbaatar	3 places	17	8	9
4	Mandalgobi, Dundgobi	6 places	18	10	8
5	Chinggis, Khentii	8 places	25	13	12
	TOTAL	30 places	105	52	53

B. Public Consultations during Project Implementation

187. **Consultation during implementation**. This Consolidated IEE contains details of the consultation undertaken during preparation of these sub-projects. In addition, consultation will take place during implementation. The PUSO PSG with support from the LIEC as required will undertake consultation interviews within 4-6 weeks of construction starting and then again every 2 months (during the periods of construction) until construction is complete. This is set out in the Environmental Monitoring Plan provided in the Environmental Management Plan.

188. It is suggested that the consultations take the form of meetings and site0based discussions and include the following:

(i) Environmental impacts of civil works (e.g., solid and liquid waste, erosion, local flooding, pollution);
(ii) Any unforeseen impacts caused by accidentally e.g. through spillages;
(iii) Civil nuisance (e.g., noise, dust, disrupted business & farming activity, social issues, community health and safety);
(iv) GRM and its procedures including details of persons to contact and contact details

189. In summary, informal monitoring interviews with affected people will focus on complaints

about community disturbance from construction activities, as well as public concerns about ecological protection, soil / land concerns and access issues. A sample Environmental Monitoring Interview Form is in the EMP for this project. This will contribute to project monitoring.

C. Information Disclosure

190. Environmental information on the project, including the IEE and other safeguards information will be disclosed in accordance with ADB's Public Communications Policy (2011) and SPS (2009). This includes:

(i) A summary of this IEE and the DEIA will be available for review in PMUs office in Mongolian language;
(ii) The IEE will be disclosed on ADB's project website (www.adb.org);
(iii) Full copies of this IEE are available upon request in English; and
(iv) Annual reports on project's compliance with the Environmental Management Plan (EMP) and other necessary information will be available at www.adb.org

VIII. Grievance Redress Mechanism

A. Grievance Redress Mechanism Objective

191. The objective of this grievance redress mechanism (GRM) is to address complaints if or when they arise. As a result, a GRM will be established in each project city, in accordance with ADB requirements and Government practices. The GRMs will remain accessible throughout project implementation stage until a Project Completion Report is issued

B. Grievance Redress Mechanism Introduction

192. A project grievance can be defined as an actual or perceived project related problem that gives ground for complaint by an affected person (AP). During consultations for the DEIA and this IEE, APs were invited to comment on the project and suggest mitigation measures; in addition, as the project das strong public support and will not involve any involuntary land or property acquisition or resettlement. Therefore, significant grievances are unlikely, however during construction and operation it is possible that unanticipated impacts may occur if the mitigation measures are not properly implemented, or unforeseen issues arise.

193. Therefore, the GRM will be accessible to diverse members of the local communities, including vulnerable groups, youths and the elderly. Multiple points of entry, including face-to-face meetings, written complaints, telephone calls, or e-mail, will be available. Requests for confidentiality and privacy for complainants will be honored where requested

C. Proposed Grievance Redress Steps and Timeframe

194. Procedures and timeframes for the grievance redress process are as follows and shown in Figure 14.

195. **Stage 1: Access to GRM.** If a concern arises, the AP may resolve the issue of concern directly with the contractor, or make his/her complaint known to either the PCU directly, or through the bagh or soum, whichever level of authority he/she is most comfortable with;

196. **Stage 2: Official Complaint to PCU**. If a complaint is filed at bag/soum level, the bag/soum representative will submit an oral or written complaint to the Public Complaints Unit (PCU). For an oral complaint the PCU must make a written record. For each complaint, the PCU must assess its eligibility. If the complaint is not eligible, e.g. related to an issue outside the scope of the project, PCU will provide a clear reply within five working days to the AP.

197. **Stage 3: PCU Complaint Resolution**. The PCU will register the eligible complaint informing the PUSO, the contractor, the PMU and ADB. The PCU, with support of the loan implementation environment consultant (LIEC), will take steps to investigate and resolve the issue. This may involve instructing the contractor to take corrective actions. Within seven days of the redress solution being agreed upon, the contractor should implement the redress solution and convey the outcome to the PCU.

198. **Stage 4: Stakeholder Meeting**. If no solution can be identified by the PCU or if the AP is not satisfied with the suggested solution under Stage 3, within two weeks of the end of Stage 3, the PCU will organize a multi-stakeholder meeting under the auspices of the head of the concerned soum, where all relevant stakeholders will be invited. The meeting should result in a solution acceptable to all, and identify responsibilities and an action plan. The contractor should implement the agreed redress solution and convey the outcome to the PCU within seven working days

199. **Stage 5: *Aimag* Governor Resolution**. If the multi-stakeholder meeting cannot resolve the problem, and the AP is unsatisfied, the PCU will set up a meeting with the relevant aimag Governor to identify a solution

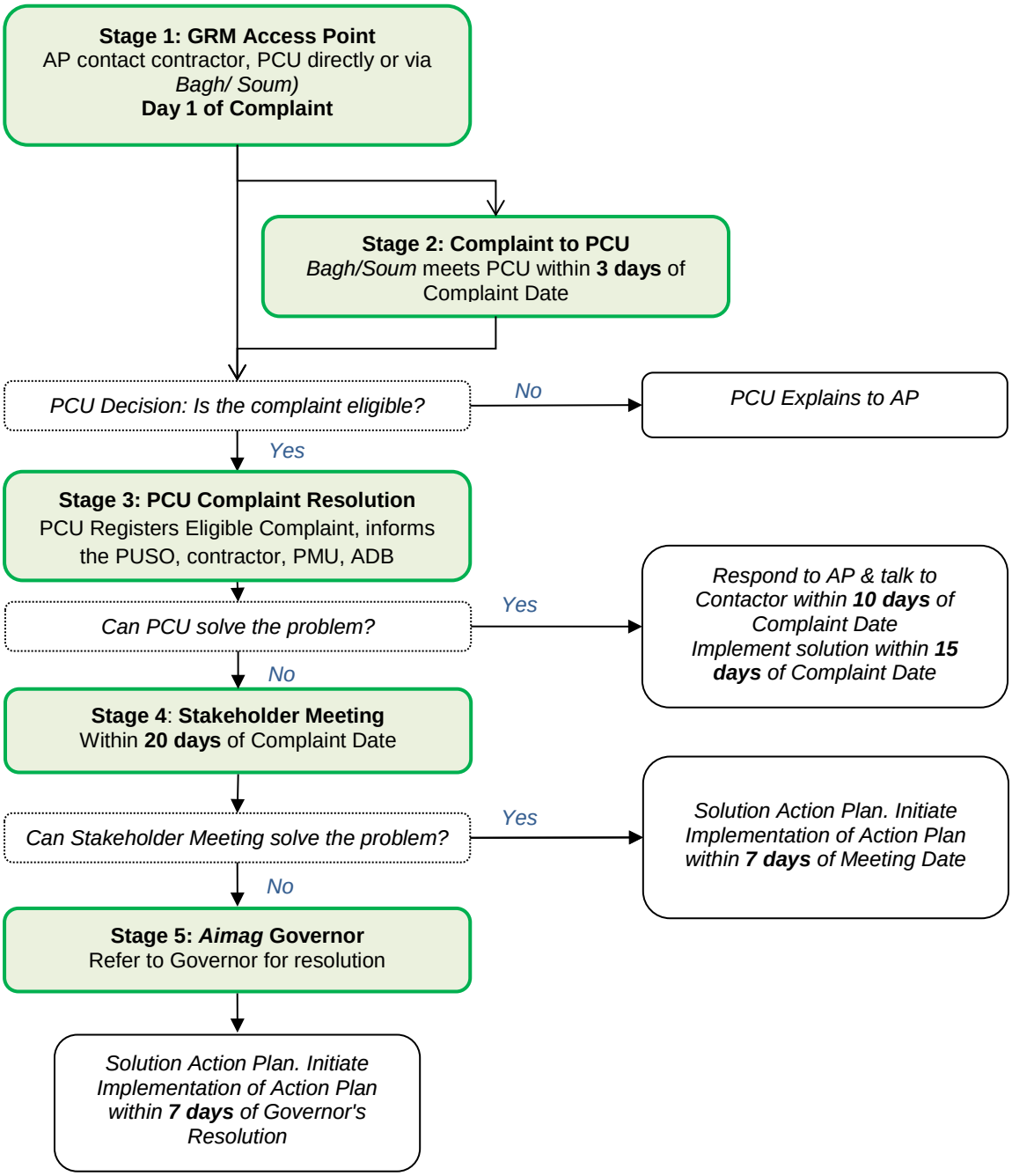
200. **ADB Special Mission**. If the *aimag* Governor is unable find a resolution, the PCU will inform ADB and a special mission will be initiated to resolve the issue. Note that if the APs are still not satisfied with the outcome, they can go through local judicial proceedings.

201. **Accountability Mechanism of ADB**. In addition, affected people may always contact the Complaints Receiving Officer of the ADB via the following addresses which will be included in the signboard:

> Complaints Receiving Officer, Accountability Mechanism
> Asian Development Bank
> ADB Headquarters, 6 ADB Avenue, Mandaluyong City 1550, Metro Manila, Philippines
> (+632) 632-4444 loc. 70309
> (+632) 636 2086
> amcro@adb.org
>
> Instructions available dere:dttp://www.adb.org/site/accountability-mecdanism/dow-file-complaint)

202. **Reporting**. The PCU will record the complaint, investigation, and subsequent actions and results. The PUSO Support Group will include this information in the quarterly progress reports to the PMU. In the construction period and the initial operational period until project completion report, the EA will periodically report complaints and their resolution to ADB in the quarterly project progress reports and annual full project EMP Progress Report.

Figure 14: Grievance Redress Mechanism



203. Responsibilities of the PCU. The PCU will:

(i) Instruct contractors and construction supervisors to refer any complaints that they have received directly to the PCU. Similarly, the PCU will coordinate with local government departments to capture complaints made directly to them;

(ii) Log complaints and date of receipt onto a complaints database and inform the PUSO and the Contractor.

(iii) Investigate the complaint to determine its validity and to assess whether the source of the problem is because of project activities, and identify appropriate corrective measures and responsible persons;
(iv) Inform the AP of investigation results and the action taken;
(v) Submit an interim report to local government agencies on status of the complaint investigation and follow-up action within the time frame assigned if a complaint is transferred from local government agencies;
(vi) Review the contractor's response to the identified corrective measures, and the updated situation;
(vii) Undertake additional monitoring, as necessary, to verify as well as review that any valid reason for complaint does not reoccur.

204. **Multi-stakeholder meetings**. The invitees to this meeting will depend on the nature of the complaint. For example if the complaints relate to health, land disputes, or labor issues, the appropriate specialist in this field will be invited to the stakeholder meeting. This may include officers from the Land Administration (land rights issues), Women's Union NGO (gender issues), Health authorities (health issues), aimag environment protection authorities, aimag Professional Inspection Agency (occupational and community safety as well as environmental issues); and the Ministry of Labor & Social Security Officer (labor issues).

IX. ENVIRONMENTAL MANAGEMENT PLAN

205. The environmental management plan (EMP) for the project is presented in Appendix 2. The EMP defines the roles and responsibilities of the institutions involved in EMP implementation. Such institutions will seek to ensure continuous improvement of environmental protection activities during preconstruction, construction, and operation of the project in order to prevent, reduce, or mitigate adverse impacts.

206. The EMP is prepared in line with ADB's Safeguards Policy Statement (2009). The EMP includes measures relevant to all WWTP sites and where appropriate, WWTP specific requirements are set out. Mitigation measures are developed in relation to the design, construction and operation of each project output, and the impacts identified in relation to the resources in the environmental baseline, as set out in this IEE.

207. The key sections of the EMP include:

(i) Implementing Organizations and Their Responsibilities
(ii) Mitigation Measures
(iii) Monitoring Plan
(iv) Reporting
(v) Training, capacity building and awareness
(vi) EMP Costs
(vii) Mechanism for Feedback and Adjustment

208. The key roles for EMP implementation are set out in the EMP and summarized in Table 23.

Table 23: EMP Roles and Responsibilities

Function	Role Related to Environmental Safeguards
Ministry of Construction and Urban Development (MCUD) The executing agency	• Overall policy, guidance and direction • Responsible for project coordination and liaison with ADB • Overall project implementation and guidance and oversight for PMU
Project Management Unit (PMU) under MCUD	• Provide guidance of the day-to-day activities of the project and assistance to PUSOs • Procure services of PMIS, LIEC and IEM • Endorse project documentation and submit to ADB for approval. • Submit the project progress reports including safeguard monitoring reports to ADB. • Report the project implementation and annual EMP monitoring reporting to ADB.
Public Utility Service Organization (PUSO), PUSO Supporting Group (PSG)	• Conduct and supervise day-to-day activities of the project. • Monitoring the construction EMP implementation and GRM Implementation. • Responsible for monthly project progress report including status of EMP implementation status and issues to PMU. • Assign person in charge for EMP coordination. • In charge of facility operation and maintenance during operation phase.
Loan Implementation Environmental consultant (LIEC) Provided under contract for Project management and implementation support (PMIS) consultants	• Provision of the Environmental experts function within the PMIS team • Provide technical assistance to the PMU and PSGs on implementing the EMP; • Update the IEE and EMP as required; • Provide training to the staff of the PMU and PSGs, PUSOs and contractors on EMP implementation. • Review bidding documents to ensure that the EMP clauses are incorporated. • Review Construction EMPs and provide recommendations for improvement. • Assist the PMU in preparing internal environmental monitoring reports • Advise on mitigation measures implementation and provide technical support. • Coordinate with independent environment monitor (IEM) and review the monitoring results. • Conduct annual EMP compliance review and support PMU in preparing the annual EMP report • Conduct training events for PUSOs and contractors on EMP requirements and implementation. • Organize, prior to project completion report (PCR) mission, a survey to assess community satisfaction with project implementation and EMP implementation performance. Draft environment sections of the PCR
Independent environmental monitor (IEM)- required to be fully independent of all organizations, stakeholders and staff related to the project	• Conduct at least two site visits to each construction site (five *aimags*) during the construction period to conduct an independent assessment of the project's compliance with the project EMP and the domestic EIAs. • Conduct independent environmental monitoring according to the monitoring plan and relevant Mongolian standards. • Assess the contractors', PUSOs', PMIS, and PMU's compliance with their respective EMP implementation responsibilities as defined in the PAM. • Prepare and submit independent monitoring reports to PMU

	• Evaluate EMP implementation effectiveness and recommend improvements. • Participate at project completion mission and provide inputs to the PCR as requested by the PMU and ADB

209. The key mitigation measures during construction will include:

(i) Good construction practices will be adopted to ensure minimal disturbance to affected persons from construction related nuisance, such as noise, dust and pollutant emissions.

(ii) The contractor will submit site specific environmental management plans for the key activities which will also require the contractor to develop appropriate maps to ensure all stakeholders are clear on where activities will take place. These specific activities are:

(a) spoil and borrow site management;
(b) solid and liquid waste management;
(c) community and occupational health and safety and emergency response; and
(d) construction workers camp management (if required).

210. Mitigation and monitoring measures are also required for the operation phase. The importance of training in WWTP site management should be emphasized if the investments are to be sustainable, and operations are to be effectively maintained as per the design. Recognizing that operator performance is critical to environmental performance, a detailed long-term operator training plan and associated budget is provided in this project, under Part B2: institutional reform and capacity development.

211. A Grievance Redress Mechanism (GRM) will be established to receive and facilitate resolution of affected peoples' concerns and grievances about project social and environmental safeguards performance. It should address affected people's concerns and complaints promptly, using a transparent process that is readily accessible to all affected persons. It will contain multiple entry points to allow affected people to approach the organization or person they are most comfortable approaching.

X. CONCLUSIONS

A. Conclusions

212. The EMP, if implemented as directed, will mitigate impacts on the natural environment and affected people to an acceptable level. The key parties for mitigation measure during implementation are the construction contractors and the operators. The implementation of this EMP will be closely monitored and reported on by the relevant stakeholders in the project.

213. The most significant impacts from the project will arise from facility operation. As a result, there is a comprehensive training and capacity building component to the project which is essential for ensuring the investment is both financially and environmentally sustainable and beneficial.

214. A robust Grievance Redress Mechanism will be established, as outlined in this EMP. It will ensure that all unplanned impacts which cause grievances for affected people are managed swiftly and a satisfactory outcome brought about.

215. Overall, the project is anticipated to bring environmental benefits to the populations of the project cities. It will serve to improve the current sewage management situation and will provide long term environmental and social improvements. It will also offer opportunities for sludge and water reuse which are not available with the current WWTPs.

B. Recommendations

216. The project will require agreements from the Government that the key risks from the sub-projects will be mitigated as set out in the EMP. In particular the implementation of construction mitigation measures, and the provision of adequate O&M budgets for operation in accordance with the design recommendations.

APPENDIX 1: COMPLIANCE AUDIT CHECKLIST

Environmental Compliance Audit Form

Criteria	Comments, Observation and Recommended Corrective Actions
Site Details	
1. Project Name and Site Location Details	
2. Location of existing WWTP (latitude and longitude coordinates);	
3. Size of existing WWTP (ha)	
Current Conditions	
4. Describe current infrastructure on site e.g. buildings, ponds	
5. Description of current environmental conditions at WWTP Site -Signs of pollution (land/water) -Wastes on site -Hazardous materials on site e.g. asbestos, chemicals -Other hazards	
Fate of Current Site	
6. Will this existing WWTP infrastructure be rehabilitated, reconstructed in the same/similar place or decommissioned (removed from site) ?	
7. Date new WWTP will become operational?	
Regulatory Compliance	
8. Current operator and responsible authority for existing WWTP;	
9. Does the existing WWTP require a permits/licenses for operation? If yes, is it in compliance with permits/ licenses	
10. Legal Compliance. For each relevant government regulation and law, clarify whether the existing WWTP is in compliance, and clarify any non-compliance issues. -E.g. Law on Environmental Protection, Mongolian National Standards as follows:, -Soil MNS 5850:2008 -Drinking water (groundwater) MNS 900:2016 -Effluent wastewater MNS 4943: 2011 -Ambient surface water MNS 4586:1998	
11. For each regulation or standard above, define remedial corrective measures that are required for existing WWTP site to be compliant with all legal requirements.	**Corrective Action**: The construction of a new WWTP site in accordance with Mongolian laws and operating standards. *-Need to determine exactly what will happen to the ponds/infrastructure on each site (especially two new WWTPS which are not on existing sites Will contaminated land, e.g. from existing spills, be removed from site?*
Sensitive Receptors	
12. Determine distance of nearest surface waters (stream, lake) that could be affected by the existing WWTP, and obtain existing surface water quality data (if available)	

Criteria	Comments, Observation and Recommended Corrective Actions
13. Confirm if existing surface water monitoring data are available for the nearest water body, e.g. from DEIA	
14. Determine distance of nearest homestead or business from defunct, or to be rehabilitated or reconstructed WWTP;	
15. Consult surrounding community to determine if there are past or present environmental, social, or human health issues with the operation of the existing WWTP	
Site Condition Photographs:	

APPENDIX 2: ENVIRONMENTAL QUALITY STANDARDS

1. **Standard for Water Quality.** The relevant standards for ambient water quality and effluent are in Table 24 and Table 25. Mongolia's national standard for groundwater which is used as a drinking water supply is shown in Table 24.

Table 24: Mongolian ambient water quality standards MNS 4586:1998

Parameter	Unit	Standard
(pH)		6.5-8.5
Dissolved Oxygen (O_2)	mgO/l	6&4 not less
BOD	mgO/l	3
COD	mgO/l	10
NH_4-N	mgN/l	0.5
NO_2-N	mgN/l	0.02
NO_3-N	mgN/l	9
PO_4- P	mgP/l	0.1
Chloride Cl	mg/l	300
Fluoride F	mg/l	1.2
SO_4	mg/l	100
Manganese Mn	mg/l	0.1
Nickel Ni	mg/l	0.01
Copper Cu	mg/l	0.01
Molybdenum Mo	mg/l	0.25
Cadmium Cd	mg/l	0.005
Cobalt Co	mg/l	0.01
Lead Pb	mg/l	0.01
Arsenic As	mg/l	0.01
Total Chromium Cr	mg/l	0.05
Hexavalent chromium (Cr^{6+})	mg/l	0.01
Zinc Zn	mg/l	0.01
Mercury Hg	mg/l	0.1
Mineral oil	mg/l	0.05
Phenol	mg/l	0.001

Table 25: Mongolian effluent wastewater quality standard MNS 4943: 2011

Parameter	Unit	Standard
Water temperature	C^o	20
pH	-	6-9
Odor	Sense	No smell
Total Suspended Solids (TSS)	mg/l	50
BOD	mg O_2/l	20
COD	mg O_2/l	50
Permanganate oxidizing capacity	mg O_2/l	20
Total Dissolved Solids (TDS)	mg/l	1,000 *
Ammonia Nitrogen (NH_4)	mg N/l	6
Total Nitrogen (TN)	mg/l	15
Total phosphorous (TP)	mg/l	1.5
Organic phosphorous (DOP)	mg/l	0.2
Hydrogen sulphide (H_2S)	mg/l	0.5
Total iron (Fe)	mg/l	1
Aluminum (Al)	mg/l	0.5
Manganese (Mn)	mg/l	0.5
Total Chromium (Cr)	mg/l	0.3
Hexavalent chromium (Cr^{6+})	mg/l	Absent
Total cyanide (CN)	mg/l	0.05
Free cyanide	mg/l	0.005
Copper (Cu)	mg/l	0.3
Boron (B)	mg/l	0.3
Lead (Pb)	mg/l	0.1
Zinc (Zn)	mg/l	1
Cadmium (Cd)	mg/l	0.03
Antimony (Sb)	mg/l	0.05
Mercury (Hg)	mg/l	0.001
Molybdenum (Mo)	mg/l	0.5
Total Arsenic (As)	mg/l	0.01
Nickel (Ni)	mg/l	0.2
Selenium (Se)	mg/l	0.02
Beryllium (Be)	mg/l	0.001
Cobalt (Co)	mg/l	0.02
Barium (Ba)	mg/l	1.5
Strontium (Sr)	mg/l	2
Vanadium (V)	mg/l	0.1
Uranium (U)	mg/l	0.05
Oil and grease	mg/l	1
Fat	mg/l	5
Surface active agents	mg/l	2.5
Phenol (C_6H_5OH)	mg/l	0.05
Trichloroethylene (C_2HCl_3)	mg/l	0.2
Tetrachloroethylene	mg/l	0.1
Chlorine remains (Cl)	mg/l	1
Bacteria triggering water-borne disease	-	Absent in 1 mg of water

3. **Ambient Air Quality**. Mongolia has a network of air quality monitoring stations which analyze air quality data for comparison with national and international standards. The standards for Mongolia and WHO are in Table 26.

4. For construction noise, IFC EDS Guideline: Occupational health and safety standards indicates IFC EDS Guideline: Occupational Health and Safety: 85 (Equivalent level LAeq,8d) 110 (Maximum LAmax, fast)

Table 26: Mongolian ambient air quality standards MNS 4585: 2007

Pollutant	**Averaging Period**	**Mongolian Standards (µg/m³)**	**WHO Ambient Air Quality Guidelines**	**Averaging Period**
Nitrogen Dioxide (NO_2)	20 Minute	85		
	1 hour	-	200	1 hour
	24 hour	40		
	Annual	30	40	Annual
Sulfur Dioxide (SO_2)	10 Minute	500		
	15 Minute	-		
	20 Minute	450		
	1 Hour	-		
	24 hour	20	20	24 hour
			125	24 hour IT-1
	Annual	10		
Particulate Matter (PM_{10})	24 hour	100	50	24 hour
			150	24 hour IT-1
	Annual	50	20	Annual
			70	Annual IT-1
Particulate Matter ($PM_{2.5}$)	24 hour	50	25	24 hour
			75	24 hour IT-1
	Annual	25	10	Annual
			35	Annual IT-1
Carbon Monoxide (CO)	30 Minute	60,000		
	1 hour	30,000	30	1 hour
	8 Hour	10,000		
Ozone (O_3)	8 hour	100	100	8 hour
			160	8 hour IT-1
Lead (Pb)	24 hour	1		
	Annual	0.5		
Hydrogen Chloride (HCl)	1 hour	-		

Source: Mongolian *Law on Air*

5. **Noise.** Mongolian noise standards are included in Ambient Air Quality Standards MNS 4585:2007 and set an allowable limit for noise in daytime (7am-10pm) at 60 dB, and night at 45 dB, with day and night measurements on 16-hour and 8-hour averages respectively.

6. These standards can be compared to the more detailed WHO guidelines which recommend that indoor noise levels should not exceed 30 dB (average equivalent over 8 hours LA_{eq}) and 45 dB (maximum for an individual noise event), and outdoor sound levels in residential areas during day time (7am-10pm) should not exceed 55 dB LA_{eq}.

7. IFC also provide noise standards as shown in the table below. These compare to the WHO standards.

Table 27: IFC Noise Standards

	Maximum allowable noise limit (hourly measurement), 1hr LA_{eq} in dB(A)	
Standard	**Day** (07:00-22:00)	**Night** (22:00-07:00)
IFC Guideline: Industrial/ Commercial	70	70
IFC Guideline: Residential/ Institutional/ Educational	55	45
MNS 4585:2007	60	45

8. For construction noise, IFC EDS Guideline: Occupational health and safety standards indicates 85dB (Equivalent level LAeq,8d) 110dB (Maximum LAmax, fast).

9. **Soil**. The soil quality standard of Mongolia is presented in Table 28. No comparable standard identified in the IFC EDS guideline or by WHO.

Table 28: Soil Quality Standards MNS 5850:2008

Parameter	MNS 5850 :2008			
	Soil Mechanical Composition			Maximum Acceptable Amount
	Clay	Loamy	Sandy	
Pb	100	70	50	100
Cd	3	1.5	1	3
Hg	2	1	0.5	2
As	6	4	2	6
Cr	150	100	60	150
Cr^{6+}	4	3	2	4
Sn	50	40	30	50
Sr	800	700	600	800
V	150	130	100	150
Cu	100	80	60	100
Ni	150	100	60	150
Co	50	40	30	50
Zn	300	150	100	300
Mo	5	3	2	5
Se	10	8	6	10
B	25	20	15	25
F	200	150	100	200
CN	25	15	10	25

10. As for construction noise, IFC EDS Guideline: Occupational health and safety standards indicates 85 (Equivalent level LAeq,8d) 110dB (Maximum LAmax, fast).

Table 29 Noise Standards MNS 4584:2007

	Maximum allowable noise limit (hourly measurement), 1hr LA_{eq} in dB(A)	
Standard	**Day** (07:00-22:00)	**Night** (22:00-07:00)
IFC Guideline: Industrial/ Commercial	70	70
IFC Guideline: Residential/ Institutional/ Educational	55	45
MNS 4585:2007	60	45

APPENDIX 3: ENVIRONMENTAL MANAGEMENT PLAN

See separate document.