

1. INTRODUCTION

1.1 Introduction to the Project

Amur Gas Processing Plant (AGPP) will be constructed in the Far Eastern Federal District of Russia, in the Svobodnensky District of the Amur region (Figure 1.1). It will be the largest gas processing plant in Russia and one of the largest in the world. The design capacity of the plant will be up to 42 billion cubic meters of gas a year. The commissioning of the plant is scheduled for 2021.



Figure 1.1: AGPP Location¹

Amur GPP is necessary for the processing of multi-component natural gas transported over the “Power of Siberia” gas transmission system from the Yakutsk and Irkutsk gas production hubs, created by PJSC Gazprom as part of the implementation of the Eastern Gas Programme (EGP). This Report focuses on the construction and operation of Amur GPP only and does not address any issues related to gas fields or the “Power of Siberia” gas pipeline system.

The commercial gas products produced by the Amur GPP include methane, ethane, propane, butane and the pentane-hexane fraction. The annual 2.5 million-ton production of ethane will be utilized by Sibur Holding to produce polyethylene at their nearest deep hydrocarbon conversion plant. It is anticipated that the purified methane will be exported to China. The Amur GPP will also include the world's largest helium production facility with a capacity of up to 60 million cubic meters per year. AGPP will process multi-component natural gas while the Gazprom Export company will perform all marketing operations in relation to its products. The organizational structure for the AGPP construction project is shown in Figure 1.2 below.

¹<http://www.gazprom.com/press/news/2016/april/article271729/>

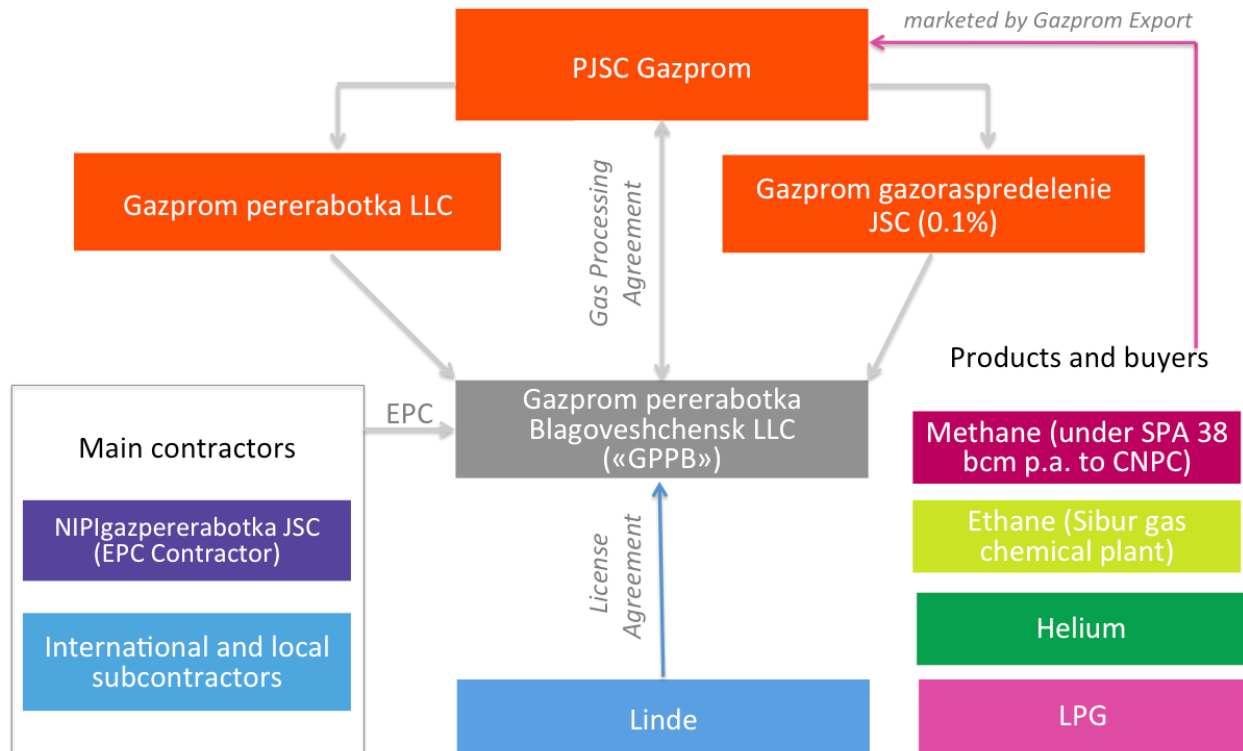


Figure 1.2: AGPP organizational structure

Gazprom pererabotka and Gazprom gazoraspedlenie established Gazprom pererabotka Blagoveshchensk (GPPB or the Company), which is a specialized company for the implementation of the Amur GPP Project. GPPB and NIPIgazpererabotka (NIPIGAZ is an entity within the Sibur group of companies) obtained approval to set up a partnership to design, coordinate deliveries of equipment and materials for and manage construction of AGPP. NIPIGAZ will act as the general contractor responsible for the Project implementation.

Linde AG (Germany) will supply process equipment for AGPP, including engineering services and delivery of units for ethane and natural gas liquids extraction and nitrogen rejection, as well as for helium purification, liquefaction, and storage. Peton, a technical and engineering holding company, has been engaged to adopt Linde's technologies under the import replacement program.

As part of the Project, Peton will open a center for the advanced training of process management and helium production plant staff. The training center will receive state-of-the-art equipment.

1.2 Project region overview

The Amur Region is located in the southeast of the Russian Federation (RF), in the temperate zone, between 48°51' and 57°04' North, and 119°39' and 134°55' East, and is a part of the Far East Federal District. The Region borders the Zabaikalsky Krai in the west, the Republic of Sakha (Yakutia) in the north, and the Khabarovsk Krai and Jewish Autonomous Region in the east. Total length of the border comprises nearly 1,250 km and the Region's area is 361,900 km². The Region's administrative center is Blagoveshchensk, a city located 7,985 km from Moscow by rail or 6,480 km by air. The Amur Region has no direct sea access. The cold Sea of Okhotsk is located a mere 150 km from its north-eastern part, and 500-600 km from its central parts. It is located 600-800 km from the warm Sea of Japan (Figure 1.3).

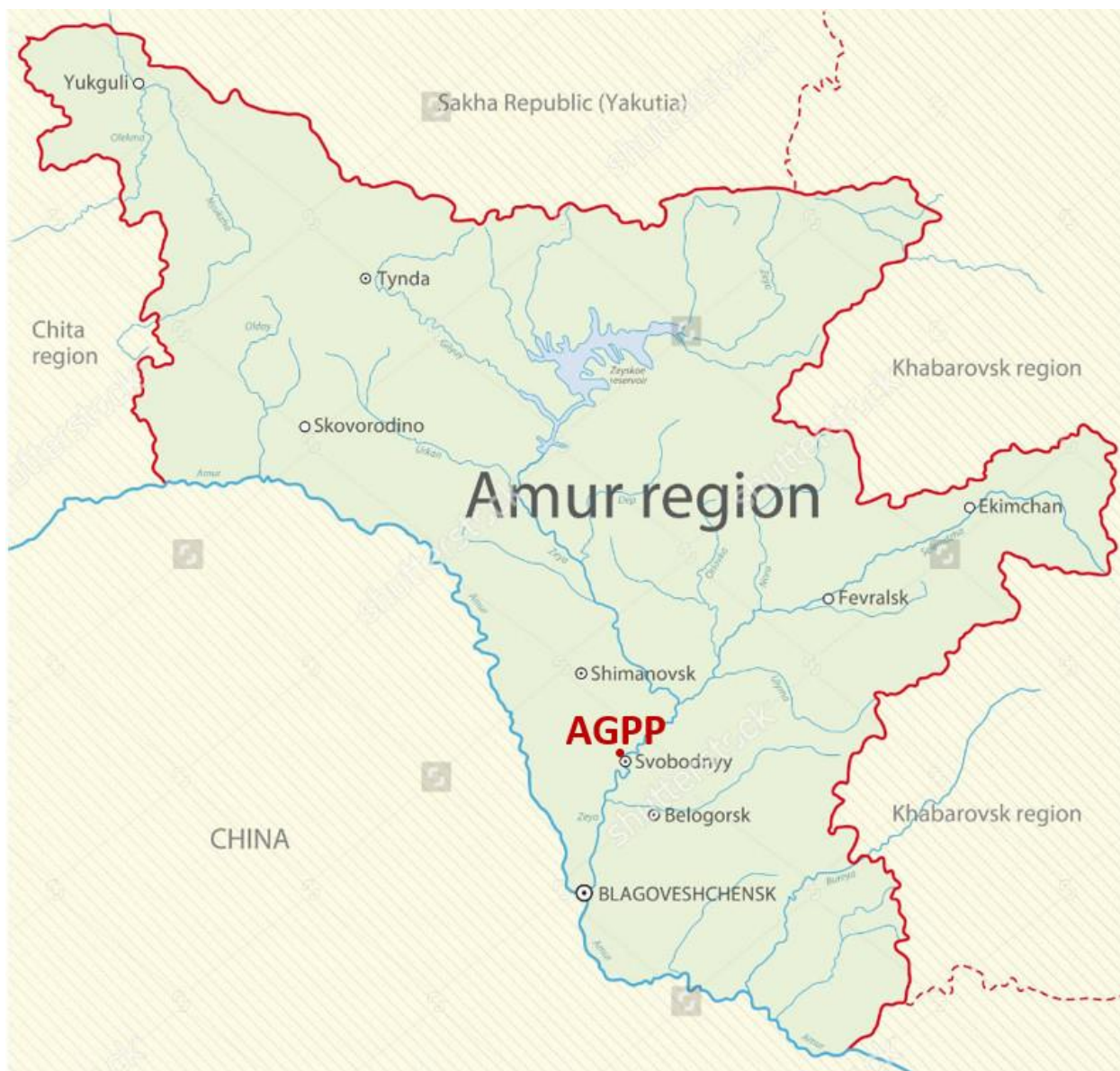


Figure 1.3: Amur Region physiographic map (scale 1:4 000 000)

According to the Federal Service for State Statistics (Rosstat) data the number of the region's population is 809,873² (2015). The population density is 2.24 persons per km² (2015). Urban population makes up 67.27 % (2015)². The region's administrative center is the city of Blagoveshchensk which accounts for nearly a quarter of the region's entire population.

The Project site is located in the southwest of the Amur region, 10-15 km from the administrative center Svobodnyy on the right bank of the River Zeya (the Amur's left tributary), 146 km from Blagoveshchensk. The Trans-Siberian Railway passes 2 km west of the AGPP site. Federal Highway M-58 "Amur" runs 9 km due northeast of the site. The distance from the AGPP site to the federal route M-58 is approximately 25 km by road.

1.3 Project location

The AGPP Project site is located in the Svobodnensky Administrative District of the Amurskaya Region at a distance 10-15 km (or about 22 km by road) from the town of Svobodny³ (Figure 1.4).

² Estimated permanent population as of January 1, 2015 and the 2014 average (published March 17, 2015). Rosstat. <http://www.gks.ru/>

³ The Project site GPS coordinates: 51°32'11"N 128°10'55"E.

The distances from the AGPP Project site to other nearby settlements are as follows:

- Yukhta settlement – 2.3 km;
- Garden/Vegetable allotments of the Yukhta settlement – 1.7 km;
- Tchernigovka village – 7.14 km; and
- Dmitrievka village – 2.9 km.

The AGPP Project site is located in 10-15 km (or about 30 km by the R-297 'Amur' motorway) from the Zeya River and about 45 km from the Svobodny port, at the crossroads of the following transnational and transregional transport corridors:

- The nearest airports are located near Blagoveshchensk and Svobodny.
- There are four river ports (Blagoveshchensky, Svobodnensky, Poyarkovsky, and Zeisky), which allow for the transportation of goods to/from China.
- The Trans-Siberian Railway is 2-5 km to the west to the Project site.
- The Federal motorway R-297 ("Amur") is passing about 7-8 km northeast to the Project site. The distance by road between the Project site and R-297 is 23 km.

A temporary jetty will be constructed on the right bank of the Zeya River for the transfer of oversized cargos during the plant construction period (6 km from Tchernigivka village near the point where the River Gashchenka falls into the Zeya River).

The gas supply to AGPP is anticipated to be by two underground pipelines connecting the plant to the "Power of Siberia" pipeline located at a distance of 2.3 km from the Project site. The processed gas (methane fraction) will be returned to the compression station KS-7a "Zeiskaya" by two underground pipelines and exported to China over the "Power of Siberia" pipeline.

The Project site is located next to the planned development of the Sibur's deep hydrocarbon conversion plant, which would start utilizing ethane produced by AGPP by 2022. An aerial photograph of the Project site area is presented in Figure 1.4.



Figure 1.4: Satellite map of the Project location

The Project will include sites designated as main activities (gas processing and helium complex) and auxiliary activities (water intake and wastewater treatment facilities, railroad facilities). A residential area (microdistrict) in the town of Svobodny is planned to accommodate Project personnel and their families. The siting of the residential area has taken into account the location of the “Power of Siberia” pipeline system, existing railway lines and roads, as well as topographic, geological, and hydrological features of the area. The following is a summary of the planned and existing facilities or features surrounding in the Amur GPP:

- The town of Svobodny is located 13 km to the north;
- Underground water intake facility site is located 870 m to the west;
- Solid domestic and industrial waste Landfill site lies 8.1 km to the southeast;
- Zavodskaya-1 railway station is located 600 m to the southeast; and
- Zavodskaya-2 railway station is parallel to the “Ust-Pera” railway public station in close proximity to it.

1.4 Environmental and social requirements applicable to the Project

The Company is seeking to procure long-term project financing for the Project and the development and operations stages. Funding is expected to be raised from Export Credit Agencies (“ECAs”), commercial banks (“Banks”), capital markets (including bond underwriters and bond investors), and other prospective lending institutions (collectively, the “Lenders” or “AGPP Lenders”). In line with this financing strategy, the Project is being developed in compliance with the following environmental and social requirements (see Chapter 2 for further details):

- Russian law, codes and standards;
- All applicable international laws and conventions to which the RF is a signatory and which have been ratified into law in the RF; and
- Applicable international Lender requirements, including:
 - The Equator Principles (2013);
 - The Organization for Economic Cooperation and Development (OECD) Common Approaches (2012);
 - The International Financial Corporation (IFC) Performance Standards (January 2012);
 - The World Bank/IFC Environmental, Health and Safety (EHS) Guidelines (April 2007) including without limitation the General EHS guidelines and applicable Industry Sector Guidelines;
 - The European Bank for Reconstruction and Development (EBRD) Performance Requirements as defined in the EBRD Environmental and Social Policy (2014);
 - The Asian Infrastructure Investment Bank (AIIB) Environmental and Social standards; and
 - Japan Bank for International Cooperation (JBIC) Guidelines for Confirmation of Environmental and Social Considerations (2012)

The Project performance will be assessed against the standards, including those provided within the above national and international environmental and social requirements. A summary of the Project standards that have been adopted is presented in Appendix 1.

1.5 Objectives and development of the ESIA

This ESIA has been undertaken to identify and assess the potential environmental and social impacts of the Project on the biophysical and human environments and to set out measures to avoid, minimize, mitigate and manage adverse impacts to acceptable levels as defined by Russian regulatory requirements, international good practice and applicable international Lender requirements.

The ESIA incorporates and documents the following processes:

- description of the Project (including definitions of the Funded Project⁴, Associated Facilities⁵ and the Project's Area of Influence (AoI) – see Chapter 4);
- characterization of a detailed environmental and social baseline;
- identification and assessment of potential environmental and social impacts and issues, both adverse and beneficial, associated with the Project;
- documentation of measures adopted to avoid, or where avoidance is not possible, minimize or mitigate and manage adverse environmental and social impacts;
- identification of feasible opportunities for improved environmental and social performance by the Project;
- development of robust management systems that will manage environmental and social performance in an integrated manner across all Project activities and throughout the life of the Project; and
- demonstration of how environmental and social performance will be improved through a dynamic process of performance monitoring and evaluation.

In support of this process, the ESIA documents the engagement by the Project with stakeholders that may be affected by the Project, and summarizes how they have been informed and consulted on matters that could potentially affect them. The ESIA also provides a framework for how the Project aims to maintain a process of meaningful engagement with stakeholders over the life of the Project.

This ESIA builds upon an extensive body of studies and reports that have been prepared for Project design and to meet the RF regulatory requirements. These include a number of environmental survey materials and “environmental protection” dedicated sections of the Project design documentation (further referred as national EIA) covering different Project facilities, that have been prepared as a part of the Russian permitting process. These provide information on existing baseline data, impact assessments, mitigation measures, program of environmental monitoring for changes in all component of the ecosystem, cost estimates for implementation of environmental measures and compensation payments. As such, these materials provide valuable input to the development of the ESIA. These materials have been submitted to and approved by the Russian authorities for Glavgosexpertiza (General Board of State Expert) review (this is a formal expert review under the Russian planning approval process) for creation of the following proposed Project facilities/activities (see also Chapter 4 for a description of the facilities):

- Stage 1. Early works facilities (preparatory works);
- Stage 2. Railway infrastructure;
- Stage 3. Project infrastructure and auxiliary facilities;
- Stage 4. Gas processing plant;
- Stage 5. Housing estate (microdistrict); and
- Stage 6. Solid Domestic and Industrial Waste Landfill.

Some of these stages overlap or run concurrently according to the Project schedule.

The start of AGPP construction was officially announced in October 2015 with the initiation of **Stage 1, Early works facilities**. This involves site clearance and landscaping; building temporary facilities; providing site accommodation for the construction contractors and other Project staff; providing water, heat, power supply, and wastewater treatment equipment, etc. As of April 2016, the Early Works Stage was ongoing with about 82% of the priority activities already carried out. As for December 2016, works on Sub-stage 1 of Stage 1 completed on 100%, works on Sub-stage 2 of Stage 1 – 65 %. As for Sub-stage 3 of Stage 1, competitive procedures on selection of construction contractors are ongoing. This Stage is generally planned for completion in July 2017.

⁴ I.e. the scope of the Project, for which funding from Lenders is sought.

⁵ As defined under the IFC performance Standards – see Chapter 4 for further details

Stage 2, Railway infrastructure and facilities construction has been launched in July 2016. OOO SvyazStroyMontazh (SSM) was awarded a contract to construct the railway track section from the “Ust-Pera” public station of the Trans-Siberian railway to the Project site (about 15 km long). Two rail stations will be built close to the Project site, “Zavodskaya-1” and “Zavodskaya-2”. SSM is carrying out design, preparatory and excavation works; setting up the permanent railway, utility networks and equipment; and erecting associated engineering structures, buildings, and railroad infrastructure facilities.

Stage 3, Auxiliary facilities started in May 2016 and includes construction of the Project infrastructure designed to transport and store over 2.6 million tons of cargo a year. This Stage is including construction of the access roads and bridges. The auxiliary facilities that will be constructed include vehicles parking and repairs workshop, fuel storage and fuelling station, water treatment plant, etc. A temporary jetty will be constructed on the River Zeya for the materials and equipment shipments by the river during the construction stage.

GPPB plans to begin **Stage 4, Gas processing plant** in May 2017 starting with construction of the license units of the first startup complex of AGPP. The first stage of Stage 4 involves construction of two units: C₂H₆ and wide light hydrocarbon fraction (WLHF) (propane, butane, pentane and hexane mixture) extraction and N₂ rejection unit, and a helium production unit⁶, two units of gas drying and purification, gas fractioning unit, WLHF purification and etc. They are scheduled to be commissioned in 2021. Four more such gas processing units will be built further by 2025, i.e. one gas processing line each year.

The design documentation for **Stage 5, Residential area** for the Project staff in Svobodny, and **Stage 6, Solid domestic and industrial waste (SDIW) landfill** has been completed, the construction of the facilities has not commenced.

Scoping and consultation are integral elements of the ESIA development process. Scoping is the process of determining the content and extent of the matters that should be covered in the ESIA and associated documentation. A scoping assessment has been completed for the Project and has been used as the basis for the development of this ESIA. A full description of the scoping assessment is provided in the AGPP Scoping Report (see Appendix 2 to this ESIA).

Engagement with stakeholders is of key importance in ensuring both that stakeholders are provided the opportunity to input to the impact identification, mitigation and monitoring process and that the performance of the Project results in the greatest possible benefits to the community. Initiating the engagement process in the early phases of the Project implementation and ESIA process is necessary to ensure timely public access to all relevant information. To facilitate this process the Company has developed a Stakeholder Engagement Plan (SEP), which has been implemented as part of the ESIA process. A further description of the stakeholder engagement processes is provided in Chapter 5.

This ESIA has been developed as a comprehensive integrated assessment of the AGPP Project, and reflects compliance with international good practice, applicable Russian regulatory requirements, and applicable international Lender requirements.

1.6 Structure of the ESIA

To address the objectives of the ESIA, this Report is structured as follows:

Chapter 1 Introduction (this chapter)

Chapter 2 Legislative and Policy Framework. This chapter provides an overview of the main regional, national and international policy and legal framework, within which the AGPP Project is to be developed and implemented. The overall policy and legal framework in the RF and in the Amurskaya Region are considered, together with an overview of applicable international Lender requirements.

Chapter 3 ESIA Process. This chapter provides an overview of the overall ESIA process and addresses: definitions of key terms; identification of potential environmental and social impacts (through scoping and consultation process); description of the criteria used to

⁶<http://www.gasworld.com/russia-helium-surge-continues-as-linde-contracted-by-gazprom/2009834.article>

determine the significance of impacts for various environmental and social topics; and how mitigation measures are considered within the assessment process.

- Chapter 4** **Project Description.** This chapter describes the Project elements, including descriptions of: the permanent and temporary Project facilities; and the construction, commissioning and operational processes. This chapter also defines the scope of the Project in terms of: the Project AoI; Associated Facilities⁷; and out-of-scope activities/facilities (i.e. activities/facilities that are not to be addressed by the ESIA as they fall outside of the Project's AoI and the Company's control).
- Chapter 5** **Stakeholder Engagement.** This chapter describes the stakeholder engagement process adopted by the Project. It describes the results of consultation activities undertaken to date, including cross-references to where issues raised in the consultation process have been addressed within the ESIA.
- Chapter 6** **Project Alternatives.** This chapter describes the Project development options considered, including the No Project Alternative, and provides a justification for the selection of the preferred Project development option.
- Chapter 7** **Environmental Baseline.** The existing environmental baseline is described and characterised in this chapter.
- Chapter 8** **Social Baseline.** The existing social baseline is described and characterised in this chapter.
- Chapter 9** **Environmental Impacts, Mitigation and Monitoring.** This chapter presents the assessment of potential environmental impacts, including identification of mitigation measures and monitoring requirements. Impacts during each phase of the Project development are assessed on a topic-by-topic basis
- Chapter 10** **Social Impacts, Mitigation and Monitoring.** This chapter presents the assessment of potential social impacts, including identification of mitigation measures and monitoring requirements. Impacts during each phase of the Project development are assessed on a topic-by-topic basis.
- Chapter 11** **Decommissioning.** Potential impacts specifically associated with decommissioning are addressed in this chapter.
- Chapter 12** **Transboundary Impacts.** This chapter considers potential long-range transboundary impacts.
- Chapter 13** **Cumulative Impacts.** This chapter addresses potential cumulative impacts as a result of other third party anthropogenic activities in the region.
- Chapter 14** **Environmental and Social Management.** This chapter describes the approaches to environmental and social management that are adopted in order to ensure that environmental and social performance is managed in an integrated manner across all Project activities and throughout the life of the Project.

⁷ In accordance with IFC Performance Standard, Associated Facilities are those activities and facilities that are not part of the financed project and would not be conducted, built or expanded if the Project was not carried out, and without which the Project would not be viable.

2. LEGISLATIVE AND POLICY FRAMEWORK

2.1 Introduction

This Chapter provides an overview of the regional, national and international policy and legal framework relevant to the Project. Specific standards that were applied to this ESIA are described in more detail in the Project Standards Document, which is provided in Appendix 1.

2.2 National legislation

Requirements for the use and protection of natural resources, the environment, and health and safety are regulated extensively at the national and regional levels in Russia. The Russian Federation RF legislation is represented by the RF Constitution, federal laws, decrees, directives and codes with further amendments at the regional level. Regional legislative and regulatory legal acts and requirements related to the Project are administered by the Amur Region.

2.2.1 Federal government structure

National level government executive authorities (ministries, agencies and services) with regulatory functions in the area of environmental protection and industrial safety relating to the Project include:

- Ministry of Natural Resources and Environment of the Russian Federation (Minprirody);
- Ministry of Construction, Housing and Utilities of the Russian Federation (Minstroy);
- Federal Service On Customers' Rights Protection And Human Well-Being Surveillance (Rospotrebnadzor);
- Russian Federal Service for Environmental, Industrial and Nuclear Supervision (Rostekhnadzor); and
- Russian Federal Fisheries Agency (Rosrybolovstvo).

Minprirody initiates development of norms and regulations in relation to the use of natural resources, rules on economic activities which exert impact on the environment, and performs compliance assurance functions. As part of its responsibilities, Minprirody also coordinates and supervises the activities, within its jurisdiction, of the following state regulatory authorities:

- Federal Service for Hydrometeorology and Environmental Monitoring (Rosgydromet);
- Federal Service for Supervision of Natural Resource Management (Rosprirodnadzor);
- Federal Agency for Water Resources (Rosvodresursy);
- Federal Agency for Subsoil Management (Rosnedra); and
- Federal Agency for Forestry (Rosleskhoz).

The federal services and agencies listed above supervise the implementation of measures on environmental protection and sustainable use of resources and issue licences and permits for activities under their jurisdiction.

Rostekhnadzor is responsible for the supervision of the following activities:

- Safe working practices in relation to the use and protection of subsoil resources;
- Industrial safety (during design, operation, conservation and closure of dangerous industrial facilities of mining and metallurgy industries);
- Safe use of nuclear power;
- Safety of electrical and heating units and networks;
- Safety of hydroelectric facilities at industrial and power generation facilities; and
- Safety in production, storage and use of industrial explosives.

2.2.2 Hierarchy of legislation

The hierarchy of the RF legislation can be summarised as follows:

- **Level 1:** *Federal Laws* are created by the State Duma (the lower house of the Federal Assembly of Russia) and then adopted by the Federal Council of Russia (the upper house of the Federal Assembly of Russia); and
- **Level 2:** *Bylaws* (including three groups):

- **Group 1: Presidential decrees and directives** – In accordance with Article 90 of the RF Constitution, the President can issue decrees and directives. Both decrees and directives are legal acts that are binding in all jurisdictions.
- **Group 2: Acts of the RF Government**– In accordance with Article 114 of the RF Constitution, the powers of government are exercised via acts based on the RF Constitution, Federal Laws, and Presidential decrees and directives. Acts issued by the RF Government are binding throughout the entire territory of the RF; and
- **Group 3: Acts of the Ministries and other executive federal / government agencies** – All environmental protection ministries and agencies have the right to issue legal and regulatory acts within the scope of their competence. Such acts are binding upon any other ministries or agencies, individuals or legal persons, and are issued as orders, resolutions, instructions, rules, provisions, articles and directives.

2.2.3 Federal legislation

There are a number of national regulatory requirements and norms that apply to the Project. The primary Federal regulatory controls relevant to the Project are listed below. More comprehensive details are provided in the Project Standards Document (see Appendix 1).

Environmental Protection

- RF Constitution of 12.12.1993 (as revised on 21.07.2014)
- Federal Law of 10.01.2002 # 7-FZ "Environmental Protection" (as revised on 03.07.2016)
- Federal Law of 27.12.2002 #184- FZ "On Technical Regulations" (as revised on 05.04.2016)
- Federal Law of 04.05.2011 # 99- FZ "On Certain Activities' Licensing" (as revised on 30.12.2015)
- Federal Law of 23.11.1995 # 174- FZ "On Environmental Review" (as revised on 29.12.2015)
- RF Government Decree of 28.09.2015 # 1029 "On endorsement of criteria for enterprises that have negative environmental impact to I, II, III and IV categories"
- Order by Goscomecologia of 16.05.2000 # 372 "On the Regulation on environmental impact assessment of planned economic and other activity in the Russian Federation"

Land Use Planning

- RF Urban Development Code of 29.12.2004 # 190-FZ (as revised on 03.07.2016)
- RF Land Code of 25.10.2001 # 136-FZ (as revised on 03.07.2016)
- Federal Law of 14.03.1995 # 33-FZ "On specially protected natural areas" (as revised on 03.07.2016)
- Federal Law of 21.12.2004 # 172-FZ "On lands' and land plots' reclassification" (as revised on 01.05.2016)
- RF Government Decree of 16.02.2008 # 87 "On the structure of sections of design documentation and requirements to their contents" (as revised on 23.01.2016)
- RF Government Decree of 07.05.2003 # 262 "On adoption of Rules for compensation to owners of land plots, land users and tenants of land plots for damage caused by withdrawal or temporary occupation of land plots, limitation of land owners' rights or by worsening land quality as a result of other persons' activities" (as revised on 31.03.2015)
- RF Government Decree of 23.02.1994 #140 "On land reclamation, removal, storage and sustainable use of the fertile top soil"

Subsoil protection

- Federal Law of 21.02.1992 # 2395-1 "On Subsoil Resources" (as revised on 03.07.2016)

Waste Management

- Federal Law of 24.06.1998 # 89-FZ "On Waste of Production and Consumption" (as revised on 03.07.2016)

Water Resources

- RF Water Code of 03.06.2006 # 74-FZ (as revised on 28.11.2015)

- RF Government Decree of 05.02.2016 # 79-FZ "On approval of Rules on surface water bodies protection"
- RF Government Decree of 11.02.2016 # 94-FZ "On approval of Rules of underground water bodies protection"
- RF Government Decree of 30.12.2006 # 844 "On Procedure for drafting and making a decision on a water body's allocation for use" (as revised on 28.09.2015)
- RF Government Decree of 12.03.2008 # 165 "On Water Use Agreement Preparation and Conclusion" (as revised on 28.09.2015)
- RF Government Decree of 23.07.2007 # 469 "On procedure for adoption of permissible standards of substances' and microorganisms' discharge into water bodies for users of the water bodies" (as revised on 08.06.2011)

Air Quality

- Federal Law # 96-FZ on Air Protection (as revised on 13.07.2015)
- RF Government Decree of 02.03.2000 # 183 "On Maximum Permissible Emissions into the Atmospheric Air and Adverse Physical Impacts" (as revised on 05.06.2013)

Wildlife and Habitats

- Federal Law # 52-FZ "On Animals" (as revised on 03.07.2016)
- RF Forest Code of 04.12.2006 # 200-FZ (as revised on 03.07.2016)
- Federal Law of 20.12.2004 №166-FZ "On fishery and water biological resource conservation" (as revised on 03.07.2016)
- RF Government Decree of 29.04.2013 # 380 "On endorsement of Regulation on measures for conservation of aquatic biological resources and their habitats"
- RF Government Decree of 13.08.1996 # 997 "On endorsing Regulations on the prevention of killing animals due to industrial processes, and due to transport link, pipeline, communications line and power transfer line operations" (as revised on 13.03.2008)

Emergency Response

- Federal Law of # 68-FZ "On the Protection of the Public and Areas against Emergencies of Natural and Technogenic Nature" (as revised on 15.02.2016)
- RF Government Decree of Decision of 15.04.2002 # 240 "On the Procedure of arrangements for oil spills prevention and response at the Russian Federation" (as revised on 14.11.2014)
- RF Government Decree of 14.02.2000 # 128 "On adoption of Provision on disclosure of information on natural environment conditions, its pollution and emergencies of technogenic nature, that did/do/might cause an adverse environmental impact"
- RF Government Decree of 24.03.1997 # 334 "On RF Procedure for collection and exchange of information on public and areas protection from natural and technogenic emergencies" (as revised on 10.09.2013)
- RF Government Decree of 30.12.2003 # 794 "Russian System of Prevention and Response to Emergency Situations" (as revised on 30.11.2016)
- RF Government Directive of 01.03.1993 # 178 "On establishment of local warning systems within potentially hazardous facilities location"
- RF Government Directive of 10.11.1996 #1340 "On procedure for establishment and use of reserves of physical resources for natural and technogenic emergencies response"
- RF Government Directive of 21.05.2007 # 304 "On natural and technogenic emergencies classification" (as revised on 17.05.2011)
- RF Government Directive of 26.08.2013 # 730 "On developing of action plans for localization and elimination of consequences of accidents at hazardous industrial facilities"

Industrial Safety

- Federal Law of 21.07.1997 # 116-FZ "On Industrial Safety of Hazardous Production Sites" (as revised on 02.06.2016)

- Federal Law of 30.12.2009 # 384-FZ "On Building and Structure Safety Technical Standards" (as revised on 02.07.2013)
- Federal Law of 21.12.1994 # 69-FZ "On Fire Safety" (as revised on 23.06.2016)
- Federal Law of 27.07.2010 # 225-FZ "On mandatory insurance of civil liability of a hazardous facility's owner for bringing harm as a result of an emergency at hazardous production facility" (as revised on 23.05.2016)
- RF Government Directive of 10.06.2013 # 492 "On licensing of operating of explosive and chemically hazardous industrial facilities related to I, II and III hazard classes" (as revised on 24.12.2015)
- RF Government Directive of 24.11.1998 # 1371 "On registration of facilities in State register of hazardous facilities" (as revised on 24.12.2015)
- RF Government Directive of 10.03.1999 # 263 "On organisation and implementation industrial control on compliance with the requirements of industrial safety on hazardous industrial facility", (as revised on 30.07.2014)
- RF Government Directive of 11.05.1999 # 526 "On the approval of submission rules for safety declaration of hazardous industrial facilities" (as revised on 21.06.2013)
- Rostekhnadzor Order of 06.11.2013 # 520 "On approval of Federal norms and regulations in the field of industrial safety "Safety requirements for hazardous industrial facilities of the main pipelines"
- Rostekhnadzor Order of 29.11.2005 # 893 "On Approval of the Procedure for the Execution of the Declaration on Industrial Safety of Hazardous Production Facilities and the Incorporated Data List", of 11/29/2005 (as revised on 18.11.2014)
- Rostekhnadzor Order of 11.04.2016 # 144 "On Approval of Safety guidelines "Methodological baseline for hazard analysis and emergency risk assessment at hazardous industrial facilities"
- Rostekhnadzor Order of 25.03.2014 # 116 "On Approval of Industrial safety regulations of hazardous industrial facilities, where equipment working under excess pressure is operated"

Health and Safety

- RF Labour Code of 30.12.2001 # 197-FZ (as revised on 03.07.2016)
- Federal Law of 30.03.1999 # 52-FZ "On Public Sanitation and Epidemiology Welfare" (as revised on 03.07.2016)
- Federal Law of 21.11.2011 # 323-FZ "On Fundamental Principles of Health Protection of the Citizens of the Russian Federation" # (as revised on 03.07.2016)
- Federal Law of 09.01.1996 # 3-FZ "On Radiation Safety" (as revised on 19.07.2011)

Socio-economic development

- RF Government Decree of 28.12.2009 No.2094-r "Socio-economic development strategy for the Far East and Baikal region for the period till 2025"
- RF Government Order No. 2193-r of 28.10.2015 "Concept of development of border areas of the RF entities, included in the Far East federal district"

2.2.4 Amur Region legislation

The main regional laws and regulations of the Amur Region relevant to the Project are given below. Further details are provided in the Project Standards Document (see Appendix 1).

General environmental aspects

- Amur Region Law of 13.12.1995 No.40-OZ (as revised on 30.05.2016) "Statute (organic law) of Amur Region"
- Amur Region Law of 10.11.2005 No.89-OZ (as revised on 17.03.2015) "On protection of the environment of Amur Region"
- Government Resolution of Amur Region of 25.09.2013 No.453 (as revised on 28.06.2016) "On approval of the State Programme "Amur Region Environmental Protection 2014-2020"
- Resolution of the Governor of Amur Region of 01.09.2015 No.222 (as revised on 22.06.2016) "On approval of the Regulation on the Ministry of Natural Resource of Amur Region"
- Government Resolution of Amur Region of 23.04.2012 No. 219 (as revised on 16.10.2015) "On approval of the Procedures of the state environmental control at the regional level in the territory of Amur Region"

Land use planning

- Amur Region Law of 05.12.2006 No.259-O3 (as revised on 05.05.2016) "On regulation of urban development in Amur Region"
- Government Resolution of Amur Region of 30.12.2011 No.985 (as revised on 23.05.2016) "On approval of the Territorial Planning Scheme of Amur Region"
- Government Resolution of Amur Region of 30.12.2011 No.984 "On approval of urban design standards of Amur Region"

Air quality

- Order of the Ministry of Natural Resource of Amur Region of 24.03.2014 No.37-OD "On approval of the Administrative Procedures of the Ministry of Natural Resource of Amur Region for provision of the public service of issuing permits for emission of harmful (polluting) substances from stationary sources located at industrial and other operation sites which are not subject to the state environmental control at the federal level"

Waste management

- Resolution of Svobodnensky District Council of People's Deputies of 18.04.2013 No.9 (as revised on 20.02.2015) "On approval of the Regulation on the scheme for treatment and disposal of household and industrial wastes in the territory of Svobodnensky District Municipality"

Protection of wildlife and habitats

- Amur Region Law of 01.09.2008 No.89-OZ "On protection of rare and endangered species of animals and plants in Amur Region"
- Amur Region Law of 08.12.2003 No.270-OZ (as revised on 03.11.2015) "On fishery and conservation of aquatic biological resources"
- Amur Region Law of 05.07.2010 No.356-OZ "On the list of game resources which may be subject to commercial hunting in the territory of Amur Region"
- Amur Region Law of 07.10.2014 No.417-OZ "On natural reserves in Amur Region"
- Government Resolution of Amur Region of 28.04.2010 No.211a (as revised on 26.09.2014) "On approval of the List of fishery plots in Amur Region".
- Government Resolution of Amur Region of 02.09.2013 No.396 "On approval of Requirements to prevention of loss of wildlife resources related to operation of industrial processes, traffic arteries, pipelines, communication and power transmission lines in the territory of Amur Region"
- Resolution of the Governor of Amur Region of 25.07.2016 No.207 "On approval of hunting limits in Amur Region"
- Resolution of the Governor of Amur Region of 18.02.2008 No.69 (as revised on 11.12.2009) "On the procedure keeping the Red Book of Amur Region"
- Resolution of the G of Amur Region Administration of 24.05.1999 No.299 (as revised on 24.12.2009) "On approval of the Rules for taking wildlife objects which are not classified as being able to be hunted or fished legally and not recorded in the Red Book of the Russian Federation, in the territory of Amur Region"
- Government Resolution of Amur Region of 26.03.2010 No.134 (as revised on 23.09.2010) «On approval of base rates for calculation of fines for damage caused by illegal production or destruction of plants and animals listed in the Red Book of Amur Region"
- Resolution of the Governor of Amur Region of 10.07.2008 No.291 (as revised on 19.02.2016) "On approval of the Regulation on protection, control and regulation of use of wildlife objects and habitats in Amur Region"
- Resolution of the Council of People's Deputies of the town of Svobodny of 10.08.2006 No.111 (as revised on 06.08.2013) "On approval of the Regulation on the procedures for forest management, use, protection, conservation and reproduction of forests in the territory of the Town of Svobodny, Amur Region"

Social environment / communities

- Government Resolution of Amur Region of 25.09.2013 No.444 (as revised on 28.06.2016) "On approval of the State Programme of Amur Region "Development of social protection system for population of Amur Region 2014-2020"

Socio-economic development

- Amur Region Law of 26.12.2000 No.280-OZ "On socio-economic development programmes of Amur Region"
- Amur Region Law of 13.11.2013 No.277-OZ (as revised on 10.06.2015) "Amur Region Socio-economic Development Programme 2013-2017"
- Government Resolution of Amur Region of 14.11.2014 No.679 "On approval of the Investment Strategy of Amur Region for the period till 2018"

Cultural heritage

- Amur Region Law of 11.09.2013 No.223-OZ (as revised on 10.05.2016) "On cultural heritage (historical and cultural monuments) of peoples of the Russian Federation in Amur Region"

Health, safety and security

- Government Resolution of Amur Region of 25.09.2013 No.454 (as revised on 28.06.2016) "On approval of the State Programme of Amur Region "Reduction of risks and mitigation of impacts of natural and man-caused emergency situations, and ensuring community safety in the Region, 2014-2020"
- Amur Region Law of 08.02.2005 No.432-OZ (as revised on 10.05.2016) "On fire safety"
- Amur Region Law of 05.10.1998 No.99-OZ (as revised on 07.03.2014) "On occupational health and safety in Amur Region"

2.3 International treaties and conventions

The RF has ratified a number of international conventions concerned with environmental and social protection, the requirements of which need to be complied with throughout the development of the Project.

A description of the relevant international treaties and conventions is provided in the Project Standards Document (see Appendix 1) and a summary is provided below.

Environmental Impact Assessment

- Convention on Environmental Impact Assessment in a Transboundary Context, 1991 (amended in 2004) (Espoo Convention)⁸.

Water surface quality

- Convention on the Protection and Use of Transboundary Watercourses and International Lakes, Helsinki, 1992 (amended in 2003); and
- Protocol on Water and Health, 1999.

Biodiversity

- Convention on Biological Diversity, 1992;
- Convention on the Protection of Migratory Species, 1979 (Bonn Convention);
- Convention on Wetlands of International Importance Especially on Wildfowl Habitat, 1971 (the Ramsar Convention); and
- Convention on International Trade in Endangered Species of Wild Flora and Fauna, 1973 (CITES).

Air quality and climate change

- United Nations Framework Convention on Climate Change, 1992;
- Kyoto Protocol, 1997;
- Vienna Convention for the Protection of the Ozone Layer, 1988;

⁸ It is noted that at the time of writing this report, the Espoo Convention has not been ratified by the Russian Federation. It should also be noted that this will only be relevant if the Project AoI as identified in the ESIA extends beyond international boundaries.

- Montreal Protocol on Substances that Deplete the Ozone Layer, 1989; and
- Sofia Protocol on the Control of Emissions of Nitrogen Oxides or their Transboundary Fluxes, 1988.

Waste

- Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, 1989 (Basel Convention).

Industrial safety

- Convention on the Transboundary Effects of Industrial Accidents, 1992 (amended in 2008).

Stakeholder Engagement

- Convention on Access to Information, Public Participation in decision making and Access to Justice in Environmental Matters, 1998 (Aarhus Convention)⁹.

Cultural Heritage

- Convention Concerning the Protection of the World Cultural and Natural Heritage, 1972; and
- Convention for the Safeguarding of the Intangible Cultural Heritage, 2003.

Community and workforce

- International Labor Organisation (ILO) conventions including the core conventions protecting workers' rights and the UN conventions protecting the rights of the child and of migrant workers:
- ILO Convention 87 on Freedom of Association and Protection of the Right to Organize;
- ILO Convention 98 on the Right to Organize and Collective Bargaining;
- ILO Convention 29 on Forced Labour;
- ILO Convention 105 on the Abolition of Forced Labour;
- ILO Convention 138 on Minimum Age (of Employment);
- ILO Convention 182 on the Worst Forms of Child Labour;
- ILO Convention 100 on Equal Remuneration;
- ILO Convention 111 on Discrimination (Employment and Occupation);
- ILO Convention 169 on Indigenous and Tribal Peoples;
- UN Convention on the Rights of the Child, and specifically Article 32.1(10); and
- UN Convention on the Protection of the Rights of all Migrant Workers and Members of their Families.

Human Rights

- The International Bill of Human Rights, 1948.

Bilateral agreements

- Agreement between the Government of the Russian Federation and the Government of the People's Republic of China on cooperation in the sphere of environmental protection (27 May 1994, Beijing);
- Agreement between the Government of the Russian Federation and the Government of the People's Republic of China on rational use and protection of transboundary waters (29 February 2008, Beijing); and
- Agreement between the Government of the Russian Federation and the Government of the People's Republic of China on cooperation in the sphere of protection, control and reproduction of aquatic life resources in the transboundary waters of the Amur River and Ussuri River (27 May 1994, Beijing).

⁹ It is noted that at the time of writing this report, the Aarhus Convention has not been ratified by the Russian Federation.

¹⁰ Article 32.1 of the Convention requires that States Parties recognise the right of the child to be protected from economic exploitation and from performing any work that is likely to be hazardous or to interfere with the child's education, or to be harmful to the child's health or physical, mental, spiritual, moral or social development.

2.4 International Financial Institutions Requirements

The Project is being developed in accordance with the following International Financial Institutions (IFIs) standards:

- The IFC Performance Standards (2012)¹¹;
- The Equator Principles (2013)¹²;
- The OECD Common Approaches (2016)¹³;
- The World Bank/IFC EHS Guidelines (2007) including the General EHS guidelines and applicable Industry Sector Guidelines¹⁴;
- The EBRD Performance Requirements as defined in the EBRD Environmental and Social Policy (2014)¹⁵;
- The AIIB standards as defined in the AIIB environmental and social framework; and
- JBIC Guidelines for Confirmation of Environmental and Social Considerations (2012)¹⁶.

Detail description of each of these standards is given in the Project Standards Document (Appendix 1).

2.5 Corporate policy and standards

The GPPB corporate policy in relation to environmental protection and occupational health and safety is in line with the common corporate policies of PJSC Gazprom and consists of the following:

- Environmental Policy 2015. The revised Environmental Policy defines some additional commitments to minimize the risks related to negative environmental impacts, including impacts on vulnerable natural objects and objects that are of importance in terms of conservation and protection; and
- Occupational Health and Safety Policy (approved by Order of PJSC Gazprom of 29 July 2009 No.235, as amended by Order of PJSC Gazprom of 23 July 2014 No.351).

The content of the Policies above is provided in Appendix 1 (Project Standards).

PJSC Gazprom developed and adopted a number of corporate sectoral standards and guideline documents in the sphere of environmental and social safety and occupational health and safety which should be taken into account at development and implementation of the Project, including the following documents:

R Gazprom 2-1.19-542-2011. Protection of atmospheric air at design of compressor stations and line sections of gas mains.

R Gazprom 12-1-003-2013. Guideline methodology for assessment of environmental impacts of facilities of OJSC Gazprom.

STO Gazprom 2-1.19-200-2008. Methodology for definition of regional transformation rates of nitrogen oxides on the basis of estimations and experimental data.

STO Gazprom 2-1.19-307-2009. Instruction on calculation of volumes of emissions, discharges and industrial wastes at gas transportation and storage facilities.

STO Gazprom 2-1.19-332-2009. Technical emission standards. Gas compressor units of OJSC Gazprom.

STO Gazprom 2-1.19-540-2011. Regulation of pollution emissions at production, transportation and storage of gas.

STO Gazprom 2-1.19-541-2011. Accounting of gross pollution emissions from combustion processes in gas-turbine-engined gas compressor units.

STO Gazprom 12-0-001-2013. Environmental regulations. Fundamental provisions.

STO Gazprom 12-3-002-2013. Design development for industrial environmental monitoring systems.

¹¹ http://www.ifc.org/wps/wcm/connect/115482804a0255db96fbfd1a5d13d27/PS_English_2012_Full-Documents.pdf?MOD=AJPERES

¹² <http://www.equator-principles.com/index.php/ep3/ep3>

¹³ <http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=TAD/ECG%282016%293&doclanguage=en>

¹⁴ Currently under revision:

http://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/ifc+sustainability/our+approach/risk+management/ehs_guidelines_technical_revision

¹⁵ <http://www.ebrd.com/who-we-are/our-values/environmental-and-social-policy/performance-requirements.html%20>

¹⁶ <http://www.jbic.go.jp/en/efforts/environment/confirm>

Methodology for calculation of long-term mean concentrations of pollution emissions (Addendum to OND-86).

R Gazprom 2-1.10-790-2014. Water and wastewater treatment plants. General technical requirements.

R Gazprom 2-1.10-801-2014. Operation organization for equipment and structures of water supply and wastewater disposal facilities.

R Gazprom 2-1.10-804-2014. Operation organization for equipment and structures of water treatment facilities.

R Gazprom 12-1-016-2015. Safe development concept for license areas located in specially protected territories.

STO Gazprom 2-1.19-630-2012. Design development for sanitary protection zones of operational sites of OJSC Gazprom.

STO Gazprom 12-1-019-2015. Environmental regulations. Planning. Environmental aspects identification procedure.

R Gazprom 12-2-020-2015. Environmental regulations. Typical schemes for disposal of industrial and domestic wastes from gas processing facilities.

2.6 Project Standards

Where Russian regulations on environmental protection and/or the requirements of international conventions differ from the relevant levels and measures presented in the applicable IFIs standards, the Project has applied the most stringent standard, unless the most stringent standard breaches the RF law or there is a strong justification to deviate from the most stringent standard. Specific Project standards applied are given in the Project Standards Document (Appendix 1).

3. ESIA PROCESS

3.1 Introduction

This section provides an overview of the overall ESIA process and addresses:

- Definitions of key terms (Section 3.2);
- Identification of potential environmental and social impacts through scoping and consultation process (Section 3.3);
- Description of the criteria used to determine the significance of impacts for various environmental and social topics (Sections 3.4 and 3.5).
- The approach to cumulative impacts (Section 3.6, with a detailed description provided in Chapter 13).
- Consideration of mitigation measures in the assessment process (Section 3.7).

3.2 Definition of terms

Definitions of key terms used in this section are provided below.

- A Project **phase** is a series of related activities, which together form a distinct stage in the life of the Project. Four phases are considered in the ESIA as follows (although for simplicity these may be combined in some sections of the ESIA where appropriate):
 - Construction
 - Commissioning
 - Operation
 - Decommissioning
- Environmental and social **receptors** are those elements of the environment and/or human society that may be affected by the Project.
- Environmental and social **impacts** are changes on environmental and/or social receptors that occur as a consequence of the Project. Impacts to individual receptors may be either **adverse** (having a detrimental/negative effect on a receptor) or **beneficial** (having an advantageous/positive effect on a receptor). Different types of environmental and social impacts are defined in terms of the following:
 - **Duration.** The precise definition of the 'duration' of impacts is dependent on the nature of the impact and the receptor of the impact, and includes both the period over which the source of impact occurs and also, for reversible impacts, the period over which recovery may occur (see also 'reversibility' below). Generic terms are used in Section 3.4 based on the qualitative descriptions below. More specific definitions are provided where appropriate on a topic-specific basis in the tables presented in Section 3.5.
 - **Short-term** impacts are predicted to last only for a limited period (e.g. during the period of a certain limited duration construction activity) but will cease either on completion of the activity or rapidly afterwards as a result of mitigation/reinstatement measures and/or natural recovery.
 - **Medium-term** impacts are predicted to last for a moderate period. Examples include impacts during the period of extended construction activities or impacts during limited duration activities but which extend for a moderate period after the completion of that activity.
 - **Long-term** impacts are predicted to continue over an extended period, (e.g. noise from operation of a development, impacts from operational discharges or emissions). These include impacts that may be intermittent or repeated rather than continuous if they occur over an extended time period (e.g. repeated seasonal disturbance of

species as a result of well operations, impacts resulting from annual maintenance activities).

- **Extent.** The precise definition of the 'extent' of impacts is dependent on the nature of the impact and the receptor of the impact. Generic terms are used in Section 3.4 based on the qualitative descriptions below. More specific definitions are provided where appropriate on a topic-specific basis in the tables presented in Section 3.5. The extent of the impacts depends on operating mode (routine mode, non-routine situations and emergencies) and is characterized by indicators such as surface of affected area, impact magnitude and depth, affected population).
 - **Local:** impacts that affect environmental or social receptors in areas localised to the source of impact and typically within the Project Area.
 - **Regional:** impacts that affect regionally environmental or social receptors or are felt at a regional scale as determined by administrative boundaries (within Amur Region).
 - **National:** impacts that affect nationally important environmental and or social resources or are felt at a national scale.
 - **International:** impacts that affect internationally important environmental and social receptors/ resources, such as areas protected by International Conventions or else are felt at an international scale.
- **Irreversible** impacts are defined as those impacts that cause a permanent change in the affected receptor.
- **Reversible** impacts are those impacts that can be reversed back to pre-existing conditions as a result of mitigation/reinstatement measures and/or natural recovery. The periods over which impacts may reverse/recover are a key link to the duration over which an impact is felt (see 'duration' above).
- Where an environmental/social **impact** is not certain to occur (e.g. due to the inherent stochastic nature of the potential impacts from routine/planned activities, or where impacts are associated with unplanned/emergency events), the significance of the impact **risk** is a function of the **likelihood** that it occurs and the **severity** of the impact should it occur.
- **Residual impacts.** Impacts are assessed both on the basis of mitigation and best practice that have been incorporated into the Project design prior to the ESIA development and also after the consideration of any additional mitigation or enhancement measures (the **Residual Impacts**).
- **Cumulative impacts.** Those impacts that result from the incremental impact of the Project when added to other existing, planned, and/or reasonably predictable future projects and developments that are not be directly associated with the Project.
- **Area of Influence.** AoI includes areas both directly and indirectly affected by the Project within and beyond the Project license area. Further definition of the AoI is provided in Chapters 4, 7, 8 and 13.

3.3 Scoping and consultation

Scoping is the process of determining the content and extent of the matters that should be covered in the ESIA and associated documentation. The scoping process aims to identify the types of environmental and social impacts to be investigated and reported in the ESIA, and to identify those aspects that are of potentially greatest significance. The primary methods for identification of potential environmental and social impacts are through:

- Review of existing project assessments and information.
- Stakeholder Engagement. Engagement with stakeholders is of key importance in ensuring that stakeholders are provided the opportunity to input to the impact identification, mitigation and monitoring process and that the Project results in the greatest possible benefits to the community. Initiating the engagement process early in the Project phases is necessary to ensure timely public

access to all relevant information. A further description of the stakeholder engagement processes for the Project is provided in Chapter 5.

- ‘Source-Pathway-Receptor’ Analysis. Identification of potentially significant environmental and social impacts is also undertaken through a structured consideration of the potential sources of impact, the pathways through impacts may affect the environment and humans (e.g. transport of emissions/discharges through the environment) and the nature of receptors (e.g. humans, flora and fauna etc.) that may be impacted. These structured approaches include interaction with design engineers.

A description of the scoping assessment is provided in Section 1.5 of this ESIA Report.

3.4 Significance criteria overview

The ESIA adopted an approach to categorize impacts by significance, which is commonly used in preparation of large project ESIAs, making use of quantitative criteria where available and where not available using qualitative criteria and expert judgement.

It is important that impacts are described consistently throughout the ESIA Report and therefore the terminology used in the remainder of this section is used throughout the Report in the assessment of impact significance.

In order to describe whether an impact is positive or negative, the following terminology has been used:

Adverse – refers to a detrimental/negative effect on a receptor.

Beneficial – refers to an advantageous/positive effect on a receptor.

A standardised approach to impact assessment allows potential impacts to be categorised consistently across all aspects. This approach is applied to the assessment of impacts in all phases of the Project (i.e. construction, commissioning, operation and decommissioning).

3.4.1 Known/certain impacts

Where impacts are certain to occur and the extent of such impacts can be reasonably predicted (for example in relation to routine and/or planned events with reasonably predictable consequences), the significance is defined by the assessed severity of that impact.

Severity: Severity is dependent upon the magnitude of the impact for example in terms of the duration (long, medium, short term), the extent (site, local, regional, national) and reversibility (reversible, irreversible) as well as on the sensitivity of the receptor (as a resource and/or to the change or impact).

Table 3.1 below details high-level generic severity criteria for negative impacts. The generic criteria below are by necessity qualitative in nature as they are intended to cover a wide range of different environmental and social aspects. However, where appropriate, these qualitative generic criteria are supplemented by more detailed and quantitative criteria that are presented on a topic-by-topic basis in Section 3.5.

Table 3.1: Generic (Qualitative) Severity Criteria

None/Negligible	No discernible impact – Effects are non-existent or the impact of a particular activity is deemed to be ‘negligible’ or ‘imperceptible’ and is essentially indistinguishable from natural background variations.
Low	<p>Slight effects, well within Project Standards¹⁷.</p> <p>Duration: short term</p> <p>Extent: localised to immediate area</p> <p>Reversibility: reversible</p>

¹⁷ The Project Standards are as defined in the Project Standards Document and as summarised in Section 2 of this ESIA.

	Sensitivity of the receptor: low sensitivity/value ¹⁸ .
Moderate	<p>Noticeable effect but still within Project Standards.</p> <p>Duration: short-term (moderate receptor sensitivity/value), medium term (low receptor sensitivity/value)</p> <p>Extent³: local (moderate receptor sensitivity/value) or regional (low receptor sensitivity/value)</p> <p>Reversibility: reversible</p> <p>Sensitivity of the receptor: see duration and extent above.</p>
High	<p>Considerable effect and/or repeated breach of regulatory/project limits.</p> <p>Duration¹⁹: medium to long term (moderate to low value receptors), short-term (high value receptors, protected habitats/species)</p> <p>Extent³: local (high receptor sensitivity/value, protected habitats/species) or regional (moderate receptor sensitivity/value)</p> <p>Reversibility: reversible (moderate/high value receptors), or irreversible (low value receptors or localised moderate/high value receptors/habitats)</p> <p>Sensitivity of the receptor: see duration, extent and reversibility above.</p>

Where positive impacts are envisaged, these are identified as being 'beneficial' and the nature of the benefit will be described, although the scale of benefit will not be assigned a specific significance level. In the case of assessment of compensation or offsets, for example in relation to socio-economic or biodiversity impacts, a detailed and bespoke analysis of the overall effectiveness of the compensation/offset will be undertaken.

3.4.2 Uncertain impacts and risks

Where an impact is not certain to occur (e.g. due to the inherent stochastic nature of the potential impacts from routine/planned activities, or else where impacts are associated with unplanned/emergency events), the significance of the impact **risk** is a function of the **likelihood** that it occurs and the **severity** of the impact should it occur. Table 3.2 below provides a description of the likelihood categories applied in this ESIA. These are set and do not vary according to impact type.

Table 3.2: Likelihood criteria

Probable	Events that are known to occur within the specific industry and likely to occur on multiple occasions with frequency over once a week. Probability of occurrence – more than 50%.
Possible	Known to occur periodically within specific industry and reasonably foreseeable to occur once during the design lifetime of the Project. Probability of an occurrence – less than 50%.
Unlikely	Known to occur rarely in specific industry or periodically within wider industry. Realistically feasible but unlikely to occur during the design lifetime of project. Probability of occurrence – less than 10%.
Improbable	Rarely heard of within wider industry and extremely unlikely to occur during the design lifetime of the Project. Probability of occurrence – less than 1%.

¹⁸ For example, low sensitivity might refer to an abundant common species where the Project would not result in any local or regional threat to population numbers. The sensitivities of specific receptors are further described in the baseline characterisation section of the ESIA.

¹⁹ The precise definition of the 'duration' and 'extent' of impacts is dependent on the nature of the impact and the sensitivity of the receptor. Generic terms are therefore used in this qualitative table, but more specific definitions are provided where appropriate in the topic-specific tables presented in Section 3.5.

The significance of the overall impact risk is then determined using the following risk matrix.

Likelihood of impact	Severity of impacts				
	Negligible	Low	Moderate	High	Major
Probable	Negligible	Low	Moderate	High	Major
Possible	Negligible	Negligible	Low	Moderate	High
Unlikely	Negligible	Negligible	Negligible	Low	Moderate
Improbable	Negligible	Negligible	Negligible	Negligible	Low

3.5 Significance criteria by topic

Significance criteria defining the Impact Severity are defined on a topic-by-topic basis in the following sub-sections. Where topic-specific criteria are not directly applicable, the generic severity criteria in Table 3.1 will be used. The topic-specific criteria tables in the sections below make reference to:

- **Project Standards** are defined within the Project Standards Document (Appendix 1).
- **Receptors.** Specific receptors are identified in the relevant sub-sections of Chapters 7 and 8 (the environmental and social baseline respectively) and Chapters 9 and 10 (environmental and social impacts respectively), including identification of their significance/importance and sensitivity.

3.5.1 Significance of impact – air emissions

The criteria to define the significance of air quality impacts are defined in the Table 3.3 below.

Table 3.3: Criteria to define significance of air quality impacts

Negligible	Low	Moderate	High	Major
Air quality				
Trivial contribution (<1%/non-measurable) to background concentrations predicted at locations outside of the boundary of the Project assets/facilities ²⁰	<p>Concentrations (including background concentrations) at nearest sensitive receptor well within (<50%) Project Standards.</p> <p>Concentrations (including background concentrations) at offsite locations (i.e. outside of the Project facility/asset boundaries) without sensitive receptors approaching but within (50 - 100%) Project Standards.</p> <p>Air quality impacts do not result in the sanitary protection zone (SPZ) extending beyond the Project facility/asset boundaries.</p>	<p>Concentrations (including background concentrations) at nearest receptor approaching but within (50 – 100%) Project Standards.</p> <p>Concentrations (including background concentrations) at offsite locations without sensitive receptors marginally above (<110%) Project Standards.</p> <p>SPZ for air quality purposes extends beyond Project facility/asset boundaries, but does not encompass any sensitive receptors.</p>	<p>Regular (1% of time for short time average period standards) exceedance (including background concentrations) of Project air quality standards at nearest sensitive receptor.</p> <p>SPZ for air quality purposes encompasses sensitive receptors and levels at the receptors with the SPZ may exceed the MPC on a regular basis.</p>	<p>Dominant contribution to long term, severe exceedances of Project air quality standards at nearest sensitive receptor.</p> <p>SPZ for air quality purposes encompasses sensitive receptors and levels at the receptors within the SPZ are expected to exceed the MPC on a long-term basis.</p>

Numeric Project Standards for the air quality pollutants of primary concern are provided in the relevant sections of this ESIA Report.

3.5.2 Significance of impact – topography and soils

The criteria to define the significance of air quality impacts are defined in the Table 3.4 below.

Table 3.4: Criteria to define significance of impacts on topography and soils

Negligible	Low	Moderate	High	Major
Soil erosion (see note 1)				

²⁰ The boundaries of the Project assets/facilities are defined in the Chapter 4 ('Project Description') of the ESIA.

Negligible	Low	Moderate	High	Major
Trivial loss of top soil (too small to be measured). No potential for rills and gullies to be formed.	Some loss of top soil due to erosion expected, but soil erosion expected to occur at the same rate as soil formation. Formation of rills and gullies not anticipated.	Net soil erosion anticipated but some (>50% of) top soil cover retained in affected areas. Formation of rills and gullies likely.	Significant loss of top soil in affected areas, limiting vegetative cover. Retained topsoil <50% of original cover.	Full loss of top soil over an extended area severely restricting/preventing vegetative cover.
Permafrost				
No change in permafrost soils as a result of Project activities	Minor thawing of permafrost in immediate vicinity of foundations/piles/equipment during installation/construction with rapid re-freezing. No long term impacts on permafrost as a result of Project activities.	Permanent/long-duration thawing of permafrost over localised area, not leading to thermokarst, frost heave and thermal erosion.	Permanent/long-duration permafrost degradation over moderate area, leading to minor and localised thermokarst, frost heave and thermal erosion.	Permanent/long-term permafrost degradation over an extended area and for prolonged periods, leading to significant thermokarst, frost heave and thermal erosion.
Soil contamination (see note 2)				
No discernible change in soil/ground baseline conditions. Expert site/pollutant-specific assessment not required.	Change of pollutants' concentration <50% from baseline conditions, but below limiting values. Expert site/pollutant-specific assessment not required. No loss in soil productivity.	Change of pollutants' concentration by 50-100%, but below limiting values. Soil quality may require reinstatement but should naturally recover within 3 years. Expert site/pollutant-specific assessment should be considered in order to prevent escalation of impact.	Significant volume of soil is contaminated exceeding limit values. Expert site/pollutant-specific assessment required to quantify and mitigate impact. Productivity losses predicted to last over 3 years following reinstatement in the absence of mitigation.	Significant volume of soil is heavily contaminated significantly exceeding limit values. Expert site/pollutant-specific assessment required to quantify and mitigate impact. Soil productivity losses predicted to be permanent in the absence of mitigation.
<p>1) 1) The soil erosion criteria apply only areas that will be disturbed and then subsequently reinstated during the construction of the Project. The significance of impacts to soil permanently lost to structures required for the operation of the Project is dealt with in terms of impacts to flora and fauna (see section 3.5.5).</p> <p>2) 2) Generic quantification of impacts is not possible unless assessed using site specific information (i.e. the type of contaminant, its toxicity, the sensitivity of receptors etc.). The given impact criteria are intended to indicate whether expert site/pollutant-specific assessment is required.</p>				

3.5.3 Significance of landscape impacts

Landscape assessment criteria are based on consideration of both the landscape sensitivity and the magnitude of change to the landscape resource.

Landscape sensitivity is defined on a 3-point scales as follows:

- **High Sensitivity:** Highest/very attractive landscape quality with highly valued, designated or unique characteristics susceptible to relatively small changes.
- **Medium Sensitivity:** Good landscape quality with moderately valued characteristics reasonably tolerant of changes.
- **Low Sensitivity:** Ordinary/poor landscape quality with common characteristics capable of absorbing substantial change.

Magnitude of Landscape resource change is defined on a 3-point scale as follows:

- **High Change:** Total, permanent loss or alteration to key elements of the landscape character, which result in fundamental change.
- **Medium Change:** (a) Permanent partial/noticeable loss of elements of the landscape character; or (b) Temporary (<3 years) loss or alteration to key elements of the landscape character, which result in fundamental change
- **Low Change:** Minor alteration to elements of the landscape character.

The significance of impacts on landscape is then assessed as follows (Table 3.5):

Table 3.5: Landscape impact significance

Magnitude of landscape resource change	Landscape Sensitivity		
	Low Sensitivity	Medium Sensitivity	High Sensitivity
No change	Negligible	Negligible	Negligible
Low change	Negligible	Low	Moderate
Medium change	Low	Moderate	High
High Change	Moderate	High	Major

3.5.4 Significance of impact on surface water resources

The criteria to define the significance of impacts on surface water resources are defined in the Table 3.6 below.

Table 3.6: Criteria to define the significance of impacts on surface water resources

Negligible	Low	Moderate	High	Major
Freshwater quality				
No discernible change in baseline concentration in receiving water bodies.	Effluent discharges within discharge limits. No discernible impacts to water quality or ecology.	Effluent discharges occasionally (\leq once per year and/or \leq 10% of the time of operation) breach discharge limits, but receiving waters have rapid dilution capacity. Some limited impact to aquatic organisms likely (as defined under Section 3.5.5).	Repeated (\leq 5 incidents per year and/or \leq 20% of time of operation) breach of effluent discharge and/or Occasional (\leq once per year and/or \leq 10% of the time of operation) breach where receiving waters have a poor dilution capacity and/or water quality Project Standards (at the edge of mixing zone) are exceeded, significantly affecting aquatic organisms (as defined under Section 3.5.5).	Persistent breach of effluent discharge limits and/or water quality Project Standards (at edge of mixing zone).

Numeric Project Standards for the pollutants of primary concern are provided in the Project Standards Document (see Appendix 1).

3.5.5 Significance of impacts on flora and fauna

The criteria to define the significance of impacts on flora and fauna are defined in the Table 3.7 below.

Table 3.7: Criteria to define the significance of impacts on flora and fauna

Negligible	Low	Moderate	High	Major
Ecological impact				
Insignificant impact on habitats integrity – no fragmentation or physical impact.	<p>Slight effects over a localised area (up to 10 ha) affecting low value habitat.</p> <p>No fragmentation, No discernible change in behaviour</p> <p>Full recovery expected to occur shortly (<1 year) after impacts cease.</p>	<p>Noticeable effect on integrity of:</p> <ul style="list-style-type: none"> Localised area (up to 10 ha) of moderate sensitivity/importance habitat Wider area (10-25 ha) of low value/sensitivity habitats <p>Species abundance/ distribution may be affected but no threat to the integrity of the population.</p> <p>Full recovery expected to within 5 years after impacts cease.</p>	<p>Noticeable impact on integrity of:</p> <ul style="list-style-type: none"> Locally valuable habitat, or loss of habitats between 25-50 ha. Low value habitat or loss of habitats > 50 ha <p>Long term decline in local population abundance of low value species distribution taking several generations (of affected species) and >5 years to recover.</p> <p>Short-term decline in population abundance of moderate or high value species distribution taking several generations (of affected species) and <5 years to recover.</p>	Reduction of nationally or internationally protected habitats and species, or loss of habitat over 50 ha.

3.5.6 *Significance of impact – noise*

The criteria to define the significance of noise impacts are defined in the Table 3.8 below.

Table 3.8: Criteria to define the significance of noise impacts

Negligible	Low	Moderate	High	Major
Noise				
Noise levels remain at or close to ambient levels that are imperceptible to receptors.	Noise level increases detectable but remain below Project Standards. Increase at sensitive receptors <5dB above ambient background levels. Little or no adverse effect on sensitive receptors anticipated.	Noise levels at sensitive receptors occasionally exceed Project Standards during exceptional events. Increase in noise levels at sensitive receptors 6 to 10dB above background. Moderate impacts to fauna as defined in Section 3.5.5.	Noise levels at sensitive receptors repeatedly exceed Project Standards. Increase in noise levels at sensitive receptors 11 to 15dB above background. High impacts to fauna as defined in Section 3.5.5.	Long term or continuous exceedances of Project Standards at sensitive receptors. Increase in noise levels at sensitive receptors >15dB above background. Major impact to fauna as defined in Section 3.5.5.

Numeric Project Standards for noise are provided in the Project Standards Document (see Appendix 1).

3.5.7 Significance of impact – waste

The criteria to define the significance of waste impacts are defined in the Table 3.9 below.

Table 3.9: Criteria to define the significance of waste impacts

Negligible	Low	Moderate	High	Major
<p>No hazardous waste (Class I to III) and very limited non-hazardous (Class IV to V) generated.</p> <p>Approved disposal facilities available for all wastes that meet Project Standards.</p> <p>No impact on long term capacity of third party waste disposal/treatment facilities.</p>	<p>Limited hazardous waste (Class I to III) and moderate volumes of non-hazardous (Class IV to V) generated.</p> <p>Approved disposal/treatment facilities available for all wastes that meet Project standards.</p> <p>No significant impact on long term capacity of third party waste disposal/treatment facilities.</p>	<p>Moderate volumes (requiring small-scale dedicated storage, transport and/or disposal facilities) of hazardous waste (Class I to III) and significant volumes (requiring large-scale dedicated storage, transport and/or disposal facilities) of non-hazardous (Class IV to V) generated.</p> <p>Approved disposal/treatment facilities available for all wastes that meet Project standards (Project operated facilities) and RF standards (third party facilities).</p> <p>Moderate impact on long term capacity (<10% of available capacity) of third party waste disposal/treatment facilities.</p>	<p>Significant volumes of hazardous waste (Class I to III) and significant volumes of non-hazardous (Class IV to V) generated.</p> <p>Approved disposal/treatment facilities available for most wastes that generally meet Project standards (Project operated facilities) and RF standards (third party facilities), but minor deficiencies to standards identified.</p> <p>Long term disposal/treatment options not available for small volumes of hazardous waste (Class I to III).</p> <p>Significant impact on long term capacity (10% to 30% of available capacity) of third party waste disposal/treatment facilities.</p>	<p>Significant volumes of hazardous waste (Class I to III) and significant volumes of non-hazardous (Class IV to V) generated.</p> <p>Approved disposal/treatment facilities available for some wastes that partially meet Project standards (Project operated facilities) and RF standards (third party facilities), but significant deficiencies to standards identified.</p> <p>Long term disposal/treatment options not available for significant volumes of hazardous waste.</p> <p>Significant impact on long term capacity (>30% of available capacity) of third party waste disposal/treatment facilities.</p>

3.5.8 Significance of impact - social

The criteria to define the significance of social impacts are defined in the Table 3.10 below.

Table 3.10: Criteria to define the significance of social impacts

Negligible	Low	Moderate	High	Major
Direct Impacts on Communities' Health, Safety and Security				
<p>Marginal, readily reversible changes or imperceptible changes in the current health, safety and security status of local communities.</p> <p>Number of affected persons: very limited (up to 10).</p> <p>Duration: very short-term (1 to 3 months).</p> <p>Likelihood: highly unlikely.</p>	<p>Minor and readily reversible changes in the current health, safety and security status of local communities.</p> <p>Number of affected persons: limited (10-100).</p> <p>Duration: short-term (3 to 6 months).</p> <p>Likelihood: unlikely.</p>	<p>Noticeable and reversible changes in the current health, safety and security status of local communities.</p> <p>Number of affected persons: moderate (100-500).</p> <p>Duration: medium-term (up to a year).</p> <p>Likelihood: likely.</p>	<p>Substantial changes in the current health, safety and security status of local communities. Reversibility of the changes depends on application of a range of technical, organisational, financial and other measures.</p> <p>Single case of serious injury.</p> <p>Number of affected persons: moderate to high (up to 1,000).</p> <p>Duration: medium-term to long-term (1 to 3 years).</p> <p>Likelihood: certain.</p>	<p>Wide-spread and irreversible disturbance/disruption to the health, safety and security status of local communities.</p> <p>Multiple cases of serious injury or single case of fatality.</p> <p>Number of affected persons: high (more than 1,000).</p> <p>Duration: long-term to long-term (more than 3 years or permanently).</p> <p>Likelihood: certain.</p>
Impacts on socio-economic resources (economic activities, governance practices and social infrastructure)				
<p>No effect on social resources of critical²¹ importance or primary livelihood assets of local communities (including indigenous communities).</p> <p>Number of affected users of socio-economic resources: very limited (up to 10).</p> <p>Duration: short-term (1 to 3 months).</p>	<p>No effect on socio-economic resources of critical importance, non-replicable heritage (tangible and intangible), or primary livelihood assets of communities (including indigenous communities).</p> <p>Number of affected users of socio-economic resources: limited (10-100).</p>	<p>Potential effect on a limited range of valuable socio-economic resources or livelihood assets of communities (including indigenous communities) that are not of primary importance to community/individual subsistence.</p> <p>Core assets and resources of the local communities may be</p>	<p>Socio-economic resources of critical importance, or primary livelihood assets of communities (including indigenous communities) are affected on the local and regional levels.</p> <p>Core assets and resources of the local communities are affected leading to deterioration of the main livelihood.</p>	<p>Socio-economic resources of critical importance, and a broad range of livelihood assets of communities (including indigenous communities) are affected, including on the local, regional and national/international levels.</p> <p>Core assets and resources of the local communities are affected,</p>

²¹ The critically of resources is determined based on a combination of existing designations, expert judgment and stakeholder engagement as appropriate.

Negligible	Low	Moderate	High	Major
Likelihood: highly unlikely.	Duration: short-term (3 to 6 months). Likelihood: unlikely.	partially affected but this does not lead to overall deterioration of the main livelihood and its viability. Number of affected users of socio-economic resources: moderate (100-500). Duration: medium-term (up to a year). Likelihood: likely.	Number of affected users of socio-economic resources: moderate (up to 1,000). Duration: medium-term to long-term (1 to 3 years). Likelihood: certain.	leading to irreversible disruption/disintegration of the main livelihood. Number of affected users of socio-economic resources: high (more than 1,000). Duration: long-term to long-term (more than 3 years or permanently). Likelihood: certain.
Impacts on cultural resources				
No effect on cultural resources of critical ²² importance, non-replicable heritage (tangible and intangible) of local communities, including indigenous communities. Number of affected users of cultural resources: very limited (up to 10). Duration: short-term (1 to 3 months). Likelihood: highly unlikely.	No effect on cultural resources of critical importance, non-replicable heritage (tangible and intangible) of local communities, including indigenous communities. Number of affected users of cultural resources: limited (10-100). Duration: short-term (3 to 6 months). Likelihood: unlikely.	Potential effect on a limited range of valuable cultural resources of local communities (including indigenous communities) that are not of primary importance to communities. Number of affected users of cultural resources: moderate (100-500). Duration: medium-term (up to a year). Likelihood: likely.	Cultural resources of critical importance of communities (including indigenous communities) are affected on the local and regional levels. Number of affected users of cultural resources: moderate (up to 1,000). Duration: medium-term to long-term (1 to 3 years). Likelihood: certain.	Cultural resources of critical importance of various communities (including indigenous communities) are affected, including on the local, regional and national/international levels. Number of affected users of cultural resources: high (more than 1,000). Duration: long-term to long-term (more than 3 years or permanently). Likelihood: certain.
Physical Displacement				
No physical displacement entailed	No physical displacement entailed, apart from short-term/readily reversible (regular)	Short-term and reversible physical displacement of minimal extent (up to 10 households),	Permanent physical relocation (regardless of the number of households affected), resulting in	Permanent physical relocation is entailed, resulting in the irreversible transformation of

²² The critically of resources is determined based on a combination of existing designations, expert judgment and stakeholder engagement as appropriate.

Negligible	Low	Moderate	High	Major
	movement of population employed by the Project as related to the rotation-based work	without an effect on their traditional lifestyle and associated activities.	the change of their traditional lifestyle and activities. The reversibility of such changes requires a range of technical, organisational, financial and other support measures.	traditional lifestyle and the cessation of traditional activities.

3.6 Cumulative impacts

Cumulative impacts are those that result from the incremental impact of a project when added to other existing, planned, and/or reasonably predictable future projects and developments. The approach taken to cumulative impacts in this ESIA is described in Chapter 13.

3.7 Consideration of mitigation

Mitigation measures are applied, where necessary, to reduce the severity and/or the likelihood of the impact and therefore reduce the overall impact/risk significance. In the ESIA, the significance of a potential impact/risk is assessed in terms of the residual impact.

For each topic, potential impacts are described during each phase of the Project (construction, commissioning and operation²³) and then their significance is assessed. A description of the mitigation measures that have been developed in line with the mitigation hierarchy²⁴ that will be applied is then included. In developing mitigation controls, the primary focus will be on mitigation of those impacts that have been categorised as having a **High** or **Major** significance. However, mitigation measures will also be considered for impacts of **Low** and **Moderate** significance to ensure that environmental and social impacts/risks are minimised wherever possible. Following the initial assessment of the impact significance (typically inclusive of any mitigation measures in the design but prior to the application of any additional mitigation measures), the significance of the residual impact is then assessed based on the application of any additional mitigation measures deemed necessary to reduce significance to acceptable levels.

Methods of prediction of impact significance within this ESIA are either quantitative or qualitative or, in certain instances, both. Quantitative methods predict measurable changes as a result of the Project (e.g. air quality predicted by numerical modelling), while qualitative assessment techniques rely on expert judgement and the experience in projects of similar nature/scale, within a structured framework to ensure consistency. It should be noted that impacts on the social environment may not always be readily amenable to the quantification or application of numeric standard values due to the unimportant nature of an effect (e.g. psycho-emotional and perceptive impacts) or correlation of a change with the specific local context (i.e. a scale of in-migration compared with the size of the original host population). Accordingly, qualitative parameters are applied when assessing those social impacts that cannot be measured in quantitative terms.

²³ Note that Decommissioning is considered separately. Also in some cases it is appropriate to combine commissioning with either the construction or operation phases.

²⁴ In line with good ESIA practice mitigation measures will be developed using the 'mitigation hierarchy' which broadly require that consideration should be given to avoidance, minimisation, mitigation and offsetting for impacts in that order of preference.

4. PROJECT OVERVIEW

4.1 General

The AGPP is needed for processing multi-component natural gas transported over the “Power of Siberia” gas transmission system from the Yakutsk and Irkutsk gas production hubs being set up by PJSC Gazprom as part of implementation of the EGP.

The marketable gas products produced by the Amur GPP will be:

- Methane;
- Ethane;
- Propane;
- Butane;
- pentane-hexane fraction; and
- helium.

The AGPP’s 1.875 million-ton/year production of ethane will be utilized by Sibur Holding to produce polyethylene at their nearby deep hydrocarbon conversion plant. The purified methane will be exported to China. The AGPP will also be the world's largest helium production facility with the capacity of up to 60 million cubic meters per year (Table 4.1). The AGPP will operate based on a tolling agreement (conversion of the toller’s fuel) with Gazprom Export, the company that will perform all marketing operations with its products.

Table 4.1: Gas Separation Products (for 2026)

Products	Units per year	Value
Commercial gas (methane fraction)	10 ⁹ standard m ³	38.8
Commercial helium	10 ⁶ standard m ³	60
Ethane fraction	10 ³ tons	1875
Propane fraction	10 ³ tons	968
Butane fraction	10 ³ tons	474
Pentane/hexane fraction	10 ³ tons	204
WLHF	10 ⁹ standard m ³	0.88
Total losses including excessive nitrogen	10 ⁹ standard m ³	1.39

The AGPP Project site is located in the Svobodnensky district of the Amur Region, 10-15 km (or about 22 km by road) from the town of Svobodny²⁵. The nearest settlements to the project site are as follows:

- Yukhta settlement – 2.3 km
- Garden/Vegetable allotments of the Yukhta settlement – 1.7 km
- Tchernigovka village – 7.14 km
- Dmitrievka village – 2.9 km

²⁵ The Project site GPS coordinates: 51°32'11"N 128°10'55"E.

The AGPP site is located 10-15 km (or approximately 30 km by the R-297, Amur, highway) from the river Zeya and approximately 45 km from Port Svobodny. The project site is also located at the intersection of the following transnational and transregional transport corridors:

- The nearest airports are located near Blagoveshchensk and Svobodny.
- Four river ports at Blagoveshchensky, Svobodnensky, Poyarkovsky, and Zeysky that will be providing facilities for moving goods between Russia and China.
- The Trans-Siberian Railway passes only 2-5 km west of the Project site.
- Federal Highway R-297 (Amur) passes 7-8 km northeast of the Project site. The distance by road between the Project site and R-297 is 23 km.

A temporary jetty is being constructed on the right bank of the river Zeya for handling oversized cargos during the construction period (6 km from Tchernigivka village near the confluence of the Gashchenka and Zeya rivers).

Gas will be supplied to AGPP via two underground pipelines connecting AGPP to the “Power of Siberia” pipeline which is located 2.3 km from the Project site. Processed gas (methane fraction) will be returned to a compressor station, KS-7a “Zeiskaya”, via two underground pipelines and will be exported to China over the “Power of Siberia” pipeline.

The Project site is located next to the planned construction site of Sibur Holding’s deep hydrocarbon conversion plant which will start utilizing Amur GPP produced ethane by 2022. AGPP site location is shown in Figure 4.1.

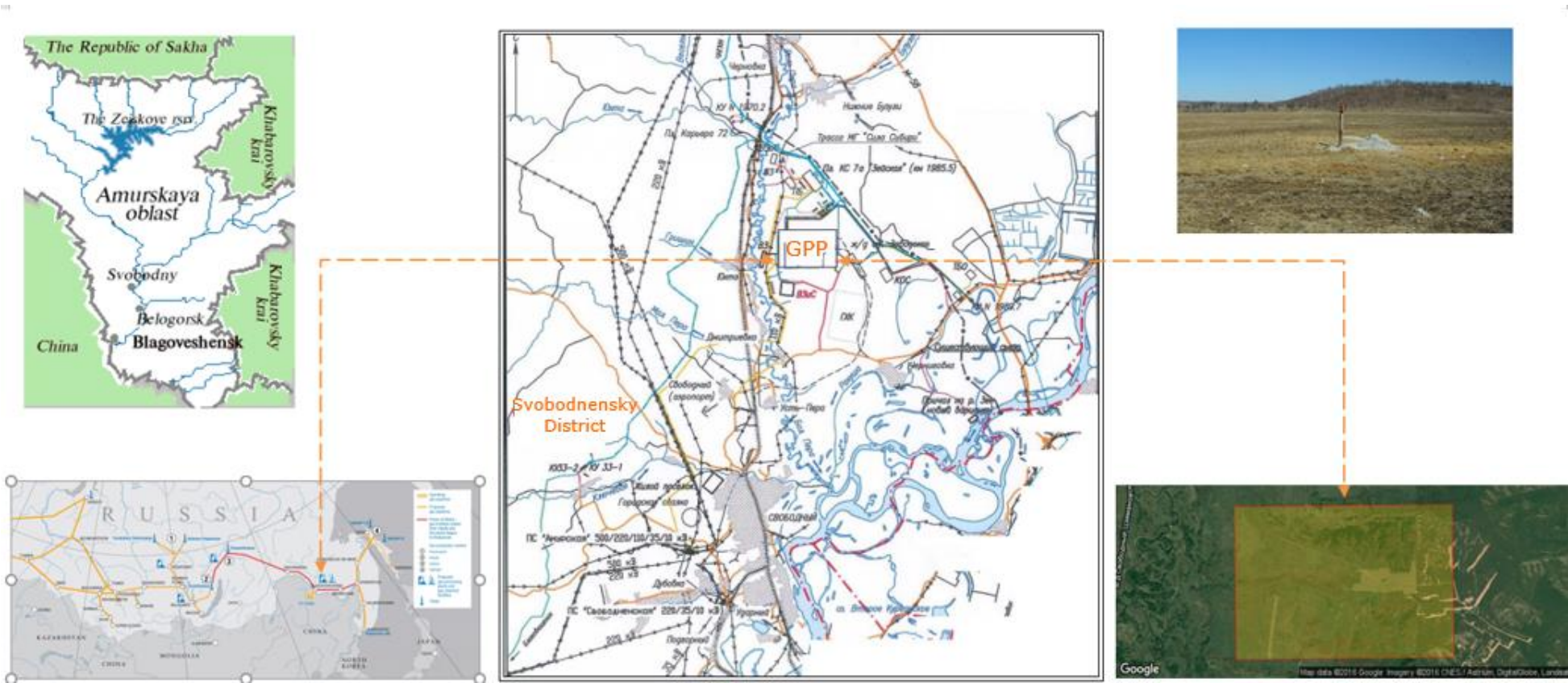


Figure 4.1: Amur GPP Project site location

4.2 Project Implementation Timeframe and Current Status

The AGPP Project was initiated in December 2012 when Gazprom made Gazprom pererabotka responsible for the Project design. Consequently, Gazprom pererabotka LLC signed an agreement with PJSC VNIPI Gazdobycha as General Design Contractor in April 2013. In December 2014 Gazprom established Gazprom pererabotka Blagoveshchensk LLC (GPPB) as a special-purpose company dedicated to implementing the AGPP Project.

Gazprom synchronized its gas production, pipeline construction and gas processing commencement efforts under the EGP. The first phase of the “Power of Siberia” gas pipeline, Chayanda – Blagoveshchensk, is expected to be commissioned in 2018 and will supply gas to AGPP from Yakutia. AGPP’s process trains will be commissioned in five phases along with the establishment of the gas production hubs in Yakutia and Irkutsk. The completion of the first AGPP construction phase is scheduled for December 2020 while the commissioning of the entire Project is scheduled for 2025.

The design work was completed in May 2016. The Project was submitted to Glavgosexpertiza and the experts’ positive conclusion was obtained on July 15, 2016 and covered the auxiliary production facilities (see Stage 3 below) and solid domestic and industrial wastes landfill (see Stage 6 below). A positive conclusion was also obtained from Amurgosexpertiza (Regional Board of State Expert Review) for railway infrastructure facilities and automobile roads. Work on the Project’s detailed design documentation commenced immediately upon receipt of Glavgosexpertiza’s positive conclusion. The design documentation on all Project facilities is expected to be completed in the second quarter of 2017.

It is expected that the construction of AGPP’s main production facilities and infrastructure will proceed in six stages:

- Stage 1. Early works facilities (preparatory works);
- Stage 2. Railway infrastructure;
- Stage 3. Project infrastructure and auxiliary facilities;
- Stage 4. Gas processing plant;
- Stage 5. Housing estate (microdistrict) in Svobodny; and
- Stage 6. Solid Domestic and Industrial Waste Landfill.

These stages are not sequential and in some case the stages (partially) overlap or run concurrently according to the Project implementation schedule in Figure 4.2. An overview of the status of the above developments stages is presented below.

- **Stage 1 (Early Works).** The start of AGPP construction was officially announced in October 2015 upon commencement of Stage 1, Early Works Facilities. The stage involves site clearing and landscaping; construction of temporary facilities; setting up accommodation for construction workers and other Project staff; supplying water of temporary constructions and facilities, heat, power, and wastewater treatment equipment, etc. Stroitransgaz, Podvodtruboprovodstroj and USK Most with a branch in the Amur Region called SK Most-Vostok have been preparing engineering facilities on the Amur GPP site. As for December 2016, works on Sub-stage 1 of Stage 1 completed on 100%, works on Sub-stage 2 of Stage 1 – 65 %. As for Sub-stage 3 of Stage 1, competitive procedures on selection of construction contractors are ongoing. This Stage is generally planned for completion in July 2017.
- **Stage 2 (Railway infrastructure).** Stage 2 construction was launched in July 2016. SvyazStroyMontazh LLC (SSM) was awarded a contract to construct the railway track section from the “Ust-Pera” station of the Trans-Siberian railway to the Project site (nearly 15 km long). Two railway stations, “Zavodskaya-1” and “Zavodskaya-2”, will be built near the Project site. SSM is carrying out design, preparatory and excavation works, laying a permanent railway line, utility lines, installing equipment; constructing key structures, buildings, and railway infrastructural facilities.
- **Stage 3 (Auxiliary facilities).** Construction work commenced in May 2016. It includes construction of the Project infrastructure designed for delivery and storage of over 2.6 million tons of cargo a year. This

Stage also includes construction of access roads and bridges. The auxiliary facilities to be constructed include a parking lot and a repairs workshop, a fuel storage, a filling station, a water and wastewater treatment plants, etc. A temporary jetty will be constructed at the Zeya River for unloading materials and equipment delivered by river during construction phase

- **Stage 4 (Gas processing plant).** GPPB plans to launch Stage 4, Gas processing plant in May 2017 starting with the construction of the foundations of the plant's license units of the first startup complex. Initially, two process units will be build: a methane and WLHF (propane, butane, pentane and hexane mixture) extraction and nitrogen removal unit, and a helium production unit²⁶, two units of gas drying and purification, gas fractioning unit, WLHF purification and etc. They are scheduled to be commissioned in 2021. Another four such gas processing units will be built by 2025, i.e. one gas processing line a year.
- **Stage 5 (Residential housing project) and Stage 6 (Solid domestic and industrial wastes landfill).** The design documentation for Stages 5 is under Glavgosexpertiza Review and for Stage 6 has been completed, but the construction has not commenced yet.

²⁶ <http://www.gasworld.com/russia-helium-surge-continues-as-linde-contracted-by-gazprom/2009834.article>

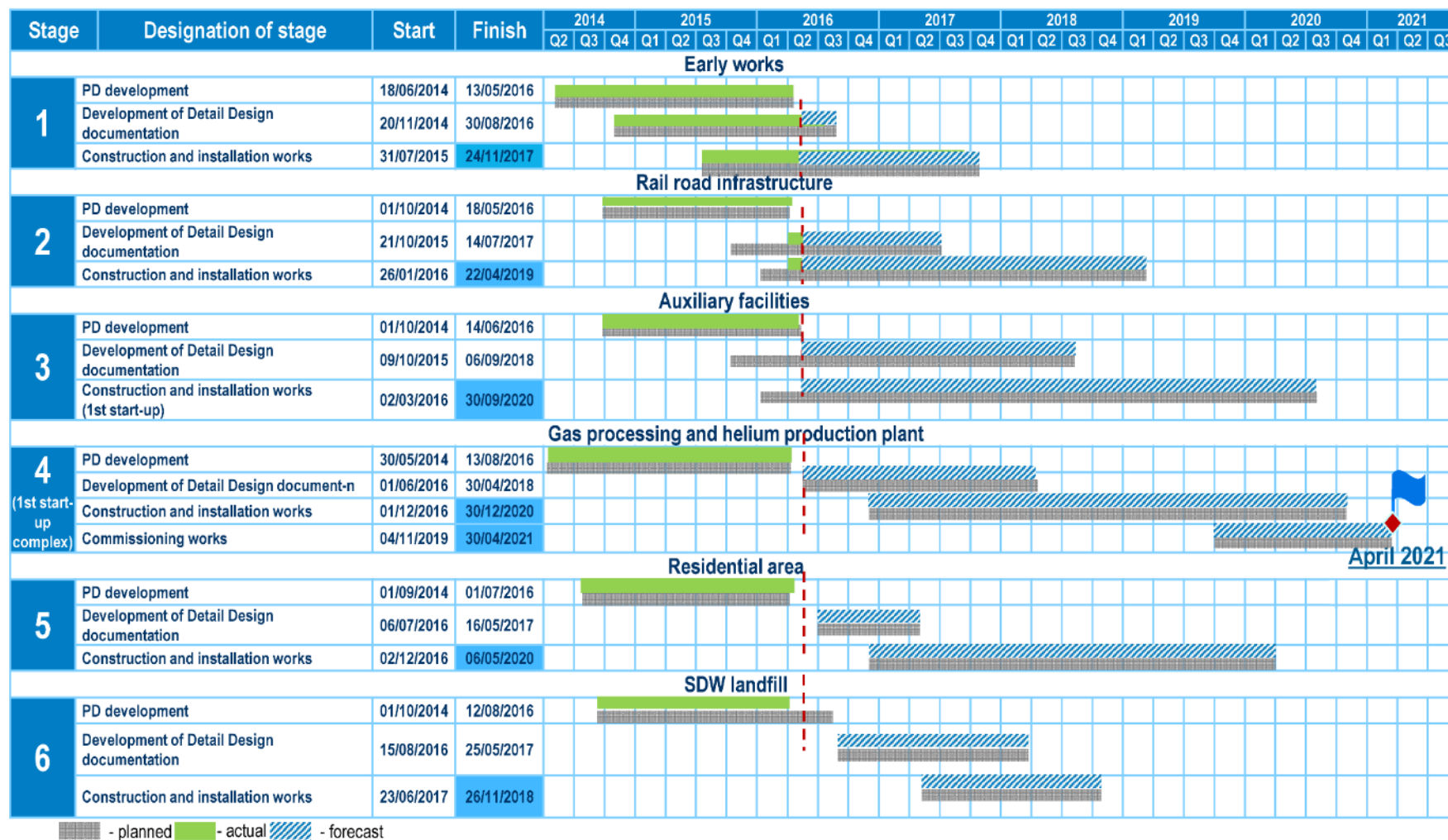
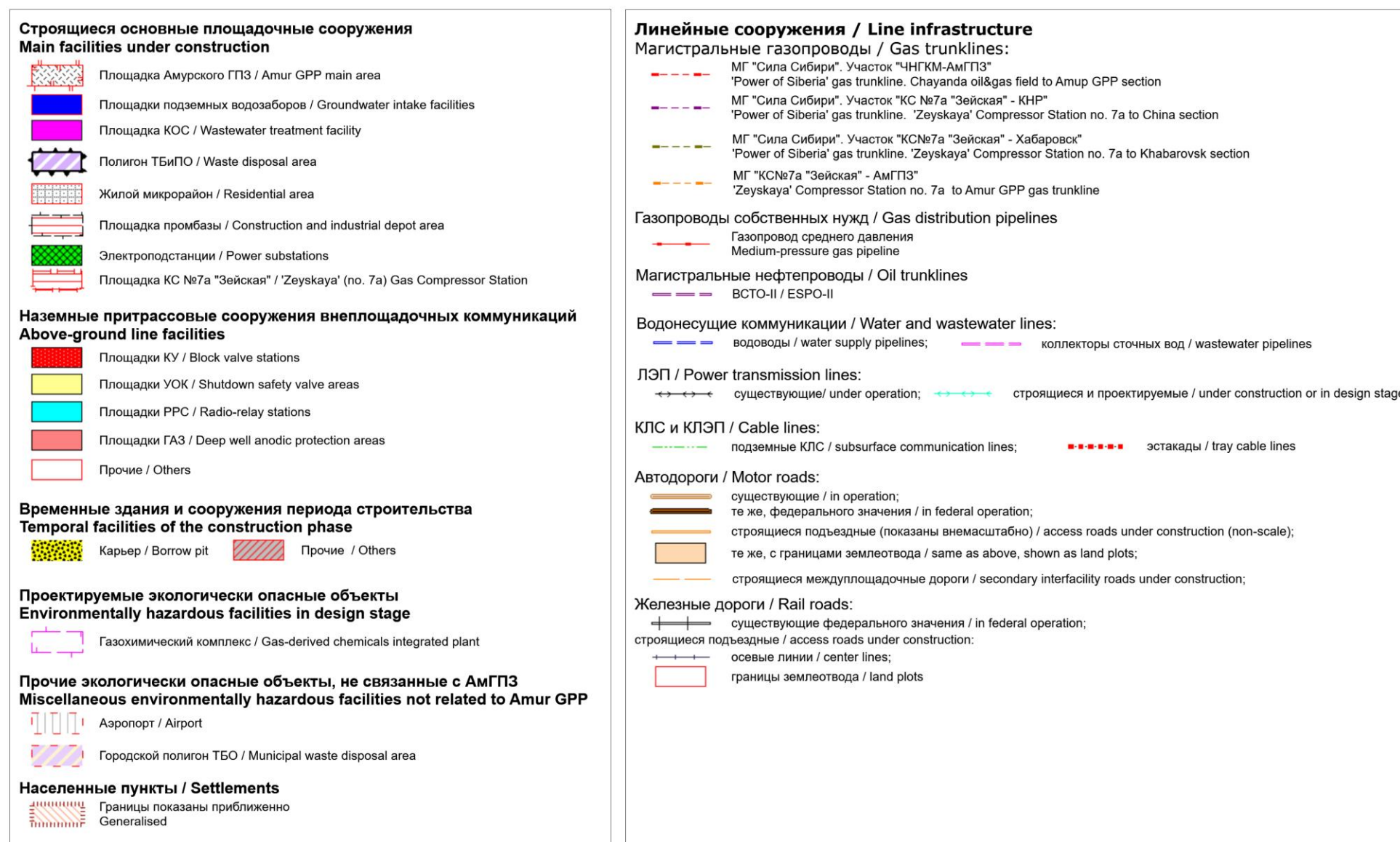


Figure 4.2: Amur GPP Construction Project Implementation Schedule

4.3 Key Project Facilities and Processes

The AGPP complex encompasses several sites for main (AGPP) and auxiliary facilities (water intake, sewage treatment, railway transport, SDIW landfill, etc.) as well as infrastructural facilities (Figure 4.3, Figure 4.4 Appendix 3). A temporary rotational camp will be built on the Temporary Buildings and Installations (TBI) site to provide accommodation for construction workers, and a residential housing project will be constructed in Svobodny to accommodate AGPP support staff. The key facilities, activities and processes planned for those sites appear below in the order of their proposed construction according to the Project stages.

**Объекты / Facilities:**

Ам ГПЗ

- основной проектируемый;
- the core facility planned and designed within the Project's framework;

Жилой микрорайон

- ассоциированные в рамках Проекта;
- facilities associated with the core object within the Project's framework;

Аэропорт "Свободный"

- планируемые, строящиеся или эксплуатируемые вне рамок Проекта
- under planning, construction or operation beyond the framework of the Project

Населенные пункты / Settlements:

Свободный

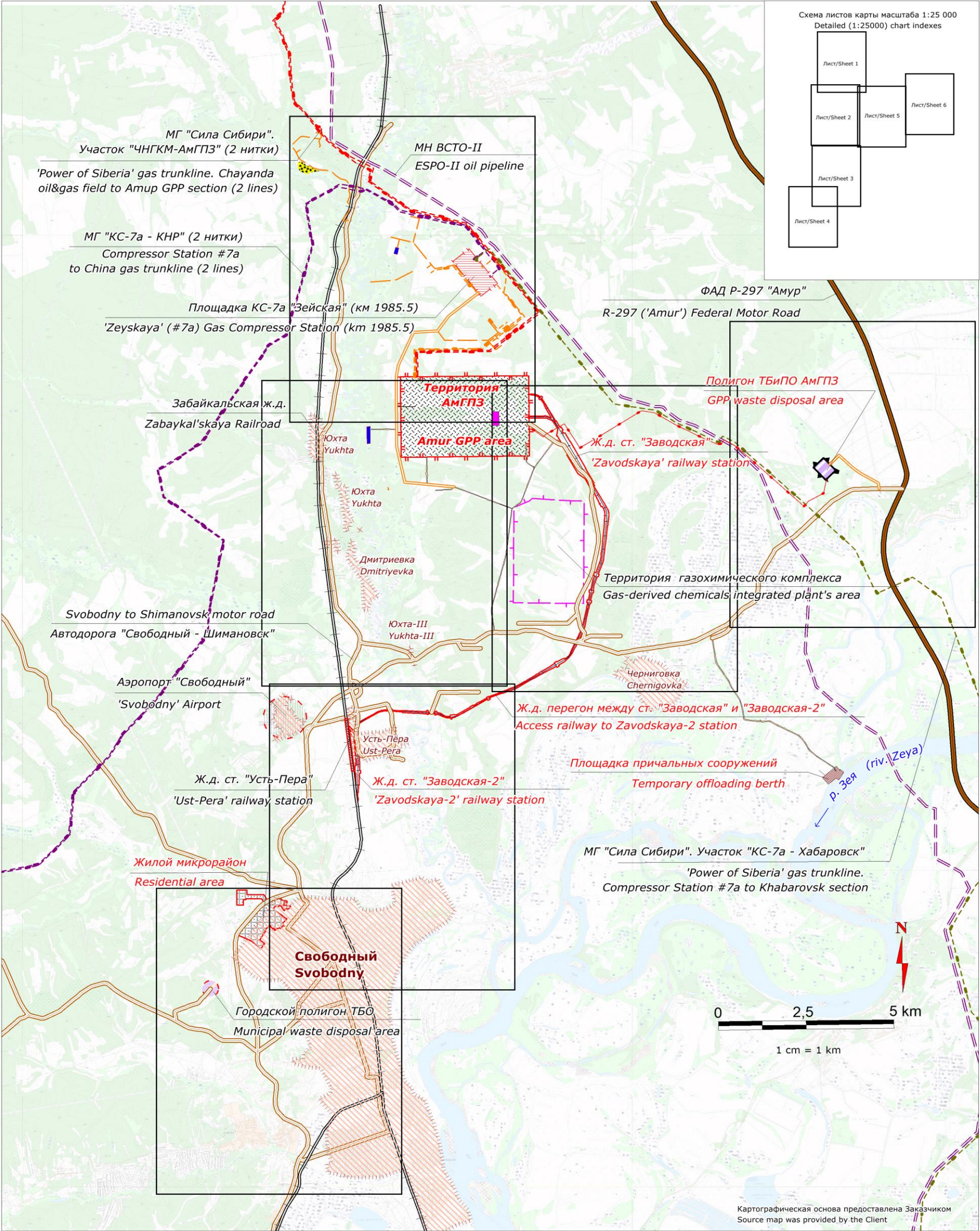
- городского типа;
- urban;

Юхта

- сельского типа;
- rural;



Figure 4.3 Project facilities layout



Амурский ГПЗ. Материалы ОВОС

Amur GPP. ESIA Report

Рисунок _____. Ситуационный план

Figure _____. Situation map

Обзорная схема / Review map

Масштаб / Scale: см, шкалы / refer to scale bar

Дата / Date: 12.12.2016 г. / Dec. 12th, 2016

Проект / Project No.: RU1100150B

Лист / Page: 2 из / of 8

Figure 4.4: Project facilities layout

4.3.1 Stage 1: Early Work Facilities

The early work facilities are to be built in three sub-stages.

4.3.1.1 Sub-stage 1.1. Facilities

Works comprising Sub-stage 1.1 were completed in May 2016, and included the following:

- AGPP Site: Before excavation work all trees and shrubs were cleared from the site (with the area of 47.42 ha);
- TBI sites: Before excavation work all trees and shrubs were cleared from the sites. Excessive topsoil was cut away in areas where its thickness exceeded 0.2 m, the fertile layer was removed for temporary storage; the site area was leveled and graded.

Sub-stage 1.1 included also construction of temporary access roads #1 and #2 to the AGPP and TBI sites.

4.3.1.2 Sub-stage 1.2 Facilities

AGPP Site

At the AGPP site a 0.2 m layer of topsoil is cut away. The removed soil is stored for re- use in reclamation of disturbed areas and backfilling in AGPP's green zone.

According to the Project's general plan the entire AGPP site will be levelled (Figure 4.5).

Infilling is to proceed in lifts of 0.3 m with subsequent compaction of each layer. The required degree of compaction is achieved using wheeled rollers. Fill materials will consist of non-heaving soils with good filtering capacity.



Figure 4.5: Grading operations on the AGPP Site

TBI Sites

Construction work at the TBI sites that were prepared during Sub-stage 1.1 commence with installation of engineering protection: anti-landslide and anti-avalanche measures (slope strengthening) and anti-waterlogging measures and surface runoff drainage (open drains).

A temporary construction workers camp consisting of three residential sections is being built on the TBI sites and is scheduled for completion by July 2017. The rotational camp will consist of modular buildings on piles (Figure 4.6). The rotational camp will house dorms, cafeteria, an infirmary, bathhouses, a laundry complex and a health/fitness center – a total of 35 amenity buildings with a total area of 72,000 m².



Figure 4.6: TBI site construction

In addition, the following facilities will be constructed on the TBI sites:

- customer base including an office building, a 30-room hotel, an equipment storage yard and a heated warehouse;
- temporary contractor base for storing inventory: three heated warehouses (including a paints warehouse) and an unheated warehouse;
- contractor's fuel and lubricants warehouse: 7 200 m³ diesel fuel tanks, and a 50 m³ diesel fuel drainage tank.

The following general infrastructural facilities are being built on the TBI site for the construction phase: water and wastewater treatment facilities, water supply and sewage pipelines, 7 transformer substations, automated modular boiler plant (with a fuel line between the pumping station and the boiler plant), a communications block-container with a mast, a waste container enclosure, a fire depot and a parking lot for buses.

Water will be supplied from groundwater wells from a water intake (WI) site (see below for details). The water supply system at the TBI site consists of several water supply pipelines: domestic water supply, industrial and fire water supply, underground water, clarified wash water (from water supply treatment facilities to source water tanks) and a filter wash pipeline.

The drainage system at the TBI site includes sanitary, storm runoff, and industrial wastewater drains as well as a drainage system for wastewater which is deemed clean.

Water treatment facilities are located at the sites of water supply treatment facilities (WTF) and wastewater treatment facilities (WWTF).

The following facilities will be installed at the WTF site:

- domestic and industrial/fire water pumping station,
- water treatment station,
- 400 m³ tank (domestic water),
- 400 m³ tank (fire water),
- 200 m³ tank (source water),
- industrial effluent pumping station,
- searchlight tower with a lightning rod.

The following facilities will be installed at the WWTF site:

- sewage treatment facilities for domestic effluent,
- sewage treatment facilities for industrial/storm water effluent,
- 700 m³ tank (domestic effluent),
- 100 m³ tank (industrial effluent),
- 2 containment ponds for domestic and industrial/storm water temporary storage,
- 2 storm water pumping stations,
- control room,
- searchlight tower with a lightning rod.

A pipeline for discharging treated wastewater is being built from the WWTF site to a wastewater outlet site on the bank of the Bolshaya Pera River. The wastewater outlet site is covered with geofabric, geogrid and riprap.

To supply power to the TBI facilities the following standalone power sources should be installed on the TBI site: 10 Energo D1000/0.4 KN20 automated container-type diesel power plants, each with the rated capacity of 1000 kW and voltage of 0.4 kV (9 operating and 1 standby/repair).

Upon completion of construction work at the TBI site the area will be landscaped and lawn grass and local species of trees will be planted.

Water intake site and water pipeline to the TBI site

The following activities will be undertaken for the WI site:

- clearing trees and shrubs from the site and site grading,
- drilling three exploration wells for water,
- installing pumping stations (one for each of the wells),
- building a fence around the perimeter of the first belt of the water intake structure SPZ (30 meters),
- installing a 2KTPA-400/10/0.4 kW self-contained transformer substation,
- installing a searchlight tower with a lightning rod.

In addition, two buried water supply pipelines, each approximately 2.7 km long, are being built from the WI site to the TBI site. The water pipelines and utility lines approach the WI site from southeast and follow the route of a planned road.

Access motor roads

Construction work for the access motor roads (AMR) includes removal of trees, roadbed fill construction and paving road surface with crushed rock for the following AMR (Figure 4.7):

- AMR #4 to "Zavodskaya" railway station, length 1.107 km,
- AMR #6 to the temporary jetty site on the River Zeya (length 6.059 km),
- A temporary AMR to the WTF site (length 0.871 km).

The local road construction company Asphalt is the AMR construction contractor. As of the end of September 2016 AMR #4 was 98% ready, and AMR #6 was 77% ready.

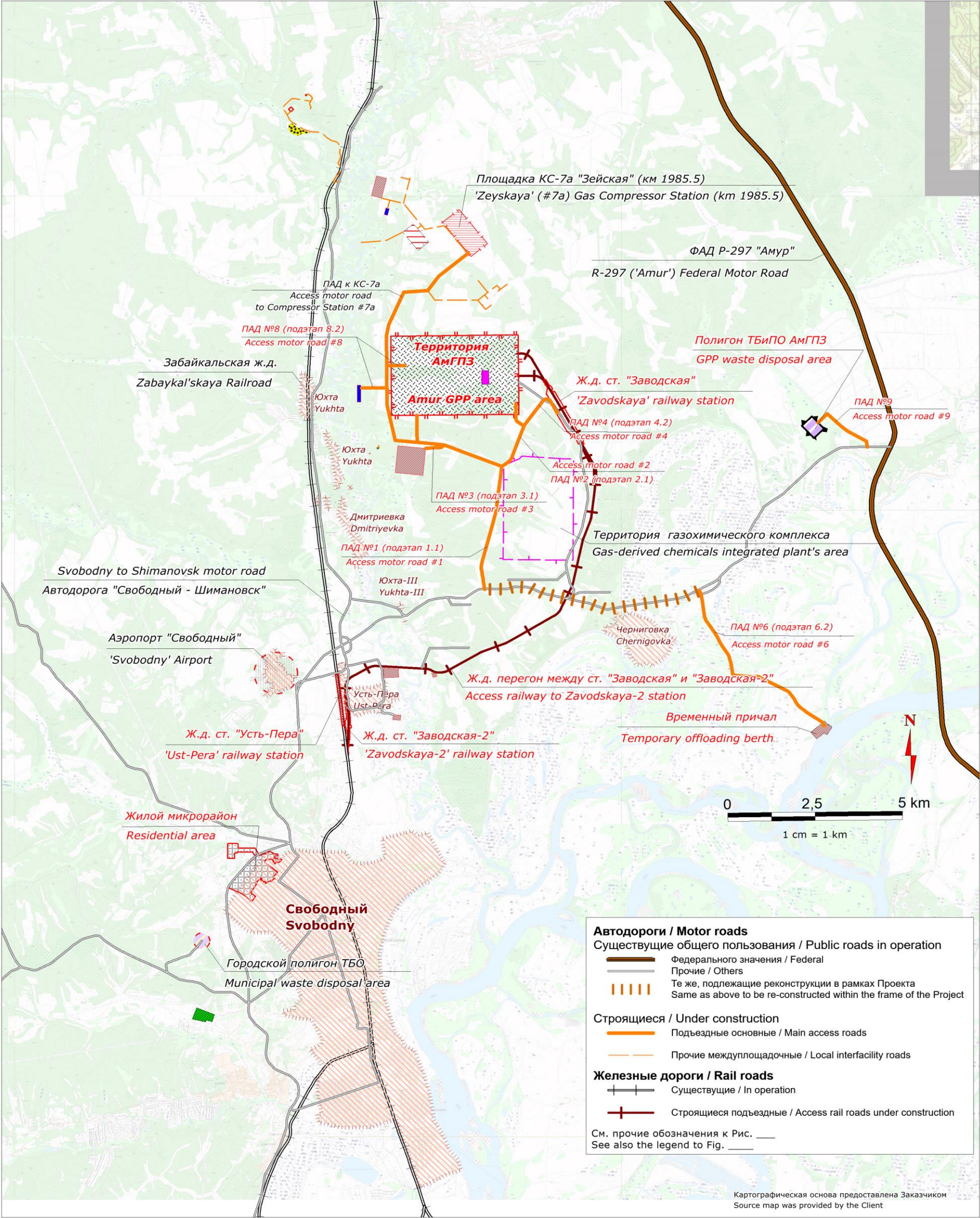


Figure 4.7 Motor and rail road map

Амурский ГПЗ. Материалы ОВОС
Amur GPP. ESIA Report

Рисунок ____ . Схема
автомобильных
и железных дорог

Figure ____ . Motor and rail road map

Масштаб / Scale: см, шкалы / refer to scale bar

Дата / Date: 12.12.2016 г. / Dec. 12th, 2016

Проект / Project No.: RU11001508

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"Zavodskaya" and "Zavodskaya-2" station sites and the section of tracks between them

Sub-stage 1.2 construction work includes deforestation and removal of 0.2-0.3 m of topsoil with subsequent construction of trackbed fill for "Zavodskaya" and "Zavodskaya-2" stations and the section of tracks between them (Figure 4.8). Topsoil should not be removed in places where there are gullies and gulches since the fertile layer is just 0.1 m thick in such places.

An excavator is used to load the removed topsoil onto dump trucks. It is then transported to temporary storage areas located within the AGPP site where it is stored in piles.



Figure 4.8: Zavodskaya 2 railway station construction site

The storage areas should be graded taking into consideration the existing landscape and local geological and hydrogeological features as well as the work previously performed during Sub-stage 1.1.

4.3.1.3 Sub-stage 1.3 Facilities

AGPP Site

Temporary driveways should be built on the site for the duration of construction with lights installed along them. Construction work includes engineering protection of the site: anti-landslide and anti-avalanche measures (e.g. slope and fill slope strengthening), anti-waterlogging protection and surface runoff drainage (construction of open drains).

The site should be enclosed by a fence with a checkpoint at the point of entry. An onsite electrical network will be installed to supply power to temporary driveway lights, checkpoints and other onsite facilities.

In addition, the following facilities will be organized:

- Temporary storage site of equipment during construction phase;
- Storage sites of temporary customs controlled area and logistical support;
- Storage sites of heavy and oversized cargoes during supply route;
- Additional AMR;
- Temporary power supply for construction sites, the main construction site of the Amur GPP.

Also throughout the life of the sub-stage administrative and service building will be constructed near to the main construction site of Amur GPP.

4.3.2 Stage 2: Railway Infrastructural Facilities

In order to meet AGPP needs a number of permanent railway infrastructural facilities is being built to enable transportation of 2.4 million tons of cargoes a year, including a bridge across the Bolshaya Pera River, a highway overpass, nearly 45 km of non-public railway tracks, and two railway stations, "Zavodskaya" and "Zavodskaya-2", near the Amur GPP production facilities and "Ust-Pera" Station.

The construction will be completed in the following sub-stages.

The first construction sub-stage will involve development of railway infrastructure connected with arrival of construction cargoes intended for AGPP. To this end it is proposed to upgrade the public station “Ust-Pera” (Figure 4.9) and to construct “Zavodskaya” and “Zavodskaya-2” stations, a section of railway line connecting “Zavodskaya-2” and “Zavodskaya” stations, and two railway lines connecting “Zavodskaya” to the loading/unloading racks and construction cargoes unloading yard.

The Project provides for:

- extending/departure tracks to the minimum useable length of 1,050 m;
- tail track with the useable length of 300 m,
- crossover tracks between two main tracks ensuring exits from both “Ust-Pera” station bottlenecks,
- construction of spur tracks for attaching/detaching individual train cars to/from assembled trains and delivering rolling stock to “Zavodskaya-2” station.

The proposed “Zavodskaya-2” station is located in direct proximity to “Ust-Pera” station. It is a single park, 5 track station. The minimum useable track length is 1,200 m.

The proposed “Zavodskaya” station is located southeast of, and in close proximity to, the AGPP site, minimizing the traffic of rolling stock and the length of shunting tracks. The construction of the section of tracks from “Zavodskaya-2” to “Zavodskaya” station (including tracks leading to the AGPP assembly yard), the bridge and the highway overpass is expected to be completed by the end of November 2017.

The proposed non-public railway line between “Zavodskaya” and “Zavodskaya-2” is a connecting track, 17,400 m in length.

It is planned to construct a railway bridge across the Bolshaya Pera River and an overpass across the motor way leading to the town of Svobodny.

The 252m long railway bridge shall consist of 7 bridge spans each 33.6m long. The spans shall be placed on massive bridge abutments and pre-fabricated intermediate massive bridge pillars on reinforced concrete piles.

The 85 m long overpass shall consist of three spans on massive abutments and intermediate pillars on drilled piles.

For movement over railway tracks the following types of locomotives will be used:

- electric – “Ust-Pera” station;
- hybrid (electric and diesel-powered) – “Zavodskaya-2” station,
- diesel-powered – connecting tracks and “Zavodskaya” station.



Figure 4.9: “Ust-Pera” Station satellite map

The construction of railway infrastructural facilities commenced in July 2016 (Figure 4.10). SSM is the contractor responsible for the construction of the section of railway tracks from the public station “Ust-Pera” to the Amur GPP production site.



Figure 4.10: Construction of railway tracks for Amur GPP

The second construction sub-stage will include development of non-public railway infrastructure connected to the arrival of empty tank cars at the Amur GPP and departure of loaded tank cars via the main railway network. To this end, a park of loading/unloading racks will be constructed at the AGPP site.

4.3.3 Stage 3: Auxiliary Facilities

4.3.3.1 Sub-stage 3.1: Auxiliary production facilities

Auxiliary production facilities are located in the southeastern part of the plant's main production site (where the highway approaches the plant) and include:

- Administrative zone buildings and installations;
- Repair services buildings and installations;
- Motor transport buildings and installations;
- General plant buildings and installations;
- WTF site;
- WWTF site.

The administrative zone will include:

- Plant Management Office;
- Infirmary;
- 300-seat cafeteria with a retail store;
- Office building for AGPP operations staff;
- Materials and equipment warehouse;
- Laboratory building;
- Buildings and installation for setting up satellite communications, television and radio broadcasting services, etc.

The repair services zone includes:

- Mechanical repairs shop (MRS) building;
- Repair service warehouse (unheated);
- Enclosure for gas cylinders, etc.

The motor transport site will include:

- Production building for motor vehicle repair and maintenance;
- Heated parking lots for buses, cars and trucks;
- Outdoor parking lot for special-purpose tracked vehicles under a canopy;
- Auto wash for cars and special-purpose vehicles;
- Refueling station consisting of 2 container-based filling stations (diesel fuel and gasoline);
- Fuel and lubricants warehouse consisting of 3,100 m³ storage tanks, etc.

The motor transport site is located within the auxiliary facilities zone near the compound's outer boundary with an additional entrance into the area via an access road.

A railway siding will be constructed providing access to the repair and warehousing area for delivery and unloading of large-sized units/equipment during both construction and operation phases.

General plant facilities consist of:

- 35 MW boiler plant;
- 250 m³ diesel fuel warehouse;
- 1,000 kW emergency diesel power plant site;
- Diesel fuel warehouse consisting of 6 100 m³ storage tanks;
- 1,600 kW block-container diesel power plant;
- Emergency rescue team depot;
- Transport checkpoint building;
- Laboratory;
- AGPP special services buildings (metrology, power supply);
- Emergency rescue units training center, etc.

The auxiliary facilities zone will include buildings and installations for warehousing and chemicals feed plant located north of the general plant facilities, namely:

- Storage yard for materials and equipment with a gantry crane;
- Heated warehouse for chemicals storage;
- Warehouse for storing production and emergency supplies;
- Loading/unloading rack;
- Temporary storage yard for storing production and consumption wastes;
- Paints and lubricants warehouse;
- Garage/parking lot for loading and unloading machinery.

The WTF site for the operational phase located between the administrative and repairs sites includes:

- Domestic and industrial/fire water supply pumping station;
- Water treatment station;
- 1,000 m³ storage tanks for drinking water (2 units);
- 1,000 m³ storage tanks for technical water (2 units);
- 10,000 m³ storage tanks for fire water (2 units);
- Laboratory building;
- Chemicals warehouse, etc.

The water treatment facilities site is locally enclosed by a fence built around the perimeter of the first belt of the water protection zone.

The WWTP site for the operational phase is located northeast of the auxiliary facilities site.

The WWTF site includes:

- WWTF for industrial effluent and storm water;
- WWTF for domestic effluent;
- Temporary storage yard for dewatered sediment containers;
- Storm runoff and domestic effluent tanks;
- Treated wastewater tanks;
- Treated wastewater pumping station;
- Wastewater pumping station for domestic effluent, etc.

The site has two exits to public roads with gates and parking lots for vehicles in front.

Searchlight towers will be used for lighting the sites, lightning rods will ensure lightning protection.

All the buildings and installations are interconnected by a network of fire and technological hard surface driveways 6 m wide and utility line corridors, to be installed both underground and overhead.

Transformer substations are built on the auxiliary production sites to ensure power supply.

A ventilated fence will be built around the plant's compound. A number of exits from the compound area to an access road serving various zones are planned. All site entrances have checkpoints.

4.3.3.2 Sub-stages 3.2/ 3.4: Temporary jetty on the river Zeya and extension of temporary jetty

A temporary jetty is planned on the river Zeya for unloading and interim storage of large-sized and heavy equipment (hereinafter, LHE) intended for AGPP construction. The Project provides for shore strengthening activities and construction of a number of facilities on the river bank, in particular, two jetty faces of 125 m each, crane installation sites with the area of 8,400 m², driveways, warehouses and slab-paved parking lots. The commissioning of the facilities is scheduled for 2017.

The temporary jetty extension (sub-stage 3.4) is driven by necessity to ensure acceptance of the declared volumes of cargo within the specified timeframe, taking into account the navigational period on the river Zeya and the delivery timing of the equipment necessary for the Amur GPP construction.

The temporary jetty will consist of the following elements:

- two dockfronts of 125 m each;
- caterpillar crane sites;
- crane super lift counterweight sites;
- 7,000 m² outdoor warehouse;
- office buildings;
- checkpoint.

Given the geographical location of the temporary jetty it is only possible to deliver cargoes to the jetty using barges and pontoons due to the limitation on vessel dimensions on the rivers Zeya and Amur. According to the information supplied by Amur Inland Waterways Basin Administration the guaranteed depth along the route to the proposed jetty construction site (KP 212 along the river Zeya) is 1.3 m. Subject to the limitation it is planned to arrange for transportation of cargoes weighing up to 1,000 tons using barges with weight capacities of 2,500-3,000 tons. River-sea vessels cannot be used to transport cargoes to the proposed jetty since the minimum ballast draft for those vessels is 1.7 m.

During the construction of Amur GPP equipment will be delivered by towed trains of barges which will cycle along the route from the Sovetskaya Gavan sea port up the rivers Amur and Zeya to the waterworks construction site on the right bank of the Zeya near the village of Tchernigovka.

The following equipment items (cargoes) will be delivered:

- reactors;
- columns;
- heat exchangers;
- absorbers;
- furnace parts;
- gas turbines;
- generators;
- compressors;
- pumps;
- large-sized modular blocks for assembly, and;
- structural steel.

Certain heavy equipment items may weigh up to 910 (high pressure oil coolant tank) – 930 tons (steam stripping column I).

Caterpillar cranes with lifting capacities between 350 and 1,350 tons will be used for unloading LHE.

The jetty will handle 32,000 tons of cargoes which will be delivered during the navigation periods (nearly 4 months a year) in 2017 - 2022. The jetty will not be in operation outside of these periods.

Due to the fact that the 2.7 ha jetty site is located on the floodplain of the River Zeya (Figure 4.11) there is a high risk of flooding during high water and flood seasons.

Upon completion of AGPP construction the temporary jetty and its access road will be no longer in use; a decision on whether or not the jetty will be used for other purposes will be taken upon completion of AGPP construction.



Figure 4.11: Preparatory work on the temporary jetty construction site on the river Zeya²⁷

4.3.3.3 Sub-stage 3.3: Access motor roads construction and upgrade

A number of access motor roads will be constructed as part of the Project implementation, including:

²⁷ <http://www.gazprom.ru/about/subsidiaries/news/2016/august/article282455/>

- AMR #1 to the AGPP site (7 km);
- AMR #2 to the AGPP site (2.5 km);
- AMR #3 to the TBI site (0.6 km);
- AMR to the railway station “Zavodskaya” (1.7 km);
- Upgrade of a 6.5 km section (of the road connecting the Amur Highway and Svobodny);
- AMR to the jetty on the River Zeya (5.9 km);
- AMR #8 to the WIS site (1.4 km);
- AMR #9 to the SDIW landfill (1.9 km).

The overall length of the newly constructed and upgraded motor roads will be 27 km.

AMRs #1 and #2 are intended for transporting the plant’s staff to the work site and ensuring continuous operation of the gas processing plant at the operational stage; they will also be used for moving construction machinery to the AGPP site during construction. AMR #1 will also be used for transporting oversized cargoes to the AGPP site. When necessary, AMR #2 will be used as an alternative to deliver heavy equipment subject to cargo width limitation.

AMRs #3 and #4 are intended for transporting cargoes during construction to the railway station under construction and the contractor’s base; subsequently they will be used for AGPP’s needs.

The upgrade of a section of the public road of regional or inter-municipal significance, “Access to Svobodny from the Amur Highway”, will be performed to enable transportation of oversized cargoes to the AGPP site.

AMR #6 to the temporary jetty on the River Zeya will be temporary and will be first used for supporting the construction of the jetty and then for transporting oversized and overweight cargoes from the jetty on the River Zeya to the AGPP site. Once all the cargoes have been delivered, the road will be dismantled.

AMR road #8 to the WIS site is intended for transportation of the Project staff, equipment for repair work and other cargoes, repair and emergency vehicles which ensure the plant’s operation.

AMR #9 is intended for ensuring the staff’s access to the work site and the continuous operation of the SDIW landfill during the operational stage; it will also be used for moving construction machinery to the AGPP site during construction.

4.3.4 Stage 4: AGPP Facilities and Processes

4.3.4.1 Key facilities and processes

Natural gas will be supplied to AGPP via two lines of the “Power of Siberia” gas pipeline, both of which will be design to Gazprom standard STO 089-2010.

The AGPP Project design provides for six process trains capable of processing 7 billion m³ of natural gas per year (Figure 4.12). Another section of the Project site is reserved for process trains 7 and 8 should it prove necessary to increase gas export to China to 42 billion m³ a year. The process trains operate independently of each other, but they are all necessary for ensuring that the volume and the quality of exported gas comply with the conditions of the Gas Purchase and Sale Agreement. A simplified natural gas processing flowchart is shown in Figure 4.13.

Amur GPP includes the following key process components (Table 4.2):

Table 4.2: AGPP Key Process Components

No.	Process units	Number of process trains
1	Natural gas metering unit	2
2	Gas purification and drying unit	6
3	Ethane and WLHF separation, nitrogen removal and nitrogen/helium concentrate production unit	6
4	Ethane metering unit	6

No.	Process units	Number of process trains
5	Gas fractioning unit	3
6	WLHF purification unit	3
7	Helium production unit ²⁸	3
8	Methane fraction booster compression stations	6
9	Methane metering unit	2
10	Flare system units	3
11	Tank farm for storing liquefied gases (commercial products)	3
12	Racks and a section of railway for loading exported liquefied gases	2
13	Fuel gas metering units	2
14	Fuel gas preparation unit	1
15	Air and nitrogen production units	3



Figure 4.12: Designer's view to the AGPP

²⁸ Another three process trains are planned for the future.

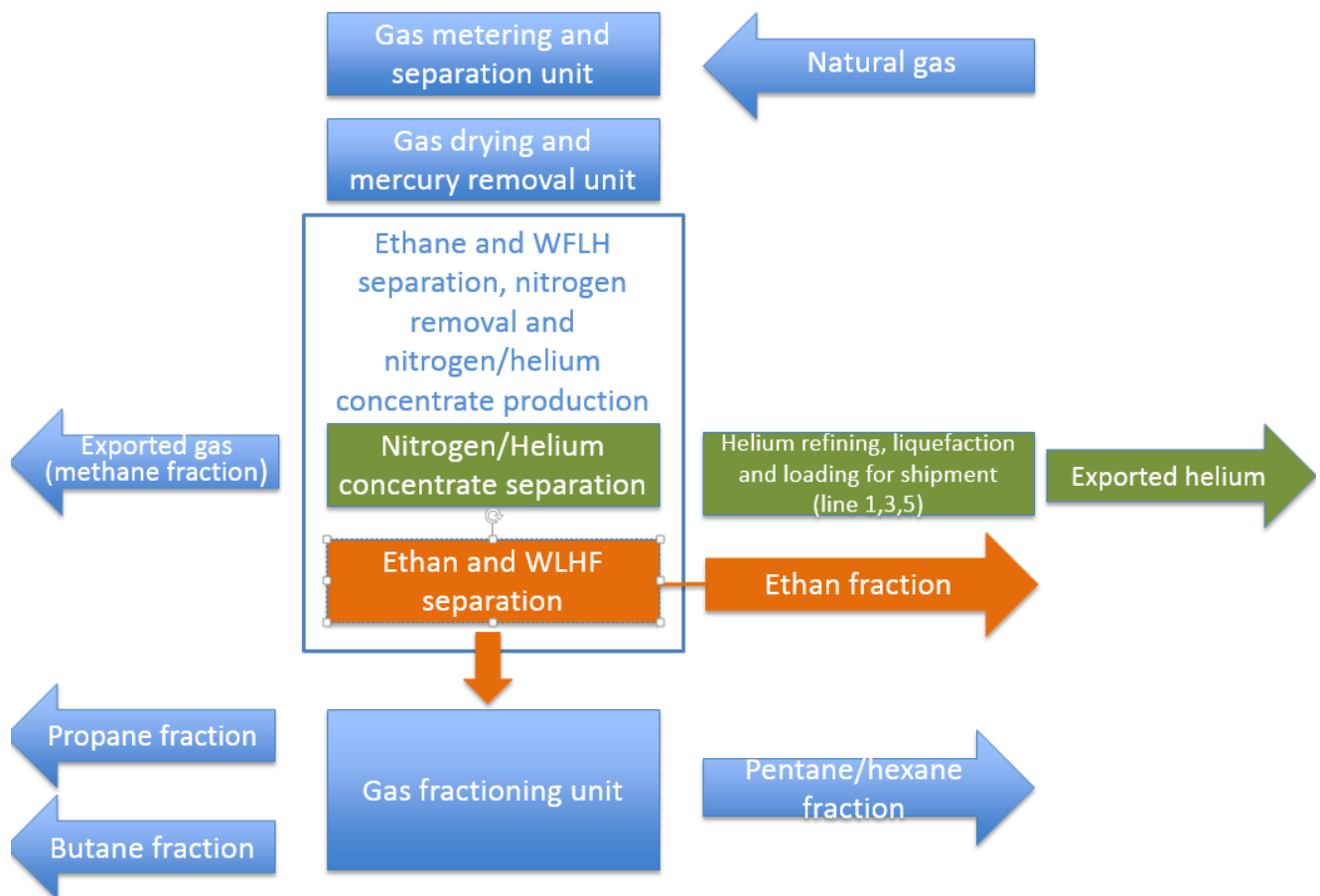


Figure 4.13: Natural gas processing flowchart

All process trains have identical design; therefore, the following description is applicable to any one of them.

The incoming gas is metered at entering AGPP and supplied to the gas purification and drying units where it is dried by a zeolite absorbent. The used absorbent is regenerated and re-used.

The dried gas is further stripped of mercury and methanol contamination by an absorbent and is treated at the cryogenic ethane and WLHF separation, nitrogen removal, and nitrogen/helium mixture production unit. Gas separation is ensured by cryogenic temperatures produced by expansion of gas in turbine expanders and also by means of heat pumps.

The products of gas separation at this stage are methane, hydrocarbons C2+B, and helium/nitrogen gas fractions. These fractions are further processed at the same unit:

- The methane fraction is compressed in the booster compression station; compressed methane is metered and fed into the export pipeline.
- The nitrogen/helium fraction flows to the helium refining, liquefaction and packaging unit where it is separated at cryogenic temperatures into nitrogen and helium. Nitrogen is sent into the nitrogen management system, and any excess nitrogen is released into the atmosphere. The liquefied helium is transported to consumers in specially designed tanks either by road or by rail.
- Fraction C2+B is separated into WLHF and ethane fractions:
 - WFLH fraction is stripped of mercaptan impurities by a zeolite absorbent and sent to the gas fractionating unit; WLHF can be sold as a commercial product if necessary.
 - Ethane fraction is transported to the deep hydrocarbon conversion plant (initially, ethane will be sent into the gas export pipeline until the deep hydrocarbon conversion plant is commissioned).

- WLHF fraction is further separated at the cryogenic gas fractioning unit into propane, butane, and pentane/hexane fractions. These fractions are loaded into specially designed tanks and sold as commercial products.

The Linde Group (Linde) will supply all core process equipment used for recovery of helium at AGPP. Linde will provide a license for the cryogenic gas separation technology, including its engineering aspects, and will supply units for ethane and natural gas liquids extraction and nitrogen rejection, as well as for helium purification, liquefaction, and storage. Linde will supply, and provide engineering support for, ethane (C_2H_6) and WLHF extraction and nitrogen rejection units and helium purification, liquefaction and storage units.

4.3.4.2 Liquefied hydrocarbons storage and loading facilities

Marketable liquefied hydrocarbons are sent to tank farms designed as part of the commercial products/feedstock base: - propane, butane, propane/hexane fraction, technical propane/butane and WLHF tanks.

The tank farm is comprised of the following key process installations:

- spherical tanks divided into groups (20 x 2,400 m³ tanks);
- tank farm manifold room;
- tank farm pumping station;
- drainage and emergency tanks;
- flare separator.

Products are loaded using the loading/unloading rack. Products are loaded into tank cars (full capacity - 75.7 m³, useable capacity - 64.2 m³) using loading risers. The loading/unloading rack includes a rack for inspecting and prepping tank cars for loading which is used to check safety and dispensing valves for operability and leak tightness and tank cars for residual pressure.

4.3.4.3 General plant process facilities

General plant process facilities are comprised of:

- flare systems ensuring safe operation of the GPP and receiving continuous, recurring or emergency discharges of flammable gases and fumes with their subsequent combustion;
- nitrogen/oxygen station supplying technical nitrogen, technical air to the plant's units during their startup and operation.
- fuel gas treatment unit (FGTU) supplying fuel gas to the plant's units during their startup and operation.

These elements are described in turn below.

Flare System

The flare system occupies two sites:

- flare separators and liquid collectors site, and
- flare stack site.

Flare separators are used during gas discharges to prevent liquids from directly entering the flare stacks. The separated gases are metered and sent to flare stacks for combustion. The remaining condensate is collected in a drainage tank fitted with a submersible pump.

AGPP's flare system is comprised of:

- Common high pressure flare system utilizing wet warm gas supplied from the gas cleaning and separation unit and gas drying unit;
- Special high pressure flare system utilising dried and cooled gas produced at the ethane and WFLJ separation unit, nitrogen separation and helium concentrate preparation unit, as well as dry gas from the gas fractioning unit;

- Common low pressure flare system.

High pressure flare systems are separated due to discharges of warm wet gas and cool dry gas which, if combined, could produce ice in flare stack pipes thus lowering the throughput capacity of the flare system and possibly clogging individual pipes.

The flare system is also used in contingency situations or in emergencies scenarios.

Nitrogen/oxygen station

The nitrogen/oxygen station consists of the following sections:

- atmospheric air compression section consisting of compressors, air coolers, an oil and moisture separator, a condensate collection tank, and a condensate removal pump;
- nitrogen production section consisting of a membrane air separation unit, nitrogen drying absorbers, filters, a nitrogen receiver;
- air production section consisting of air drying absorbers, filters and instrumentation air receiver.

FGTU

The FGTU supplies fuel gas to the plant's consumers. Two types of fuel are planned for the unit:

- Type 1 – raw gas;
- Type 2 – marketable gas after the booster compressor station.

Use of raw gas (fuel type 1) is planned until normal operation of Start-up Complex I is achieved. Once normal operation is achieved type 2 fuel will be used. Treatment of fuel gas consists of reducing its pressure to operational, drying, filtering and heating.

4.3.4.4 Key engineering support solutions

Power supply

At present, the main source of power supply in the vicinity of the AGPP construction site is the electrical substation "Amurskaya" owned by the Amur Electrical Grid Company, an affiliate of Federal Grid Company, United Energy System, located in Svobodny, 30 km southwest of the Project site.

Based on the information on power and capacity balances in the United Energy System of the East and the Amur electrical grid it was decided that electricity would be supplied to AGPP from the new "Power of Siberia" thermal power plant (TPP) with the external power grid serving as backup; a 220/110 kV substation, "Zavodskaya", will be constructed and connected to the 500/220 kV substation "Amurskaya".

To distribute the electric power received from the 220/110 kV substation "Zavodskaya" and the "Power of Siberia" TPP among AGPP's consumers a 110 kV distribution substation, "AGPP", will be constructed at the plant's site and connected to the 220/110 kV "Zavodskaya" substation by four 110 kV high-voltage transmission lines, each 3.9 km long.

Until the "Power of Siberia" TPP is commissioned (Q IV of 2020) electric power will be supplied by Amur Electrical Grid. 1,000 kW and 1,600 kW diesel power plants will serve as a backup power source.

Heating

The main heating sources for the Amur GPP will be waste-heat boilers to be installed at the GPA-32 units in the compressor station areas of the booster compressor stations (BCS) for the medium-pressure methane fraction (MPMF). The unit productivity of a waste-heat boiler is 8 MW. The heating water generated by the waste-heat boilers is heat-transfer agent used in the heat recuperation system. After commissioning of all stages of the MPMF BCSs the total amount of the recuperated heat will be 46.8 MW.

Before the commissioning of the BCSs, heating water will be provided by hot-water boiler stations that will also provide some heating water during peak periods in winter when only part of the MPMF booster compressor stations will be commissioned. After all stages of the BCSs will have been commissioned, the hot-water boilers will be on stand-by.

The modular automated hot-water boiler station with a design capacity of 68 MW will be the only heating water source for the facilities to be constructed during the fourth stage of construction, when the plant will be only partially commissioned. The boiler station will comprise four hot-water boilers of 12 MW capacity each and hot-water boilers of 10 MW each. The main source of heating during AGPP construction and operation is a 35 MW automated water heating block-container boiler plant. The boiler plant uses diesel fuel which is stored at the diesel fuel warehouse consisting of 6 100m³ storage tanks.

Once the fuel and pneumatic gas treatment unit is put into operation the water heating boiler plant will use gas as its main fuel. Diesel fuel will be used in emergencies.

Steam supply

Steam will be supplied from the "Power of Siberia" TPP generating superheated steam at a pressure of 1.6 MPa and a temperature of 250°C. Steam will be used for periodic steaming of process installations.

Steam will be used for the technologic process throughout a year and 24 hours per day. The steam supply system for the process installations is of close-circuit type. To ensure reliable steam supply, all trunk steam supply trains will comprise two operating steam pipelines and one stand-by pipeline. Condensate pump stations will be installed at the process units to recycle the steam condensate via condensate pipelines of the thermal power plant (one operating pipeline and one stand-by pipeline).

Commercial metering of the supplied steam and recycled condensate will be performed at the steam and condensate metering station.

Water supply

During the operational phase AGPP will be fitted with the following water supply systems:

- Domestic/drinking water supply;
- Fire water supply;
- Industrial water supply;
- Circulation water supply;
- Recycled water supply (to transport treated stormwater from the WWTF into the fire water tanks), and;
- Underground water supply (to transport water from wells into the fire water tanks).

The Amur GPP facilities will be supplied with water from the WIS located in the Bolshaya Pera River valley. The structure consists of three clusters located 180 m apart from each other. Two of the clusters have 3 wells each (2 operational, 1 standby), the third cluster has a single monitoring well.

Two wells are constantly in operation, two are used for replenishing fire water reserves (in the absence of recycled water). Two standby wells become operational should any of the other wells malfunction. The wells are 100 m deep. Each well is fitted with a modular pumping station. A heating cable is provided to keep the wells from freezing.

A fence will be constructed around the perimeter of the first belt of the WI site's SPZ (30 m).

Water from the water intake will be supplied to the WTF site: water treatment plant and fire water tanks.

During the operational phase the capacity of the water treatment plant will be 3,200 m³/day, including:

- 1,600 m³/day for domestic/drinking needs;
- 1,600 m³/day for production needs.

Wastewater removal

During operation AGPP generates the following types of wastewater: domestic, industrial stormwater, saline, and storm runoff; they are collected in corresponding drains depending on the type and sent to the WWTF site.

Three types of drains will be constructed on the Project site:

- Industrial stormwater;
- Storm runoff;
- Domestic.

The following installations will be built on the WWTF site:

- WWTF for industrial stormwater and storm runoff;
- WWTF for domestic effluent;
- Domestic effluent equalization tanks (2x200 m³);
- Industrial stormwater equalization tank (2000 m³);
- Storm runoff equalization tanks (2x5,000 m³);
- Treated effluent accumulation tanks (2x5,000 m³);
- Treated effluent pumping station;
- Wastewater pumping station for domestic effluent.

All the buildings and installations on the WWTF site will be delivered complete with corresponding equipment.

Industrial stormwater is collected from production processes, from washing and testing process equipment, from fuel and lubricants warehouses surrounded by dikes or bund walls. The industrial stormwater removal system is designed to handle 50% of the fire water flow.

Industrial stormwater is pumped into two 2,000 m³ industrial stormwater tanks installed on the WWTF site. From there, it is pumped to the treatment facilities.

Storm runoff is collected from roads, driveways, undeveloped areas, rooftops, parking lots via stormwater inlets. Then it is sent into the 5,000 m³ vertical stormwater tanks installed on the WWTF site and subsequently pumped to the treatment facilities.

After treatment, industrial stormwater and storm runoff are sent into the 5,000 m³ treated effluent tanks and then, whenever necessary, to the gas processing and helium production site into recycled water tanks for industrial and firefighting needs. Unclaimed by the plant, excess treated industrial stormwater and storm runoff are discharged into water bodies in the amount of up to 30,000 m³/day.

Saline wastewater from the boiler plants, circulation water pumping station, and filters are gravity fed into domestic wastewater sewers and then pumped into two domestic effluent tanks installed on the WWTF site with subsequent transportation to the domestic WWTF.

WWTF, a KOS-850 water treatment plant, are provided as part of TBI for treating domestic and industrial effluents and surface runoff. The modular KOS-850 unit will be delivered by the Shtark group of companies. The KOS-850 is intended for operation in severe weather conditions at temperatures as low as -52°C. The unit will provide several stages of treatment: from chemical treatment to ultra-violet decontamination and sediment dewatering. The technology on which the KOS-850 is based involves anaerobic and aerobic biological treatment processes using activated sludge or suspended/attached growth. Activated sludge microorganisms feed on organic and mineral pollutants which are present in wastewater.

Domestic effluent in the amount of 791 m³/day is fed into a receiving accumulation tank and then sent to the WWTF with the maximum capacity of up to 850 m³ /day, and treatment efficiency 98.99%.

Industrial wastewater (10 m³ /day) and storm runoff (290 m³/day) is fed into a 100 m³ accumulation tank and then sent to the modular industrial stormwater treatment plant with the nominal capacity of 300.0 m³/day, and treatment efficiency 99.74%.

Treated wastewater from the TBI site will be discharged into the Bolshaya Pera River via a sewer.

Treated domestic wastewater is discharged into the the Bolshaya Pera (Figure 4.14). The discharge location was chosen taking into consideration the existing surface water sources for nearby population centers. The discharged effluent conforms to the standards applicable to water bodies utilized for fisheries.



Figure 4.14: Treated wastewater discharge location

4.3.4.5 Construction Phase Life Support Facilities

During construction of the Project's facilities and installations a significant number of staff will be involved, working in rotations; approximately 2,100 members of the construction staff will be simultaneously present at the construction site. Workforce for the construction project will be provided by means of:

- rotational shifts: 80% (for work requiring skilled construction workforce), including 80% inter-regional rotational shifts, 15% intra-regional rotational shifts;
- traditional methods which involve hiring workers from the local population: 20 % (for work not requiring skilled workforce).

In the case of inter-regional rotations, rotational staff will be brought from Vladivostok, Krasnoyarsk, Irkutsk, Novosibirsk, Khabarovsk, Omsk, Tomsk, Surgut, Yakutsk.

The rotational camp, production buildings, repair services and warehouses will be located at the temporary buildings and installations site.

4.3.5 Stage 5: Social Infrastructural Facilities

The implementation of the AGPP construction project will require a substantial workforce. The following social infrastructural facilities will be constructed in Svobodny to accommodate AGPP workers:

- Residential housing project for 5,000 residents (Figure 4.15) with the total area of 142,015.3 m², including a police station, a passport office, drugstores, a baby food bank, grocery and hardware stores, bank offices;
- Secondary general school for 900 students;
- Cultural and recreational center consisting of a large 750-seat auditorium, a 180-seat movie theater, a kids' playground and a club zone accommodating 180 persons;
- Combined sports/fitness center with an ice rink, a swimming pool, a bowling alley, gyms, and cafes;
- Two kindergartens with an indoor swimming pool for 500 children in total;
- A polyclinic with a pharmacy kiosk for adults designed for 220 visits a day and a children's ward designed for 70 visits per shift (Figure 4.16);
- Commercial laundry;

- Commercial kitchen;
- Bathhouse;
- Garages for buses and communal vehicles;
- Office center including a 50-room hotel, a 100-seat restaurant, and a sports/fitness block with a sauna;
- Communications center;
- Department store with a consumer services center;
- Fire depot designed for 4 to 6 fire engines;
- Two open multi-level parking garages with a car wash and a maintenance shop;
- 80 MW liquid fuel-fired boiler plant (to be subsequently converted into gas-fired);
- The housing project's heat networks to be connected to the new boiler plant;
- The housing project's internal plumbing;
- The housing project's water intake facilities, water treatment plant, sewage treatment facilities.



Figure 4.15: Layout of residential housing project in Svobodny



Figure 4.16: Polyclinic design

The location of the social infrastructural facilities was chosen in accordance with the resolution of the council of people's deputies of the Municipal Entity Town of Svobodny dated April 4, 2013 "On Amending the General Urban Development Plan for the Town of Svobodny" which defines the residential housing reserve zone (Appendix 1), and Resolution #1221 dated July 25, 2014 of the Municipal Entity Town of Svobodny on reserving land plots for mixed and residential development.

4.3.6 Stage 6: SDIW Landfill

During the operational phase AGPP will generate solid domestic and industrial wastes but the capacity of the region's existing SDW landfills is insufficient for the Project's needs. Therefore, a SDIW landfill) will be

constructed for disposal of hazard class IV to V industrial wastes and thermal decontamination of hazard class III to V domestic and industrial wastes.

The SDW landfill will be constructed 8 km southeast of the main AGPP site. SDW landfill site with the area of 19.6 ha is located on a watershed, 6.5 km east of the River Zeya (Figure 4.17).

The SDW landfill is designed to receive 375,000 tons of wastes during a 25-year period, including 168,000 tons of wastes for burial and 205,000 tons for thermal decontamination.

8,200 tons of wastes will be sent for thermal decontamination every year, including:

- 5,500 tons of hazard class III and IV liquid wastes;
- 2,700 tons of hazard class II to V solid wastes;
- 1.4 tons of medical wastes.

6,700 tonnes of waste will be disposed at the landfill annually, including ash and slag generated by the thermal waste treatment.



Figure 4.17: SDW landfill layout

18 cells for burying industrial wastes (IW) are designed for the landfill's main production area, including 5 cells for burying wastewater sludge (WS). Each cell is sized 45x89 m, and is 2 m deep. The cells are surrounded by earth bunding 2.5 m high, they are protected with landfill liner and fitted with a drainage system and a leachate collection system. Cell slopes and floor are covered with liners which form a low permeable barrier made of geosynthetic waterproofing materials laid on top of a leveling sand layer.

Two units, each with the capacity of 100 kg/h, will be used for thermal decontamination of hazard class III to V solid industrial wastes and hazard class IV to V solid domestic wastes. One unit with the capacity of 3,000 kg/h will be used for thermal decontamination of liquid wastes (oil from oil traps, slime from oil tanks cleaning, storm and snowmelt water from waste burial cells, sludge from biological WWTF). The 100 kg/h units are installed in steel containers; the 3,000 kg/h unit is located in a block-modular building. Natural gas will be used as fuel.

Wastes are transported to the landfill by trucks. Garbage trucks are inspected and weighted at the landfill entrance. An automated monitoring system is used to check all vehicles for radiation. A portable detector is used to detect mercury vapors.

No toxic, radioactive or biologically active wastes will be allowed at the landfill.

4.3.7 Project Decommissioning

It is proposed that AGPP will function for so long as the "Power of Siberia" pipeline remains in operation delivering raw gas to AGPP. The operational phase will last for at least 30 years in accordance with the gas

delivery contract between Gazprom and China National Petroleum Corporation (CNPC). Project decommissioning documentation will be prepared shortly before the end of AGPP's operational phase and will, in particular, provide for reclamation of the Project sites.

4.4 Area of Influence, Associated Facilities, Out-of-Scope Facilities/Activities

4.4.1 Project Area of Influence

The Project's AoI will include areas both directly and indirectly affected by the Project both within and outside the Project site.

The areas directly affected by the Project include those affected by direct physical impacts from the gas processing plant or associated auxiliary facilities located within the Project battery limits

The Project will also have indirect impacts outside the Project site including:

- AGPP construction phase:
 - Lights and visual impacts outside the Project area.
 - Impacts on the river water quality downstream of the temporary jetty on the River Zeya (only during construction phase).
 - Noise and air pollution produced by construction vehicles.
 - Damage to local roads caused by heavy trucks and construction machinery.
 - Socio-economic benefits to local communities and population centers in the Svobodnensky district.
- AGPP operational phase:
 - Lights and visual impacts outside the Project area.
 - Noise and air pollution caused by AGPP operations.
 - Noise and air pollution caused by AGPP export operations involving trucks or rail transport.
 - Socio-economic benefits to local communities and population centers in the Svobodnensky district.

4.4.2 Associated Facilities

According to the IFC Performance Standard associated facilities are facilities that are not funded as part of the project and that would not have been constructed or expanded if the project had not existed and without which the project would not be viable. For example, the following facilities/activities may be deemed as associated according to the IFC definition:

- Trains, trucks or vessels designed for transporting liquefied gas/liquefied gas transportation (Figure 4.18);
- Logistics bases/terminals for servicing and distribution of isothermal tanks filled with liquefied gases;
- Sections of railway tracks linking together Project facilities; railway stations "Zavodskaya", "Zavodskaya-2", and "Ust-Pera";
- Sibur's deep hydrocarbon conversion plant, etc.
- Residential housing project in Svobodny, including associated social facilities (medical center, secondary school, two kindergartens, a police station and a fire depot, a water intake structure and engineering infrastructure), etc.

See the full list of associated facilities along with the reasons why they have been categorized as such in Table 4.3 below.

Table 4.3: Associated facilities / activities

Facilities / Activities	Is this facility / activity funded as part of the Project?	Would this facility/activity have existed had the Project not been implemented?	Would the Project be viable without this facility/activity?	Notes
Associated engineering facilities/activities:				
Transportation (by contractors) of cargos required for AGPP construction	No	No	No	
Transportation (by contractors) of cargos required for AGPP operation	No	No	No	
"Power of Siberia" TPP and associated transmission lines and substations	No	No	No	Gazprom entrusted Gazprom Energo with managing and servicing the Project's power infrastructure.
KS-7a "Zeiskaya" compressor station	No	No	No	KS-7a "Zeiskaya" compressor station is within the Project's area of influence since it is connected with the AGPP site by gas import and export pipelines which are part of the Project.
Logistics bases/terminals for transporting liquefied gases to customers	No	No	No	Gazprom Gazenergoset will construct a special logistics terminal near Vladivostok for managing helium transportation operations. LNG transshipment terminal in Port Vanino will be constructed under a contract between Gazprom Export and Sakhatrans.
Trains, trucks and vessels equipped for transportation of liquefied gases	No	No	No	Liquefied helium will be transported in special isothermal tanks. These tanks, along with a fleet of trucks equipped for transportation of such tanks, are also deemed as Associated Facilities since they are not neither funded nor owned by the Project.

Facilities / Activities	Is this facility / activity funded as part of the Project?	Would this facility/activity have existed had the Project not been implemented?	Would the Project be viable without this facility/activity?	Notes
Sections of railway tracks constructed to provide access to Project facilities, and railway stations "Zavodskaya" and "Zavodskaya-2"	No	No	No	Gazprom entrusted Gazprom Trans with managing and servicing the Project's railway infrastructure.
Sibur's deep hydrocarbon conversion plant	No	No	No	AGPP produced ethane will be utilised by the plant.
Associated social facilities / activities:				
Social facilities associated with the residential housing project in Svobodny (see section 4.3.5)	No	No	No	Social infrastructure is sponsored by the Project and will be managed by the district of Svobodny administration. The Project would not be viable without workers which require social infrastructure.



Figure 4.18: Isothermal tanks for liquefied helium transportation²⁹

4.4.3 Out-of-Scope Facilities

The activities that will not be addressed by the ESIA, since they are outside the Project's AoI and beyond GPPB's control, are listed in Section 4.4.4. In particular, the "Power of Siberia" gas pipeline (except the compressor station KS-7a "Zeiskaya") is considered an out-of-scope facility in relation to the AGPP Project for the following reasons:

- (i) The AGPP Project does not include any sections of the "Power of Siberia" gas pipeline, and
- (ii) The "Power of Siberia" gas pipeline is not directly owned, operated or managed by the Project.

²⁹<http://www.eastrussia.ru/news/logotsentr-obsluzhivaniya-iso-konteynerov-s-geliem-sozdast-v-primore-gazprom-gazenergoset/eastrussia.ru>

Consequently, the “Power of Siberia” pipeline is regarded as being outside the Project’s AoI, and is excluded from the associated facilities list.

Examples of Project-related out-of-scope facilities/activities are given below:

- Quarries and borrow pits used by the construction contractors during the construction phase under agreements with licensed quarry operators;
- Public roads/highways, bridges, ports and airports. AGPP will benefit from implementation of the proposed projects involving construction of bridges across the Amur River which will shorten helium export routes to China;
- The Amur Region electric power generation and distribution facilities (which supply power to the Project during construction phase and serve as backup during operational phase) are outside the Project scope. The additional high voltage power transmission lines which are required for hooking up the Project facilities to the power grid will be owned by the electricity distribution companies. AGPP will benefit from implementation of the region’s planned brand-new projects. For example, a major 8 GW thermal power plant, Erkovetskaya, will be constructed in the Amur Region as a joint project with the State Grid Corporation of China (SGCC). The commissioning of the power plant’s first phase is scheduled for 2019.

4.4.4 *Project, Associated Facilities, and Out-of-Scope Facilities/Activities Summary*

A summary of the Project facilities/activities, out-of-scope facilities/activities, and associated facilities/activities described above is given below:

Project facilities/activities:

- Construction phase temporary Project facilities including the temporary jetty on the River Zeya intended for handling oversized cargoes;
- Gas pipeline sections connecting AGPP with the “Power of Siberia” main gas pipeline and the compressor station KS-7a “Zeyskaya”;
- GPP, auxiliary facilities and infrastructure within the Project battery limits;
- SWIW landfill designed specifically for the Project’s needs;
- WI facilities (wells) and water supply pipelines;
- Project contractors’ (construction phase) and AGPP’s (operational phase) water treatment facilities, including sewers for discharging effluent into the rivers;
- Accommodation for Project staff owned by the Project.

Associated facilities/activities:

- Transportation of cargos required for AGPP construction (performed by contractors);
- Transportation of cargos required for AGPP operation (performed by contractors);
- Trains, trucks or vessels equipped for transporting liquefied gas/liquefied gas transportation;
- Logistics bases/terminals for servicing and distribution of isothermal tanks filled with liquefied gases;
- Residential housing project in Svobodny, including associated social facilities (medical center, secondary school, two kindergartens, a police station and a fire depot, a water intake structure and engineering infrastructure);
- Sections of railway tracks linking together Project facilities; railway stations “Zavodskaya”, “Zavodskaya-2”, and “Ust-Pera”;
- Sibur’s deep hydrocarbon conversion plant.

Project out-of-scope facilities

- “Power of Siberia” gas pipeline and gas producers supplying gas over the gas pipeline;
- Amur Region generating plants/Electrical grid outside the Project area;

- “Power of Siberia” thermal power plant and transmission lines/substations;
- Ports, public roads, bridges used for delivering AGPP products to consumers;
- Waste disposal facilities other than the Project’s own landfill;
- Public railway lines and stations;
- Communal water treatment facilities in Svobodny serving Project staff’s apartments in Svobodny;
- Accommodation rented by Project staff;
- Airports near Svobodny and Blagoveshchensk;
- Quarries used during the Project’s construction phase

5. STAKEHOLDER ENGAGEMENT

5.1 Introduction

This Chapter presents information on actions and practices related to the engagement of interested parties of the Project.

The Project's potential external stakeholders (e.g. local communities and authorities) are most likely to be located in the following settlements:

- Town of Svobodny;
- Yukhta
- Yukhta-3
- Chernigovka
- Dmitrievka

Stakeholder engagement is required in order to ensure that the Project implementation is beneficial to local and regional stakeholders, and to discover and properly manage potential negative impacts of the Project. Initiating the stakeholder engagement process at the early stage of the Project, together with the adoption of appropriate communication mechanisms, helps to ensure the following:

- timely public access to all relevant information; and
- that all stakeholders are provided with an opportunity to input into the Project design, the identification and assessment of impacts and measures for impact mitigation and enhancement (in the case of beneficial effects).

This chapter covers the following key issues:

- Identification of the key stakeholders;
- Overview of the approach of the Company to the stakeholder activities;
- Overview of consultation and stakeholder engagement activities undertaken to date;
- Brief description of stakeholder engagement activities to be taken in future;
- Current and future roles and responsibilities related to stakeholder engagement;
- Consideration of necessity of Free, Prior and Informed Consent (FPIC) process;
- List of key steps of the grievance mechanism proposed by Ramboll Environ;
- Brief indication of monitoring and reporting procedures as proposed by Ramboll Environ.

As part of the ESIA package, Ramboll Environ has prepared SEP, which includes details on all topics discussed in this chapter as the chapter primarily presents concise information only.

5.2 Key stakeholders

Identification of key stakeholders is a vital part of the ESIA process required to understand the groups that have been or will be affected by the Project. For the purposes of effective and tailored engagement, the Project stakeholders have been categorised into the following key groups:

Affected Parties

This category includes persons, groups and other entities within the anticipated Project AoI that are directly affected (actually or potentially) by the Project and/or have been identified as most susceptible to change associated with the Project.

This group involves affected landowners and land users, rural communities in the project area of influence, communities living in the town of Svobodny, local hunters and fishermen, Project contractors and subcontractors and Project workers.

Interested Parties

Individuals/groups/entities that may not experience direct impacts from the Project but who consider or perceive their interests as being affected by the Project and/or who could influence the Project and the process of its implementation in an indirect way are included in this category.

This category of stakeholders includes various federal ministries and agencies, regional ministries and agencies, district and local level authorities, business, religious organizations, civil society organizations, mass media representatives, and higher education institutions.

More details on stakeholder groups are provided below.

5.2.1 Affected Parties

5.2.1.1 Affected landowners and land users

Landowners and land users, whose land has been acquired or will be temporarily occupied for Project purposes, are stakeholders in the Project.

50 private land plots (total surface area: 528 hectares) have been purchased from as many landowners (with co-owners in a few cases). Landowners are usually local farmers that were using this land for agriculture (with some plots unused), crops being mostly soya, wheat, and barley. Most plots have been acquired in 'willing buyer – willing seller' amicable transactions with compensation based on regional values. Compulsory acquisition procedures, based on the federal interest declared for the Project, have been used in a small number of cases where landowners were unwilling to reach an amicable transaction. The compensation process is currently complete (September 2016). Some land plots did have private land users, usually under a formalised rental agreement with the landowner.

In addition, 113 plots were also acquired from State and municipal property for a total surface area of 1,088 hectares. No private land users have been identified on these plots.

5.2.1.2 Rural communities in the project area of influence

Within the territory of Svobodnensky District, and not including the town of Svobodny, which is addressed in the following section, the Project Area of Influence intersects the territory of three adjacent Village Councils (see table below):

- Dmitrievka, within which the settlements of Dmitrievka, Ust-Pera, Yukhta and Yukhta-3 are part of the Project Area of Influence;
- Zheltoyarovo, within which the settlement of Chernigovka is part of the Project AoI;
- Nizhny Buzuli, which includes land that is affected by the Project but no close-by settlement.

Key characteristics of settlements in the Project area of influence are described in Table 5.1 below.

Table 5.1: Key Characteristics of Settlements in the Area of Influence

Settlement	Village council	Current population (number of residents, 2016)	Distance to AGPP facilities(km)
Dmitrievka	Dmitrievka	406	1.6 km to construction camp
Ust'-Pera	Dmitrievka	439	0.5 km to railway station and
Yukhta	Dmitrievka	388	2.2 km to plant
Yukhta 3	Dmitrievka	127	2.5 km to construction village
Chernigovka	Zheltoyarovo	460	5.2 km to port on Zeya River

5.2.1.3 Town of Svobodny

The current population of the town of Svobodny is about 57,000 residents. Only a small fraction of the population of Svobodny will be affected by the Project, with anticipated impacts essentially positive:

- People that will be employed directly or indirectly by the Project in the construction or operations phases, including sub-contractors and local supply chain such as the catering and other businesses;
- People that will benefit from construction of a worker accommodation micro-district, to be built for the operations phase in the northern part of the city;
- People that will benefit indirectly from the improved tax basis of the city, with expected positive impacts on local infrastructure, social facilities, and delivery of social services.

In interaction with Project representatives, the Svobodny population is represented by the Municipal Administration.

5.2.1.4 Hunters and fishermen

The Ramboll-Environ team met with the chairman of the Association of Hunters and Fishermen, which is the Amur Region branch of the Russian Association of Community Societies of Hunters and Fishermen, an officially recognised NGO in the Russian Federation. The representative³⁰ of Hunters and Fishermen indicated that they have an active membership of about 600 people and explained the role of the organisation:

- The Association has the right to raise concerns and facts to the attention of these enforcement organs (namely the Regional State Inspection of Hunting and Fishing);
- They monitor kills and participate in the allocation to local community associations of a quota for all species that can be hunted;
- They monitor fauna on an annual basis along defined transects and share the results with regional level enforcement organs.

The representative of hunters and fishermen also shared specific concerns in regards of the Project, and associated projects, particularly the pipelines of “Power of Siberia”:

- The pipeline construction and operations phase will entail a ‘corridor’ effect which will be detrimental to fauna movements; generally the representative met believes that the pipeline construction will be more detrimental than that of the gas plant, essentially because of this corridor effect through forested areas; it is also feared that the deforested corridor, probably including a vehicular track for pipeline maintenance purposes, will increase induced access to areas that are essentially inaccessible at the moment, thereby facilitating hunters’ and poachers’ access, and associated negative effects to fauna.
- However, the deforestation of the Project area itself will also be detrimental to local fauna, both from a habitat transformation and from a migration conditions perspective.
- Noise and light from the construction site may also be disruptive to local fauna.
- Lastly, a specific concern was raised in respect of influx of construction and operations workforce to the Project area and to the Svobodny area: it is feared that this will increase the pressure on natural resources in general, but also more specifically that this workforce, which will mostly be male, will include a number of hunters and fishermen, which may significantly increase the pressure on terrestrial and aquatic fauna.

5.2.1.5 Project contractors and sub-contractors

The main current Project contractors with whom GPPB has passed agreements are presented in table 5-2.:

³⁰ Mr Kalishchuk Sergey Nikolayevich

Table 5.2: The principal GPPB contractors

	Early work facilities	Railway infrastructural facilities	Auxiliary Facilities			GPP	Residential housing	SDIW landfill
			Onsite and water treatments facilities	Temporary jetty on the River Zeya	Motor roads			
Project management	Gazprom pererabotka Blagoveshchensk LLC							
General Designer	PJSC VNIPIgazdobycha							
Design	PJSC VNIPIgazdobycha	NIPI NG PENTON LLC	PJSC VNIPIgazdobycha	NIPI NG PENTON LLC	JSC NIPIGaz pererabotka	NIPI NG PENTON LLC OJSC KRIOGENMASH	NIPI NG PENTON LLC	NIPI NG PENTON LLC
Site preparation	OJSC Bureyagesstroy JSC Asphalt JSC USK Most JSC Stroytransneftegas Podvodtruboprovodstroy LLC	SvyazStroy Montazh LLC		Trest Zapsibgydro story LLC				
Detailed Engineering	PJSC VNIPIgazdobycha JSC NIPIGazpererabotka JSC SDKM Spezstroykonstrukziya LLC	M-Proyekt LLC		CJCS Sibrechproyekt	Artstroy LLC	Linde AG		
Construction including Piling	Podvodtruboprovodstroy LLC SAP-Holding LLC JSC Stroytransneftegas	SvyazStroy Montazh LLC		Trest Zapsibgydro story LLC				
Water supply & discharge	JSC Stroytransneftegas	SvyazStroy Montazh LLC		Trest Zapsibgydro story LLC				
Utility systems	Sistemy I Seti LLC CJSC Inzhenernee Sistemy Servis	SvyazStroy Montazh LLC		Trest Zapsibgydro story LLC				

	Early work facilities	Railway infrastructural facilities	Auxiliary Facilities			GPP	Residential housing	SDIW landfill
			Onsite and water treatments facilities	Temporary jetty on the River Zeya	Motor roads			
Accommodation camp and temporary facilities	JSC Stroytransneftegas Podvodtruboprovodstroy LLC SAP-Holding LLC	SvyazStroy Montazh LLC		Trest Zapsibgydro story LLC				
Sub-contractor	JSC Mostdorstroy Stroytransgaz Sibir' LLC	JSC Kompaniya Mostostroy SpezStroyPut' LLC		CJSC Mostootryad-69				
Plant and Equipment (incl. Long lead items)		SvyazStroy Montazh LLC						
Procurement and supply	JSC NIPIGazpererabotka	JSC NIPIGaz pererabotka	JSC NIPIGaz pererabotka	JSC NIPIGaz pererabotka	JSC NIPIGaz pererabotka	JSC NIPIGaz pererabotka	JSC NIPIGaz pererabotka	JSC NIPIGaz pererabotka

Other contractors are about to be selected for further phases of work and various lots.

In accordance with usual modalities on such objects, these direct contractors may employ sub-contractors for certain specific construction activities, transport and logistics, or tasks such as provision of security, catering, and cleaning services.

5.2.1.6 Project workers

Project workers are stakeholders in the Project. In the peak of the construction phase (2018 to 2021), it is anticipated that up to 18,000 workers will be involved. These can be categorised as follows:

- Direct GPPB employees, a compact team essentially dedicated to construction supervision, stakeholder engagement, occupational health and safety supervision, social and environmental impact management tasks. It is anticipated that a team of about 50 individuals will be involved in the construction phase as direct GPPB employees.
- Employees of the main EPC Contractor NIPIGAZ.
- Employees of contractors tasked with specific construction lots such as road or railway construction.
- Employees of sub-contractors in the sub-contracting chain that is usual on similar major construction projects, for example security services, cleaning, catering, transport, as well as specific construction activities.
- Off-site employees in the supply chain of the Project that work exclusively for the Project (for instance drivers of transport companies that would work exclusively for the Project during the construction period).

In the construction phase, GPPB direct employees includes a limited number of professionals tasked with supervision activities. However, in the operations phase, GPPB will operate the plant and will bring numerous direct employees, with limited sub-contractor involvement. It is anticipated that the total number of permanent, operations phase workers will be around 3,000.

GPPB has partnered with the Amur State University to develop chemical engineering trainings at graduate and post-graduate levels. The University, with GPPB's financial support, purchased specific technical equipment to enable these trainings. A first cohort of students (including a number of young people from the Svobodnensky District and the town of Svobodny) is currently attending such trainings. They are potential Project employees, hence also stakeholders.

5.2.2 Interested parties

5.2.2.1 Government authorities

Federal level

Federal ministries and agencies potentially involved or interested in the Project are the following:

- Ministries of the Russian Federation:
 - The Ministry of Natural Resources and Environment;
 - The Ministry of Civil Defence, Emergencies and Disaster Relief;
 - The Ministry of Healthcare;
 - The Ministry for Industry and Trade;
 - The Ministry of Transport;
 - The Ministry of Energy;
 - The Ministry of Construction, Housing and Utilities;
- Federal Supervision Agencies:
 - The Federal Service for the Oversight of Consumer Protection and Welfare;
 - The Federal Service for Hydrometeorology and Environmental Monitoring;
 - The Federal Service for Supervision of Natural Resources;
 - The Federal Agency for Water Resources;
 - The Federal Agency for Mineral Resources;
 - The Federal Agency for Technical Regulations and Metrology;

- The Federal Agency for Fishery;
- The Federal Service for Environmental, Technological, and Nuclear Supervision;
- The Federal Agency for Forestry.

Regional level

Regional level agencies involved in the Project include all regional branches of the Federal ministries and agencies.

- Regional Ministries/Departments of the Amur Region:
 - The Ministry of Social Security of the Amur Region;
 - The Amur Region Department of Employment;
 - The Amur Region Department of Water Resources of Amur Basin Water Affairs Authority of the Federal Agency of Water Resources;
 - The Amur Region Department for Subsoil Resources' Use;
 - The Ministry for Natural Resources of the Amur Region;
 - The Ministry of Healthcare of the Amur Region;
 - The Ministry of Transport and Construction of the Amur Region;
 - The Ministry of Agriculture of the Amur Region;
 - The Ministry of Housing and Utilities of the Amur Region;
 - The Ministry of Economic Development of the Amur Region.
- Representations at the regional level of federal supervision agencies:
 - The Amur Region Authority of the Ministry of Civil Defense, Emergencies and Disaster Relief
 - The Amur Region Authority of the Federal Service for Supervision in the sphere of Consumer Rights and Human Welfare Protection (Rospotrebnadzor);
 - The Amur Region Authority of the Federal Service for Supervision in the sphere of Natural Resources (Rosprirodnadzor);
 - The Amur Region Authority of the Federal Service for Supervision in the sphere of Veterinary and Phytosanitary (Rossel'khoznadzor);
 - The Amur Region Authority of the Federal Service for Ecological, Technological and Nuclear Supervision (Rostekhnadzor);
- Regional level agencies:
 - The Amur Region Department of Forestry Affairs;
 - The Amur Region Department of State Road-transport Supervision (Rostransnadzor);
 - The Amur Region Department of State Construction and for Supervision in the sphere of Housing;
 - FGBU Department for Hydrometeorology and Environmental Monitoring;
 - The Amur Region Fire Fighting Service;
 - The Amur Region Department of Hunting Sector.

District level

At District level, two Municipal Organisations are interested in the Project:

- Municipal Organisation 'Svobodnensky District', which corresponds to the rural part of the territory of the District and administers all rural villages in the District and associated infrastructure;
- Municipal Organisation 'Town of Svobodny', which administers the urban territory of the City.

Both Municipal Organisations have similar structures, as follows:

- A head (currently Romanov Yuri Pavlovich for the Svobodnensky District and Kaminsky Robert Valentinovich for the town of Svobodny), with a deputy and administrative support officers;
- A number of departments, including, amongst others, economy, education, public health, emergency situations, culture, sport, security;
- A council of deputies, which approves certain executive decisions and is formed of area deputies elected from party lists.

Local level

At the local level, three rural councils ('se/sovet') are interested, two of which were met by the Ramboll Environ team in August 2016 and were able to express their questions and concerns.

5.2.2.2 Businesses

Local businesses are interested parties. At present, a limited number of local businesses (based in Svobodny District) are used by the Project for services including catering, accommodation, cleaning and security. Other businesses from Blagoveshchensk are also involved in the Project. The business base in Svobodnensky District and the town of Svobodny is currently limited but local companies could play a role in the Project as sub-contractors to larger contractors. It is therefore expected that when in full construction phase, the Project will support further development of local businesses.

5.2.2.3 Religious authorities

The Company has been liaising with the ecclesiastic jurisdiction of the Orthodox Church of Russia based in Blagoveshchensk in respect of the potential construction of a new church in the town of Svobodny. The church was initially intended for the workers microdistrict but following negotiations with both the Orthodox Church and the Municipal Administration, it was decided that the new church would be built for the whole city in a central location rather than in the new microdistrict. Negotiations have been held with Archpriest Valery Syrtsov, secretary of the Diocese and titular priest of the Svobodny church (existing and to be built).

5.2.2.4 Civil society organisations

At this point in time, no local or regional non-governmental organisations with a specific interest in the Project have been identified, with the exception of the Hunters Association described in section 5.2.1.4 above.

5.2.2.5 Press and mass media

The following mass media are active in the Svobodny area:

- Newspapers:
 - "Zejskie Ognj", based in the town of Svobodny with a local editorial team, which has existed under various names since pre-Revolution times;
 - "Svobodnensky Vestnik";
 - "Svobodnaya Gazeta";
 - "Amurskaya pravda"
- Press agencies:
 - "Amur-info";
 - "Port-Amur";
 - "ASN 24";
 - "Interfax DV"

- "Rossiya Segonya DV"
- "Vostok Rossii"
- Radio:
 - "Russkoe Radio", Svobodny, 101.9 FM;
- TV channels:
 - "GTRK-Amur" ("Vesti-24", "Rossiya-1" and "Rossiya-24");
 - "Alfa-Kanal";
 - "Gorod";
 - "Pervy Regionnoy Kanal";
 - Channel "Region 28", which partners with the national network "REN TV";
- Websites:
 - "gzt-sv.ru", which is the on-line version of newspaper "Zejskie Ogny", and includes daily news, forums for citizens, and has a dedicated link to information related to the Project;
 - "svobnews.amur.ru", which is the official website of the Municipal Organisation of the town of Svobodny;
 - "svobregion.ru", which is the official website of the Municipal Organisation "Svobodnensky District";
 - "svb28.ru";
 - the regional website "ampravda.ru", which provides a news service at regional level.

5.2.2.6 Higher education institutions

As mentioned in section 5.2.1.6, GPPB has partnered with the Amur State University to develop chemical engineering trainings at graduate and post-graduate levels. The University, with GPPB's financial support, purchased specific technical equipment to enable these trainings. A first cohort of students (including a number of young people from the Svobodnensky District and the town of Svobodny) is currently attending such trainings. Gazprom and the University will organise during the course practical internships in the Gazprom network of similar plants in other regions of Russia to provide practical experience to the students.

5.3 Past consultation and engagement activities

5.3.1 Engagement and information disclosure format

For disclosing Project-related information and engaging with relevant stakeholders, the Company employs the following activities:

- Periodic press-releases;
- Participation in business forums and exhibitions such as the Far East World Economic Forum, an international business forum that takes place every year in Vladivostok on the model of the St Petersburg World Economic Forum, and other similar events of regional and inter-regional significance;
- Individual negotiations with landowners in respect of land acquisition and temporary occupation;
- Regular meetings with local administrative organs on issues such as Project construction progress, the development of worker accommodation in Svobodny, job opportunities, social, environmental and economic impacts;
- Meetings with local businesses on procurement and employment opportunities;
- Meetings with various stakeholders at local and regional levels, mainly including the following:
 - Regional and local authorities of the Orthodox Church, particularly in regards of the construction of a new church in Svobodny that will be sponsored by GPPB;
 - Hunters and fishermen.

Besides, as part of National EIA, the Company also held statutory public hearings.

The Company views valuable the local knowledge that may be provided by local experts. Therefore, GPPB initiated the establishment of the Community Council involving prominent local stakeholders in order to disseminate information about the Project; the participants of the Council may be grouped as follows:

- Representatives of local (Svobodny and Svobodnensky district) authorities;
- Representatives of non-governmental organizations and activists of Svobodny and Amur region;
- Media workers;
- Workers of government-funded entities (e.g. schools, hospitals).

The role of the Council is the following:

- Contribute to disseminating information about the Project and its impacts to the local and regional civil society;
- Seek advice and feedback on the Project and its impacts from the local and regional civil society through a number of independent, well regarded individuals;
- Discuss any specific issues as warranted by the implementation of the Project.

More specifics on the engagement and information disclosure format are provided in SEP.

5.3.2 *Current roles and responsibilities*

The Company currently maintains a team based in Blagoveshchensk with frequent visits to the Svobodnensky district located about 150 km away. The team includes one experienced (female) specialist specifically in charge of stakeholder engagement, including liaising with local community organisations, local government agencies, the local press and other mass media, in both Blagoveshchensk and Svobodnensky District. Other specialists involved in stakeholder engagement include:

- The General Director of the Company, who is in charge of high-level interaction at federal, regional, and local levels, and frequently visits the Project area (Blagoveshchensk, Svobodny, and Project Area of Influence);
- The head of the Asset Department based in Blagoveshchensk and his deputies and collaborators, who are specifically in charge of interaction at the regional and local levels, particularly with regards to land acquisition and associated negotiations with landowners, including both private persons and Government agencies.

5.3.3 *Engagement activities taken to date*

Stakeholder engagement activities to-date have mainly included:

- Statutory public hearings held as part of regulatory processes related with the national EIA and amendments to the General Plan;
- Negotiation meetings held with landowners whose land had to be acquired or occupied for Project purposes;
- Other engagement activities organised by GPPB as part of public relations activities, including presence at exhibitions and other forums at regional and inter-regional level (both Amur Region and Far East Federal Province).

The particular engagement activities are listed in Table 5.2.

Table 5.3: Engagement activities taken by GPPB to date

Date	Nature of engagement	Location of engagement	Key concerns and suggestions raised
Early 2015 to mid-2016	Interaction with landowners whose land is affected by the Project (about 50 individuals in total) to reach negotiated agreements in respect of land acquisition and/or temporary occupation	<ul style="list-style-type: none"> Landowners' homes GPPB offices in Blagoveshchensk and Svobodny District and town administration offices in Svobodny 	Not all landowners agreed immediately and reaching an agreement sometimes required numerous meetings. Key concerns raised were related to valuation of land and crops. Compulsory acquisition of land per RF legislation had to be triggered in a limited number of cases (about 5) where no amicable agreement could be reached.
Early 2015 to mid-2016	Interaction with State and municipal agencies whose land is affected by the Project	<ul style="list-style-type: none"> GPPB offices in Blagoveshchensk and Svobodny District and town administration offices in Svobodny 	No specific concern raised.
30 April – 30 May, 2015	Disclosure of Technical Tasks for preparation of national EIA for Amur GPP. Information about the EIA procedure and the Technical assignment was published in the local and federal press.	<ul style="list-style-type: none"> Svobodny District Administration office / webpage www.svobregion.ru; Nizhnebuzulinsky District Administration office; Dmitrievsky District Administration office; VNIPI Gazdobycha, www.vnipigaz.gazprom.ru. 	No specific concerns or comments were expressed in the registers during the disclosure period.
23-09-2015	Public hearing on preliminary draft of AGPP Project EIA, carried out by VNIPI Gazdobycha jointly with the Svobodnensky District Administration.	Three separate events in Chernigovka village, Dmitrievka village, and the town of Svobodny	<p>Main questions raised by the attendance were in regards of:</p> <ul style="list-style-type: none"> Construction schedule Freshwater pollution prevention Employment of the local population at the Project
23-09-2015	Public hearing on waste disposal facility project (located close to Chernigovka village)	Chernigovka village	Main question was raised by the Head of Svobodnensky District Administration, who suggested that the waste disposal facility designed for the Project should be available for the domestic waste disposal by the local population. The Project representatives promised to consider this option.

Date	Nature of engagement	Location of engagement	Key concerns and suggestions raised
11-05-2016	Public hearing in relation to housing estate design project in the Northern part of Svobodny for AGPP staff.	town of Svobodny	<p>Main questions raised by the attendance were in regards of:</p> <ul style="list-style-type: none"> • Who would be responsible for operations and maintenance at this housing estate? • GPPB representative answered that this housing estate may be handed over to the Svobodny Administration upon its commissioning. • Local population would like to have opportunity to establish businesses serving this accommodation area, such as kiosks selling gardening fruit and vegetables. <p><u>Conclusions:</u></p> <p>The public supported the proposed housing development and answers to questions were deemed satisfactory.</p>
17-08-2016	Consultative meeting between the Ramboll-Environ ESIA team and representatives of Svobodnensky District	Svobodny administrative building	<p>The following points were discussed (with respect to situation and key issues in the Svobodnensky District):</p> <ul style="list-style-type: none"> • Economic situation of the District, including industry and agriculture; • Unemployment and employment expectations at the Project; • Social and economic impacts of cosmodrome construction; • Demographic trends; • Public health (morbidity and services); • Education; • Infrastructure (road, fluvial, air, rail); • Natural hazards and emergency response; • Cultural events and cultural heritage
18-08-2016	Consultative meeting between the Ramboll-Environ ESIA team and representatives of the town of Svobodny	Svobodny administrative building	<p>The following points were discussed (with respect to situation and key issues in the town of Svobodny):</p> <ul style="list-style-type: none"> • Economic situation of the city, including industry and agriculture; • Unemployment and employment expectations at the Project; • Social and economic impacts of cosmodrome construction; • Housing and issues with housing; • New micro-rayon meant for GPPB employees in operations phase; • Demographic trends; • Public health (morbidity and level of services, key issues); • Education (pre-school, primary and secondary);

Date	Nature of engagement	Location of engagement	Key concerns and suggestions raised
			<ul style="list-style-type: none"> • Infrastructure (road, fluvial, air, rail); • Natural hazards and emergency response; • Crime and security issues; • Cultural events and cultural heritage; • Connectivity to Blagoveshchensk and public and private transport issues
19-08-2016	Consultative meeting between the Ramboll-Environ ESIA team and the Dean of the Amur State University and his key staff	University campus in Blagoveshchensk	<p>The following points were discussed:</p> <ul style="list-style-type: none"> • Presentation of the University, its past and present achievements, and its current projects and networks at national and international levels • Participation of the University in the Project educational objectives • Visit to University facilities dedicated to training in chemistry supported by the Project • Discussion of access to this training by young students hailing from Svobodny and Svobodnensky District • Discussion of potential further developments and enhancement of current results.
19-08-2016	Consultative meeting between the Ramboll-Environ ESIA team and Association of Hunters and Fishermen of Amur Region	Office of the Association in Blagoveshchensk	<p>The following points were discussed:</p> <ul style="list-style-type: none"> • Association current membership; • Delivery of hunting and fishing licenses; • Association current activities, particularly in regards of participating to regulation enforcement, illegal poaching, and fauna monitoring (both terrestrial and aquatic); • Role in allocation of hunting quota to local hunters groups and associated monitoring of kills; • Protected areas; • Hunting reserves; • Areas of traditional land use (associated with Indigenous Groups); • Key concerns of the Association in regards of the Project: <ul style="list-style-type: none"> • Corridor effect (pipeline of the "Power of Siberia" network) • Deforestation of the Project area and conversion into industrial area, with associated disruption to fauna • Potential for poaching and increased pressure on natural resources from incoming Project workforce.

Date	Nature of engagement	Location of engagement	Key concerns and suggestions raised
19-08-2016	Consultative meeting between the Ramboll-Environ ESIA team and Head of Historical and Archaeological Museum in Blagoveshchensk	Premises of the Museum in Blagoveshchensk	<p>The following points were discussed:</p> <ul style="list-style-type: none"> • Pre-history and history of the Project area; • Presence of Indigenous Groups; • Current status of cultural heritage in the Project area; • Conservation and curation strategy; • Role of regional museum in curation of artefacts identified in the Amur Region; • Monitoring of on-going construction works and associated chance find procedures; • Potential Project role in further support of cultural heritage conservations efforts at regional level; • Intangible cultural heritage.

As part of engagement activities, Amur GPP reached formal cooperation agreements with several stakeholders reflecting the long-term Corporate Social Responsibility of the Company. The parties of the agreements are:

- Government of the Amur Region (two agreements signed);
- GKU Amuruprador, State Road Authority for the Amur Region;
- The Employment Service of the Amur Region;
- Ministry of the Amur Region for Education and Science.

More particulars of the engagement activities taken and agreements reached are discussed in SEP.

5.4 Future Engagement and Information Disclosure Methods

The Project will use various engagement and information disclosure methods according to international best practice (IFC Standards) to ensure that different stakeholder groups are fully consulted and involved in ESIA decision-making process. The principles of the stakeholder engagement in future include:

- Engagement will aim at providing local communities that are directly affected by the project and interested stakeholders with access to timely, relevant, understandable and accessible information, in a culturally appropriate manner, and free of manipulation, interference, coercion and intimidation.
- Stakeholder engagement will involve the following elements: stakeholder identification and analysis, stakeholder engagement planning, disclosure of information, consultation and participation, grievance mechanism, and ongoing reporting to relevant stakeholders.
- The requirements of Russian national law with respect to public information and consultation will be met.

The following engagement methods may be potentially used by the Project:

- General community meetings;
- Focus groups;
- Face-to-face meetings;
- Mass media;
- Community council;
- Information and reading center;
- Forums, workshops and exhibitions;
- Project leaflet and newsletter;
- Project website;
- Site visits.

The following documentation disclosure methods shall be potentially used by the Project:

- Dissemination of the quarterly Project leaflet among the affected (potentially and actually) communities and other stakeholders;
- Disclosure of the Project ESIA prepared by Ramboll Environ;
- Disclosure of the Non-Technical Summary of the Project ESIA.

Specific elements of future engagement activities and information disclosure format are described in SEP.

5.5 Future stakeholder engagement and information disclosure timeframe

As stipulated by SEP, major activities related to stakeholder engagement and information disclosure will be held throughout the Project lifecycle.

More specifics regarding the timeframes are provided in SEP.

5.6 Free, prior and informed consent

No indigenous communities or groups reside in the proximity to the Project site in Svobodnensky district or in the town of Svobodny. Therefore, at this point of the Project development it is not required to obtain free, prior and informed consent from indigenous communities.

5.7 Grievance mechanism

Stakeholder Engagement Plan prepared by Ramboll Environ stipulates key principles and elements of the grievance mechanism that is to be employed by the Company. The grounds for the proposed mechanism include IFC, EBRD, Equator Principles and similar standards. The SEP defines the following steps of grievance mechanism:

- Filing and registration;
- Allocation for review and resolution;
- Review and resolution;
- Notification of the proposed resolution;
- Appeal (if applicable);
- Closure.

It is expected that grievance statistics will be generated quarterly based on a number of parameters as defined by SEP.

5.8 Monitoring and reporting

SEP offers a set of the indicators that will be used to monitor and assess the efficiency of the stakeholder engagement activities, including a number of various meetings, number of stakeholders included in the Stakeholder Register, number of suggestions and recommendations received by the Company using various feedback mechanisms, etc.

5.9 Future roles and responsibilities

GPPB allocates stakeholder engagement responsibilities to one experienced specialist specifically in charge of stakeholder engagement, including liaising with local community organisations, local government agencies, the local press and other mass media, in both Blagoveshchensk and Svobodnensky District. This specialist is based in Blagoveshchensk with frequent visits to the Svobodny area and reports to the General Director. Other Company specialists will be involved on as needed basis, including the General Director and the Head of the Asset Department and his collaborators.

6. REVIEW OF PROJECT ALTERNATIVES

6.1 Introduction

The objective of the Project is construction of a gas processing plant for extraction of valuable fractions from the raw natural gas transported via the “Power of Siberia” gas pipeline from the gas fields located in Yakutia and Irkutsk Region and supply of the commercial-grade products for export and to the domestic markets in the RF.

This chapter presents the results of an analysis of technically and financially feasible alternatives for implementation of this Project in order to achieve the defined objectives with due consideration of the environmental and social impacts. The analyzed alternatives have been considered at the feasibility study stage, resulting in approval of a final Project alternative described in Chapter 4. The structure of this Chapter includes discussion of strategic high-level alternatives (e.g. 'zero alternative') and more detailed description of the alternatives specifically for this Project and considered in the process of the Project design development.

The alternatives related to site selection for the AGPP construction, natural gas separation technology and infrastructure facilities are analyzed in the context of optimization of project design, environmental and social aspects of the Project.

The alternative relating to the location of the KS-7a “Zeyskaya” compressor station, where raw natural gas will be supplied from AGPP has not been considered within the framework of this ESIA Report, because that compressor station, similarly to the “Power of Siberia” pipeline, is not incorporated in the structure of the AGPP Project facilities. However, the KS-7a compressor station is mentioned in the solutions adopted for this Project as an associated facility. Such references are made to provide an overall context, especially if third parties had made decisions influencing in a direct way the Project implementation plan.

Alternatives for this Project were revised several times because of numerous changes and modifications made in the technical solutions and aimed at ensuring the required safety level, efficiency of the production processes and equipment and environmental performance improvement, which influenced the final selection of the most appropriate Project alternative. The assessment of the environmental impacts associated with the Project implementation and definition of the appropriate mitigation measures are based on an analysis of the approved Project alternative (see Chapters 9 and 10 of the ESIA Report).

6.2 Need for the Project

The basis for implementation of this Project has been determined in the following essential documents:

- Governmental Program for construction of a united system in Eastern Siberia and Far East of Russia for natural gas production, transportation and supply including potential export to the markets in China and other countries of the Asian Pacific region approved by the RF Ministry of Energy (Order No.340 of 03.09.2007³¹; and
- Gazprom's Eastern Gas Program (EGP)³², including construction of a united “Power of Siberia” pipeline system for natural gas transportation from the gas fields located in the Irkutsk Region and Yakutia via Khabarovsk to Vladivostok and further to the Asian Pacific region (APR).

AGPP is the main link in the technologic line designed to supply the methane fraction of natural gas to China. Gazprom and CNPC signed on May 21, 2014 the Purchase and Sale Agreement for the Russian gas supply via the Eastern Route (“Power of Siberia” gas pipeline). The 30-year contract provides for Russian gas supplies to China in an amount of 38 billion cubic meters a year. Gas supplies under the contract are to be commenced during the period from May 2019 to May 2021.

The Purchase and Sale Agreement is supported by an agreement between the RF Government and the Government of the People’s Republic of China to supply gas from the RF to China by the Eastern route

³¹ <http://docs.cntd.ru/document/902059423>

³² <http://www.gazprom.ru/about/production/projects/east-program/>

signed in Moscow on October 14, 2014. The volume of exported gas will increase gradually as shown in Table 6.1.

Helium is a unique product essential for development of a number of high-tech sectors of industry. To ensure long-term economic interests of the Russian Federation, as well as energy and technological security of the country it is necessary to create a reliable system for helium production and supply both to domestic and international market places.

According to different assessments, the world's demand for helium will increase by 2030 to 250-300 million m³ (as compared to the current demand of 170-180 million m³). Natural gas is the main and virtually the only source of helium. Russia is one of few countries with significant helium resources. With the commencement of the large-scale natural gas production in Eastern Siberia and in the Republic of Sakha (Yakutia) and with the AGPP project Russia could become the world's largest helium supplier. Gazprom intends to export up to 60 million m³ per year of helium from AGPP, predominantly to China, South Korea and Taiwan (Table 6.1).

Table 6.1: Gas production schedule

Year	2021	2022	2023	2024	2025	2026 - 2030
Gas export to China, billions of Nm ³ /year	3.08	10	15	22	30	38
Helium production, 10 ³ Nm ³ /year	20	40	40	60	60	60

AGPP products will also be sold in Amur Region and other regions of the RF. For example, liquefied hydrocarbon gas (LHG) produced at AGPP will be in high demand in Amur Region, because the gasification level in this region is only 33.9%.

6.3 Approach to the Analysis of Alternatives

In accordance with IFC Performance Standard PS 1 "Assessment and Management of Environmental and Social Risks and Impacts", the ESIA includes examination of technically and financially feasible alternatives to assess the respective impact sources and documented justification of proposed solutions. The purpose of an analysis of alternatives is to optimize the solutions related to project design, construction and operation on the basis of feasible project alternatives. The analysis enables consideration of environmental and social criteria at an early stage of the project implementation.

It is important to take into account the fact that the AGPP Project is an integral part of Gazprom's EGP. As such, some of the alternatives and solutions adopted by Gazprom for the wider EGP have, to varying degrees, predetermined some aspects of the AGPP Project and these are considered briefly in this Chapter.

The structure of the analysis of alternatives described in this Chapter takes an "inverted pyramid" approach and includes a series of logic steps starting from the high-level alternatives (including alternatives predetermined by third parties, e.g. by Gazprom) and more detailed description of alternatives controlled by GPPB. The Project alternatives have been considered at two levels:

1. Analysis of preliminary alternatives of Project development as a whole and selection of an alternative (see Subsection 6.4), including a consideration of:
 - No-project alternative ('Zero' Alternative).
 - Alternative site selection in Amur Region assessed on the basis of the following criteria:
 - i. Land use and suitability for construction of Project facilities;
 - ii. Availability and accessibility of the existing infrastructure (including also social infrastructure);
 - iii. Environmental aspects of site selection alternatives.

- Alternative process flow diagrams and processes assessed on the basis of the following criteria:
 - i. Compliance with GPPB criteria with regard to output volumes and product quality;
 - ii. Comparative characteristics of process flow diagrams and production processes;
 - iii. Comparative characteristics of the demand for basic types of resources for technological needs;
 - iv. Comparative analysis of the proposed solutions relating to water supply and wastewater management;
 - v. Comparative analysis of the expected quantities, types and concentrations of industrial wastes, air emission and wastewater discharge to the environment depending on the applied technology.

2. Analysis and selection of technical alternatives within the framework of the selected Project alternative (see Subsection 6.5), including consideration of the following alternatives:

- Solid waste disposal;
- Electricity supply;
- Water abstraction and water supply system.

GPPB had set up a team for technoeconomic assessment of the cryogenic gas separation technology, who undertook a detailed comparative technoeconomic assessment of gas processing alternatives at the Amur GPP³³, the results of which have been used in this Chapter.

6.4 Analysis of Preliminary Alternatives for Project Development

An analysis of the preliminary alternatives for the Project development as a whole and selection of a preferable alternative in the process of the Feasibility Study development for justification of the AGPP construction (Front End Engineering and Design (FEED)/ Project design development stage). A brief description of preliminary alternatives for the Project development as a whole is presented below, including substantiation of the preferable alternative selection.

6.4.1 "No Project" Alternative

The 'No Project' alternative ("Zero" alternative) means to give up the implementation of this Project, implying the following consequences:

- Failure to meet the governmental Program for construction of a united system in Eastern Siberia and Far East of Russia for natural gas production, transportation and supply including potential export to the markets in China and other countries of the APR;
- The Russian Federation will not be able to fulfill its obligations foreseen in the Agreement for supply of natural gas from Russia to China via the eastern route;
- No ethane fraction can be extracted, which is required for operation of the deep hydrocarbon conversion plant financed by Sibur for polyethylene production, and as a consequence, the plant will not be constructed;
- Helium contained in the natural gas transported via the "Power of Siberia" gas pipeline and required for a number of sectors of industry and research institutions will not be extracted;
- The potential failure to meet the long-term domestic demand for commercial-grade gas, helium and liquefied hydrocarbon gas for the needs of Eastern Siberia, Russian Far East and other regions of the RF.

The "No Project" alternative will result in:

- Loss of the development project having important significance both for the national economy and as a source of energy having international importance; and

³³ "Statement prepared by the technoeconomic team for assessing the cryogenic gas separation technology for the Amur GPP". 'Gazprom pererabotka Blagoveshchensk', Moscow, 2015.

- Loss of opportunities for regional development and attraction of domestic investment sources associated with the AGPP Project implementation.

In case of no project, the intensity of technogenic impact on the subject area and the degree of anthropogenic transformation of environment components will remain at the currently existing level described in Chapters 7 and 8. It will not cause any changes in the profitability of the farmland and other land resources located within the areas considered for the project construction.

To summarize, the selection of the 'No Project' alternative will make it possible to avoid adverse environmental impacts associated with the Project implementation and discussed in Chapter XX of this Report. However, the 'No Project' alternative will result in substantial negative consequences, while the construction project implementation will bring significant benefits for the economic and social development of Amur Region and the RF as a whole (for more details see Chapters 8 and 10 of this Report).

6.4.2 *Alternatives for Site Selection for the Project Facilities*

Gazprom's EGP predetermined in 2007 a tentative selection of a site for the AGPP in the vicinity of the town of Belogorsk³⁴. The site selection for the AGPP Project was coordinated with the location of the KS-7a "Zeyskaya" compressor station of the "Power of Siberia" gas pipeline selected by Gazprom without consideration of the AGPP Project. These projects will have shared infrastructure facilities, i.e. electricity supply lines, access roads, opportunities to use railroad facilities.

During the initial stage of the AGPP Project development, the following sites were considered for the Project:

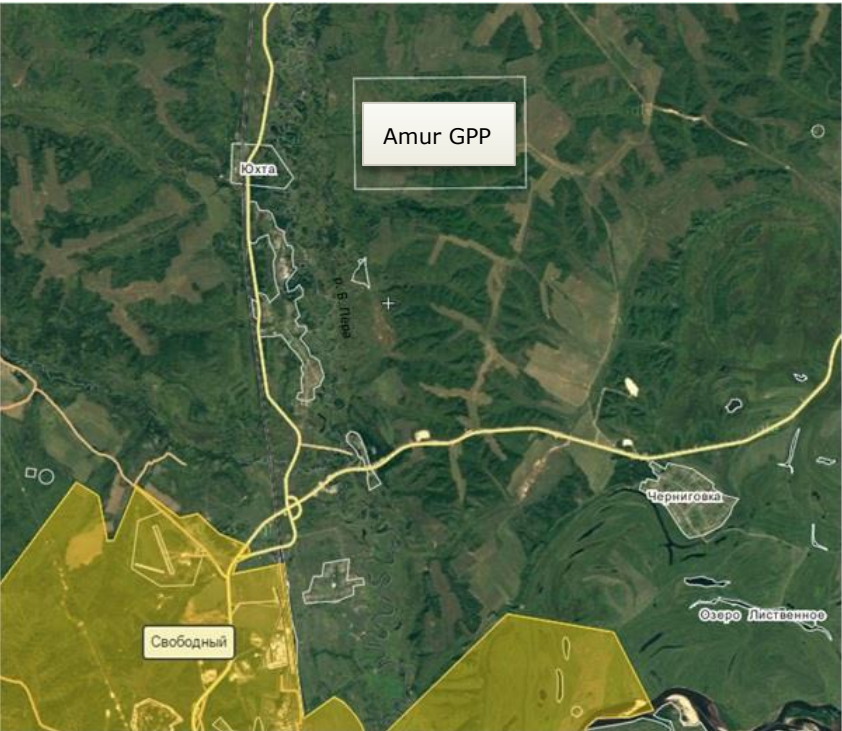
1. A site located at a distance of 25 km north-east of the town of Belogorsk, in the central part of the Seryshevsky district, Amur Region, and 4.5 km south of the village of Vernoye;
2. A site in Svobodnensky district, at a distance of 13 km north of the town of Svobodny;
3. A site in the vicinity of the village of Markov, Blagoveshchensk district.

In late April 2013, specialists of Gazprom pererabotka, the customer of the Project, visited all those sites. Alternative 3 was rejected due the absence of railway connections in the vicinity, this site selection alternative was rejected, and only Alternatives 1 and 2 were considered later (Figure 6.1).

³⁴ <http://www.gazprom.ru/about/production/projects/east-program/>



(1)



(2)

Figure 6.1: Alternatives for AGPP site selection in Amur Region:
(1) in Seryshevsky district, (2) in Svobodnensky district.

6.4.2.1 Land Use and Opportunities for Project Site Selection

The alternative sites for the AGPP construction are located on farmland both in the case of Alternative 1 and Alternative 2. According to the schematic layout map of the Svobodnensky district municipality, there are basically no limitations for the AGPP construction at any of the two sites.

6.4.2.2 Available and Accessibility of the Existing Infrastructure

When assessing the alternatives for the Project site selection the following criteria were taken into consideration with regard to the accessibility:

- Vicinity of transport hubs: airports, river ports / navigable rivers, Trans-Siberian railway line;
- Availability of a well developed system of access motor roads / access to federal highways;
- Availability of a power supply infrastructure;
- Vicinity of residential areas with well developed social infrastructure.

Based on the above criteria, the alternative sites for the Amur GPP Project were assessed on the basis of expert judgment. For each criterion 1 point was given for the minimal degree of development and 3 points for the maximum degree of development. In case, when the degree of the infrastructure development in both cases was similar, both were given 2 points each. The results of the assessment are presented below in Table 6.2.

Table 6.2: Assessment of infrastructure in the vicinity of the alternative sites for AGPP construction

Criteria	Alternative1: in Seryshevsky district		Alternative 2: in Svobodnensky district	
	Number of points	Remarks	Number of points	Remarks
Vicinity to transport hubs (airports, river ports / navigable rivers, highways and Trans-Siberian railway stations)	1	The site located near the Trans-Siberian railway line. No river ports or navigable rivers near the site. No airports near the Project site.	3	The site located near the Trans-Siberian railway line; "Ust-Pera" station located near the site. Four river ports are accessible: Blagoveshchensk, Svobodny, Poyarkovo and Zeya. Construction of a provisional river jetty required on the Zeya River. There is an airport near the town of Svobodny. Distance for import / export supplies shorter than in the case of Alternative 1.
Availability of well developed system of access motor roads / access to federal highways	2	The site is located near the federal highway R-297 "Amur". Construction of access motor roads will be required.	2	The site is located near the federal highway R-297 "Amur". Construction of access motor roads will be required.
Availability of power supply infrastructure	1	The available power supply infrastructure is poorly developed.	3	There is a well developed power supply infrastructure.
Vicinity to residential areas with well developed social infrastructure	2	The nearest city (Seryshev) located at a distance of 20 km from the Project site. Another nearest city (Belogorsk) is located at a distance of 20 km from the Project site.	3	The nearest city (Svobodny) located at a distance of 13 km from the Project site. The Project personnel can use the use the local social infrastructure and be partially accommodated in the city.

Criteria	Alternative1: in Seryshevsky district		Alternative 2: in Svobodnensky district	
	Number of points	Remarks	Number of points	Remarks
		The Project personnel can use the use the local social infrastructure and be partially accommodated in the city. Nevertheless, investments will be required to develop the social infrastructure and provided accommodation facilities.		Nevertheless, investments will be required to develop the social infrastructure and provided accommodation facilities.
Total number of points	6		11	

According to the assessment using the above criteria, Alternative 2 is appears to be preferable, because the site is located in the direct vicinity of both the Trans-Siberian railway line and the Zeya River, which can be used for transportation of large pieces of equipment for the Amur GPP.

6.4.2.3 Environmental Aspects for the Site Selection Alternatives

Air Emissions

In the case of Alternative 1 it will be required to construct access motor roads to connect it with the R-297 'Amur' highway (approximately 13 km) and a branch rail track to connect the site with the Trans-Siberian railway line (approximately 25 km). The site near the town of Svobodny is located much closer to the existing highway Svobodny-Shimanovsk and the railway line (approximately 2 km). It is therefore expected that in the case of Alternative 2, air emissions from the motor vehicles and railway transport will be less significant during both the construction phase and the operational phase of the AGPP Project.

Surface Water Bodies

Gas pipelines and other required linear facilities can have adverse impact on the surface water bodies to be crossed by them, especially during the construction phase of the Project. This includes negative impact on the hydrology and water quality at crossing points and drainage or excessive wetting of the adjacent areas as a result of changes in the surface runoff regime. Using appropriate construction method it will be possible to mitigate the adverse impact (e.g. by constructing overhead crossing points for gas pipelines and bridges for roads), but certain residual impacts and risks could still persist despite such measures.

In the case of Alternative 1, it will not be required to construct any water body crossings for pipeline branches from the 'Power of Siberia' trunk pipeline, while in the case of Alternative 2 it will be needed to construct a crossing across the Bolshaya Pera River to ensure supplies of raw gas to the planned gas processing plant.

Landscapes and Soils

For construction and subsequent operation of the gas processing plant it will be required to construct access roads and power supply infrastructure facilities, which would result in modification of the landscape and significant impact on the soil cover. In the case of Alternative 1, the site is located at a significantly larger distance from any highways and railway lines and from the local power supply infrastructure facilities as compared to Alternative 2. Although in the case of Alternative 2 it will be also required to construct access roads and some power supply infrastructure facilities, the Project site will be much closer to the existing infrastructure facilities, so that the impacts will be much less significant.

Vegetation and Wildlife

The sites in the case of both Alternative 1 and Alternative 2 are located in areas categorized as farmland and the natural flora is represented to a rather limited extent and within a large part of the area it is replaced by

cultivated crops and ruderal plant species. The impact on the vegetation and wildlife in both cases will be approximately similar.

Protected Nature Areas

One of the criteria was the distance between the Amur GPP site and any existing specially protected nature areas, mentioned below:

- Alternative 1: the village of Vernoye is located at a distance of 25 km from the northern boundary of the nature reserve 'Voskresenovskiy' (special habitat/wildlife management area) of regional significance.
- Alternative 2: the site near the town of Svobodny is located at a distance of approximately 30 km from the western boundary of the nature reserve 'Iverskiy' (special habitat/wildlife management area) of regional significance.

Based on the environmental factors mentioned above, the alternative sites for the Amur GPP Project were assessed on the basis of the experts' judgment.

For each aspect a certain number of points was given: 0 for the lack of any adverse impact; 1 point for the minimal level of negative impact and 3 points for the maximum level of negative impact. If the impact of both alternatives was similar 2 points were given to each alternative. The results of the assessment are presented below in Table 6.3.

Table 6.3: Environmental assessment of Project site selection alternatives

Criteria	Characteristics	Assessment of Project site selection alternatives	
		Alternative 1: Site in Seryshevsky district	Alternative 2: Site in Svobodnensky district
Air emissions	Gross emissions to the atmosphere from transport traffic	3	1
Surface water bodies	Number of water bodies to be crossed by gas pipelines	0	1
Landscape and soils	Ability of nature complexes for self-recovery	3	1
Vegetation and wildlife	Degree of sustainability of plant assemblages	2	2
Specially protected nature areas	Negative impact of the Project on protected nature areas taking into consideration the disturbance between them and the Project site.	0	0
Total number of points		8	5

It may be therefore concluded on the basis of experts' judgment that the alternative with a Project site in Svobodnensky district is preferable from the environmental viewpoint.

6.4.2.4 Summarized Assessment of the Site Selection Alternatives for the AGPP Project

The results of an analysis of the site selection alternatives for the AGPP Project are summarized in Table 6.4, from which it can be seen that Alternative 2 has advantages in comparison to Alternative 1. The overall cost saving for Alternative 2 over Alternative 1 is estimated at 22 to 24 billion Rubles.

After a thorough comparison of the two alternatives, Gazprom has preferred Alternative 2, i.e. construction of the gas processing plant at the site in the vicinity of the town of Svobodny³⁵. This choice was positively supported by the Svobodnensky District Administration.

In addition to the mentioned advantages for construction and operation of the AGPP, Alternative 2 will ensure some supplementary benefits outside of the Project framework:

1. The distance for ethane transportation to Sibur's chemical plant for deep hydrocarbon conversion would be approximately 80km for Alternative 1 whereas the chemical plant will be located in the immediate vicinity of the Alternative 2 location.
2. Advantages for the 'Power of Siberia' trunk gas pipeline:
 - a. The gas pipeline route was changed to coordinate it with the location of the AGPP site according to Alternative 2 and in this case no crossing of the Zeya river by the pipeline is required;
 - b. The gas pipeline will be shorter by 80-85 km as compared to Alternative 1.
3. The export pipeline to China will be shorter by 30-50 km in comparison to Alternative 1.

As a result, Gazprom's saving in the process of the 'Power of Siberia' pipeline will amount to US \$ 1 billion.

³⁵ Letter No.04/12-919 of 26.05.2014 by Gazprom "Approval of the site selection alternatives for GPP, Helium Plant and Chemical Plant" addressed to PJSC "VNIPIgazdobycha"

Table 6.4: Comparison of the Project site selection alternatives

	Alternative 1: Seryshevsky district			Alternative 2: Svobodnensky district		
	Land use and suitability for Project construction	Availability and accessibility of existing infrastructure	Environmental aspects	Land use and suitability for Project construction	Availability and accessibility of existing infrastructure	Environmental aspects
Advantages	Equal for both alternatives		Construction of crossings across watercourses for the 'Power of Siberia' trunk pipeline will not be required.	Equal for both alternatives	<p>The "Ust-Pera" railway station is located not far from the site.</p> <p>Four river ports are accessible: Blagoveshchensk, Svobodny, Poyarkovo and Zeya.</p> <p>An airport is located near the site (town of Svobodny).</p> <p>The distance for import/ export supplies is shorter than in the case of Alternative 1.</p> <p>A well development power supply infrastructure is available.</p> <p>The nearest city (Svobodny) is located at a distance of 13 km from the Project site.</p>	<p>Air emissions from transport vehicles and railway transport will be less significant both during construction and operational phases.</p> <p>The vicinity of the existing infrastructure facilities will reduce the impact on the landscape and soils in comparison to Alternative 1.</p>

	Alternative 1: Seryshevsky district			Alternative 2: Svobodnensky district		
	Land use and suitability for Project construction	Availability and accessibility of existing infrastructure	Environmental aspects	Land use and suitability for Project construction	Availability and accessibility of existing infrastructure	Environmental aspects
Disadvantages		<p>It will be required to construct 13 km of access motor roads from the R-297 "Amur" highway and a rail track ca.25 km long from the Trans-Siberian railway line.</p> <p>There are no river ports and navigable rivers near the site.</p> <p>There are no airports near the site.</p>	Construction of access roads and power supply infrastructure will cause significant air emissions, impact on the landscape and soils in comparison to Alternative 2.		<p>It will be required to construct a provisional river jetty on the Zeya River.</p>	<p>It will be required to construct one river crossing across the Bolshaya Pera River to supply raw gas for the planned GPP.</p>

6.4.3 *Review of Alternative Gas Processing Technologies*

In order to determine and select the optimal process technology for the planned gas processing plant, GPPB commissioned the following companies to develop alternative project design documentation: Linde/Peton and Air Liquide/Kriogenmash.

GPPB specialists analyzed the data related to the experience of Air Liquide and Linde AG and concluded that the Linde AG has preferable practical experience for the objectives defined for this Project. For example, Linde AG has experience in design development and supply of installations for ethane extraction and nitrogen removal from gas with a capacity of up to 13 billion m³/year, while Air Liquide has practical experience in design development and supply of installations only for nitrogen removal from natural gas with capacities of as low as 2 billion m³/year. The lack of experience in engineering of high-capacity installations is associated with a risk of not achieving the planned design capacity when contracting Air Liquide.

A comparison of technologies for natural gas separation in the alternatives proposed by Linde/Peton and Air Liquide/Kriogenmash has been made by the specialists using a set of criteria, the most important of which are discussed below.

6.4.3.1 Compliance with the Terms of Reference with Regard to Output Capacity and Product Quantity

According to the conclusion of the GPPB specialists on the proposed technologies, both proposed alternatives comply in general with the requirements defined in the Terms of Reference. The most significant deviations from the requirements are:

- Low degree of helium extraction in the case of Air Liquide/Kriogenmash technology: 95.2% instead of the required 98%;
- Low pressure of the high-pressure methane fraction at the inlet of the booster compressor station in the case of the Air Liquide/Kriogenmash technology: 1.42 MPa (exc.) instead of 1.9 MPa (abs.).

6.4.3.2 Comparison of the Process Flow Diagrams and Process Technologies

The comparative characteristics showing the main differences of the cryogenic gas separation technology and helium extraction technology proposed by Air Liquide and Linde/Peton are presented in Table 6.6. A comparison of the process block diagrams of the two alternatives is presented in Figure 6.2.

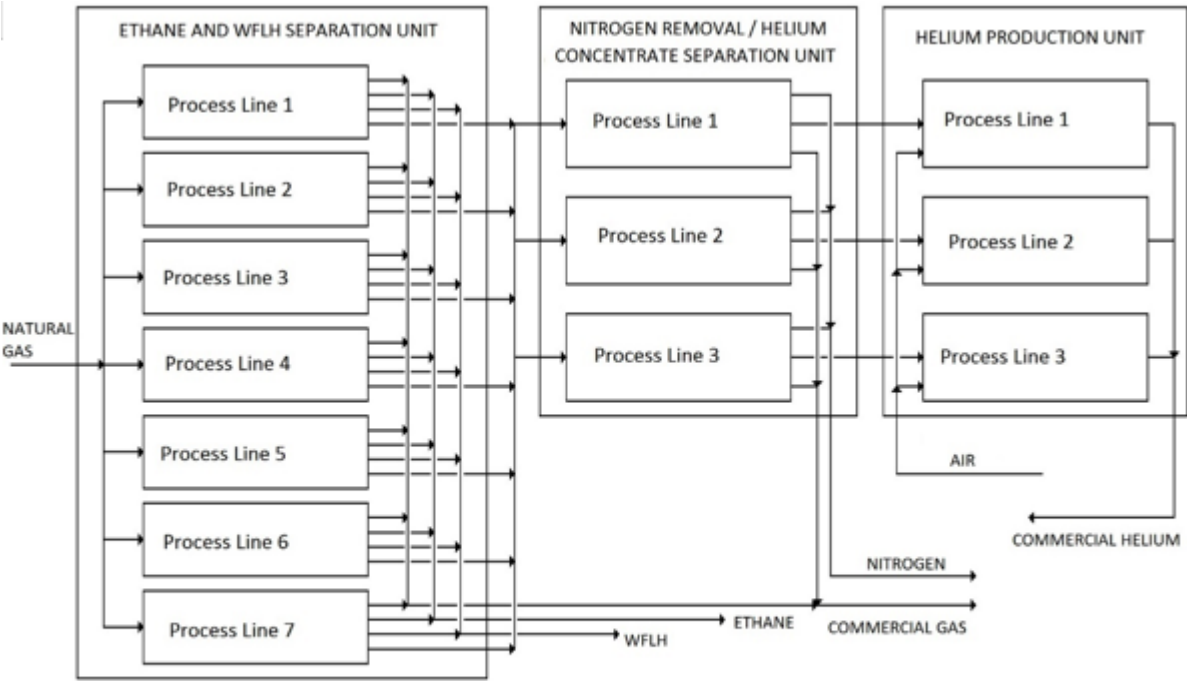
With regard to most criteria, the Linde/Peton alternative has the following technical advantages in comparison to the Air Liquide/Kriogenmash technology:

- A self-sufficient refrigeration circuit using a mixed refrigerant produced from the raw gas;
- High degree of use of modular heat-exchange equipment in "cold blocks" permitting a reduction in the loss of cold;
- Linde/Peton technology makes it possible to reach a high degree of ethane extraction: 97.9% as compared to 92.3% in the case of Air Liquide/Kriogenmash technology;
- Low methane fraction pressure: 1.4/0.6/0.3 MPa (abs.) at the inlet to the booster compressor station in the case of Air Liquide/Kriogenmash technology against 1.9 MPa (abs.) in the case of Linde/Peton technology;
- Specific hourly capacity of Linde/Peton technology is higher by 6% than that of Air Liquide/Kriogenmash technology;
- Energy efficiency of Linde/Peton technology with regard to electricity and fuel gas consumption is 12% and 21%, respectively;
- After a reduction of the nitrogen content of raw gas (starting from Year 5 of the operational phase) it will be possible to produce up to 100,000 t/year of liquefied natural gas without any retrofitting of the installation;
- Possibility of "hot start" without a liquid nitrogen reserve;
- Linde Ag, as opposed to Air Liquide, entitles the Customer to use its patents (e.g. that for nitrogen removal from natural gas);
- Other conditions being equal, the hourly capacity of the Linde/Peton technology is higher by 6% than that of Air Liquide/Kriogenmash technology;
- Recovery of most valuable components with the Linde/Peton process circuit is also higher than in the case of the Air Liquide/Kriogenmash process circuit (Table 6.5).

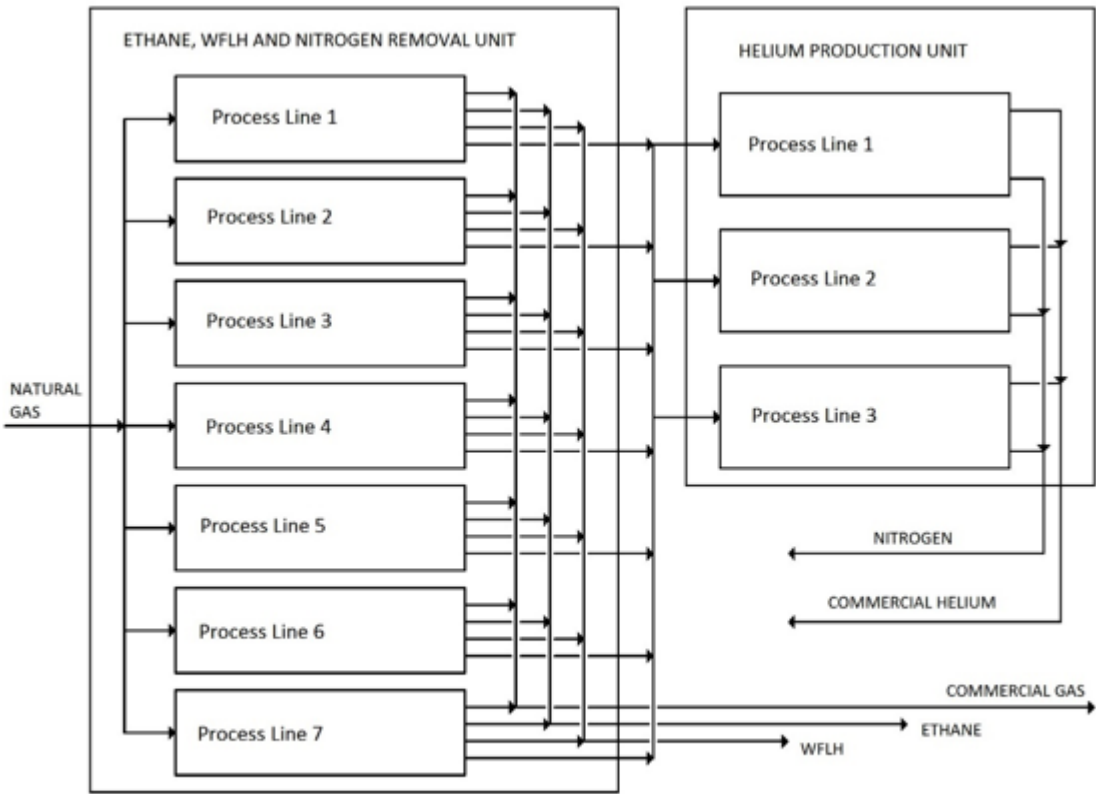
Table 6.5: Comparison of extraction of valuable components

Description of performance values	Linde/Peton	Air Liquide/Kriogenmash
Helium extraction to commercial-grade helium, %	<u>98.82</u>	<u>95.20</u>
Ethane extraction to C ₂ + fraction, %	<u>98.07</u>	<u>92.31</u>
Propane extraction to C ₂ + fraction, %	<u>100.00</u>	<u>98.87</u>
Ethane extraction to ethane fraction, %	<u>97.87</u>	<u>92.27</u>
Propane extraction to WLHF, %	<u>93.50</u>	<u>98.83</u>
Extraction of valuable hydrocarbons C _x + to WLHF, %	<u>100.00</u>	<u>99.87</u>

The technical solutions aimed at production of commercial-grade helium, its liquefaction and packaging are at a high level in both cases, i.e. Linde/Peton and Air Liquide/Kriogenmash alternatives.



AMUR GPP GAS PROCESSING OPTION PROPOSED BY LINDE



AMUR GPP GAS PROCESSING OPTION PROPOSED BY AIR LIQUIDE

Figure 6.2: Comparison of process flow charts for different AGPP technologies

Table 6.6: Comparison of alternative technologies for cryogenic gas separation and helium production

Ser. Nos.	Basic parameters	Air Liquide/Kriogenmash	Remarks relating to parameters of Air Liquide/Kriogenmash technology	Linde/Peton	Remarks relating to parameters of Linde/Peton technology	Comparison of both alternatives
1	Total built-up area, ha	38	<i>Area per 1 process line:</i> <ul style="list-style-type: none"> Ethane and WLHF extraction unit: 0.84 ha; Nitrogen removal and helium concentrate production unit: 0.4 ha; Unit for fine purification and liquefaction of helium: 1.06 ha. 	44	<i>Area per 1 process line:</i> <ul style="list-style-type: none"> Ethane and WLHF extraction, nitrogen removal and helium concentrate production: 1.42 ha; Unit for fine purification and liquefaction of helium: 1.36 ha. 	The Peton alternative will require a larger area: by 0.48 ha for each process line and by 6 ha for the AGPP as a whole as compared with the Kriogenmash alternative.
2	Operating hours per year, hours	8 500		8 000		The hourly capacity of Linde/Peton alternative is higher by 6% than that of Air Liquide/Kriogenmash technology.
3	Quantity of extracted ethane (per 1 line), '000 t/year	400		434		The efficiency of Peton technology is higher by 34,000 t/year as compared to Kriogenmash technology.
4	Ethane extraction, %	92.3	A process of recirculation of the methane product fraction is used with its feed directly to the inlet of the ethane and WLHF extraction unit with the aid of a methane fraction compressor. Additional 3% of the ethane extraction degree are achieved due to increasing the recycled methane fraction up to 10%, which is sent to a demethanizer unit, significantly increasing thereby the production cost of this product.	98.00	It is achieved by an optimal combination "two expanders - cold box - heat pump - cryogenic rectification NGL/NRU" ensuring the maximum possible level of cryogenic gas separation with an extraction degree close to 100%.	Peton technology is more efficient and less expensive in operation as compared to Kriogenmash technology.
5	Ethane content in ethane fraction, % by mass	98.90	This value complies with the Technical Specification TU 0272-155-313239492014	95.60	This value complies with the Technical Specification TU 0272-155-313239492014	The ethane content in ethane fraction is lower by 3.3% by mass in the case of Peton technology, although both alternatives comply with the Technical Specifications (TU)
6	Output of commercial-grade gas:					

Ser. Nos.	Basic parameters	Air Liquide/ Kriogenmash	Remarks relating to parameters of Air Liquide/ Kriogenmash technology	Linde/Peton	Remarks relating to parameters of Linde/Peton technology	Comparison of both alternatives
	Low-pressure methane (for 8,000 hours of operation)	0.28 MPa, 0.82 billion st.m ³	Production of commercial-grade gas of three pressure levels.		Peton/Linde uses smaller gas pumping units at lower operating costs due to compression of a single stream with an initial pressure of 1.9 MPa instead of compression of three streams of lower pressure as proposed by Kriogenmash.	Linde/Peton uses smaller gas pumping units at lower operating costs.
	Medium-pressure methane (for 8,000 hours of operation)	0.57 MPa, 0.84 billion st.m ³				
	High-pressure methane (for 8,000 hours of operation)	1.42 MPa, 5.01 billion st.m ³		1.9 MPa, 6.55 billion st.m ³		
7	Number of compressors in the main process circuit	76		65		The number of compressors in the main process circuit in the case of Peton alternative is smaller by 11 units as compared to Kriogenmash alternative.
	of which booster compressors for commercial-grade gas (methane)	24	Required are electrically driven gas pumping units: four EGPA-4, six EGPA-10 units and fourteen GPA-32 units for compression from a pressure of 0.24 MPa to 6.4 MPa at each of the seven booster compressor stations.	16	It is sufficient to have 16 standard-type GPA-32 units for compression from a pressure of 1.9 MPa to 6.4 MPa. Energy is provided by burning commercial gas at a rate of 76,700 st.m ³ /hour.	The power requirement for commercial gas compression to 6.4 MPa is lower in the case of Peton alternative.
8	Number of process blocks	13	The NGL process is performed separately from the NRU process, requiring in addition to 7 NGL units also three NRU units. The same number of helium production units is required.	10	Due to the union of ethane extraction processes (NGL) and nitrogen removal from methane (NRU), it is sufficient to have 7 cryogenic units and 3 helium production units. Start-up and shut-down are simplified because the unit combines NGL/NRU processes.	The number of process units in the Peton alternative has been reduced by 3 units as compared to Kriogenmash alternative by combining the units for ethane extraction process (NGL) and nitrogen removal from methane (NRU).
9	Number of process blocks	13	7 NGL units; 3 NRU units; 3 HRU units.	10	7 NGL + NRU units; 3 HRU units.	
10	Electric power requirement for cryogenic separation units, MW	143.00	A turbo-expander with a compressor is used.	145.50		Electric power requirement of the cryogenic separation units in Peton technology is higher by 2.5 MW as compared to Kriogenmash alternative, along with a significantly lower power required for the booster compressor station.
	of which electric power requirement for booster compressor stations, MW	66.03		13.30		

Ser. Nos.	Basic parameters	Air Liquide/ Kriogenmash	Remarks relating to parameters of Air Liquide/ Kriogenmash technology	Linde/Peton	Remarks relating to parameters of Linde/Peton technology	Comparison of both alternatives
11	Recycled water supply, m ³ /hour	6 220	Considerable volumes of recycled water are required for additional cooling of the streams.	Not required	Air-cooling units are used for cooling the process streams. The use of refrigerators with water cooling can ensure a significant reduction of the built-up area.	The Peton technology does not use water cooling, resulting in a substantial saving of water as compared with the Kriogenmash alternative.
12	Number of technological units	450		378 (including 10 refrigerator compartment)		
13	Units in operation:		The most recent industrial gas separation installation was commissioned by Air Liquide in 2012-2014 in China with a maximum capacity of up to 1.9 billion m ³ /year.		Several large-tonnage industrial installations for ethane separation and nitrogen removal from natural gas using Linde technology are successfully operated. Linde has built the its largest gas processing plants in the Persian Gulf region (Saudi Arabia, UAE - Abu Dhabi), with a capacity of a single process line of up to 13 billion m ³ /year.	As compared to Air Liquide, Linde has much more extensive experience in construction of helium extraction plants.
	NGL units for ethane and C ₃ + separation	8		6		
	NRU units for nitrogen removal from natural gas	7		5		
	Units for fine helium purification and liquefaction	Over 80		Over 500		
14	Units for fine helium purification		Double-stage hydrogen removal. Helium concentrate consumption is ten times lower. The required catalyst quantity is lower by 5.5 times than in the case of Peton technology.		Single-stage hydrogen removal. Helium concentrate consumption is ten times higher. The required catalyst quantity is higher by 5.5 times than in the case of Kriogenmash technology.	Single-stage hydrogen removal. Helium concentrate consumption is ten times higher. The required catalyst quantity is higher by 5.5 times than in the case of Kriogenmash technology.
15	Design capacity in terms of dried and purified gas	7.7 billion st.m ³ /year	For 8,500 operating hours/year at 110% of nominal design capacity	7.75 billion st.m ³ /year	For 8,500 operating hours/year at 100% of nominal design capacity.	The Peton technology permits operation at the design capacity without exceeding the nominal load.
	per one line for ethane and WLHF extraction	7.0 billion st.m ³ /year	For 8,500 operating hours/year at 100% of nominal design capacity	7.29 billion st.m ³ /year	For 8,000 operating hours/year at 100% of nominal design capacity.	

6.4.3.3 Comparative Characteristics of Main Types of Required Resources

The following heat-transfer agents are required for the operation of the process equipment: cooling water, heating water, medium-pressure steam, AMT-300 oil. In addition, fuel gas is used for purging of process pipelines.

The main unique feature of the Linde/Peton technology is the use of air cooling in the technologic process. In the case of Air Liquide/Kriogenmash technology, large quantities of recycled water are used for cooling the process stream.

It should be also pointed out that the thermal oil requirement for the Air Liquide/Kriogenmash technology is higher by a factor of 2.3 as compared to the Linde/Peton case.

The heat requirement for heating and ventilation of buildings is higher by a factor of 1.87 in the case of Air Liquide/Kriogenmash.

In the case of the Linde/Peton technology, heating water will be utilized for process needs. In the case of Air Liquide/Kriogenmash technology, heating water is not used in the technologic processes.

To summarize, as far as the heat-transfer and cooling agents requirement is concerned, the Air Liquide/Kriogenmash alternative is more resource intensive.

6.4.3.4 Comparison of Environmental Characteristics of the Alternative Technologies

A comparison of the required water supply and wastewater management aspects of the considered alternative technologies has indicated that the water requirement for general and drinking needs is higher in the case of the Air Liquide/Kriogenmash technology, resulting as a consequence in larger domestic wastewater volumes (Table 6.7). This is attributed to the fact that in the case of the Air Liquide/Kriogenmash technology recycled water is used for cooling, while no recycled water supply is needed for the Linde/Peton technology, because it uses air cooling.

Table 6.7: A comparison of alternative technologies with regard to water supply and wastewater management aspects

Description of parameters	Measurement units	Air Liquide/Kriogenmash technology	Linde/Peton technology
<u>Water for general and drinking needs of the operating personnel</u>	m ³ /day m ³ /year	6.3 <u>2450.78</u>	<u>0.45</u> <u>1650.00</u>
<u>Technologic and industrial needs</u>	m ³ /day m ³ /year	<u>4.55</u> <u>1783.6</u>	<u>3.75</u> <u>1360.00</u>
<u>Recycled water supply</u>	m ³ /hour	<u>6220</u>	0
<u>Total firewater volume</u>	m ³	<u>1657.35</u>	<u>3150</u>
<u>Domestic wastewater</u>	m ³ /day m ³ /year	<u>6.3</u> <u>2307</u>	<u>0.45</u> <u>1650.00</u>
<u>Industrial wastewater</u>	m ³ /day m ³ /year	<u>4.55</u> <u>2513.7</u>	<u>1043.36</u> <u>12470.00</u>
<u>Rain and snowmelt water</u>	m ³ /day m ³ /year	<u>1266.8</u> <u>42750.00</u>	<u>3384.3</u> <u>36610.00</u>

No data is available with regard to air emissions in the case of the Linde/Peton technology, and a comparison of the alternative technologies is therefore impossible.

A comparison of the alternative technologies with regard to waste generation is presented below in Table 6.8. The amount of generated wastes of Hazard Classes 1 to 4 is significantly smaller in the case of the Linde/Peton technology: 705 t/year against 2,308.6 t/year in the case of the Air Liquide/Kriogenmash technology.

The levels of impact of the AGPP on the elements of the natural environment when applying the Linde/Peton and Air Liquide/Kriogenmash technologies are summarized in Table 6.8.

Table 6.8: Comparison of the levels of environmental impact of the alternative technologies

Impact on environment components	Alternative technologies ³⁶	
	Linde/Peton	Air Liquide/Kriogenmash
Impact on soil cover		
Disturbance of soil cover in the process of construction	440 000 m ² (44.0 ha)	380 000 m ² (38.0 ha)
Solid waste generation, t/year		
Waste of Hazard Class 1	0.0	0.0
Waste of Hazard Class 2	0.0	0.0
Waste of Hazard Class 3	661.5	307.00
Waste of Hazard Class 4	43.9	2001.58
Waste of Hazard Class 5	0.0	431.313
Emissions of pollutants to the atmosphere, t/year		
Air emissions from AGPP operation	No data is available	22 641.92
Wastewater discharge, '000 m³		
Total wastewater	49.25	46.98

6.4.4 Summarized Assessment of Alternative Technologies for AGPP

A summary of a comparison of the main environmental and non-environmental (i.e. technical, economic and logistic) aspects of the two alternative technologies for AGPP is presented below in Table 6.9. It is clear from the analysis that overall the alternative proposed by Linde/Peton has substantial advantages from both technical and environmental perspectives. An assessment made on the basis of expert judgment by GPPB with the use of a detailed set of criteria, suggests a conclusion that the Linde/Peton technology is preferable (Table 6.10)³⁷.

³⁶ Data referring to the following AGPP configuration: seven process lines for ethane and WFLH extraction, nitrogen removal and helium concentrate production and three lines for fine purification and liquefaction of helium.

³⁷ "Statement prepared by the technoeconomic team for assessing the cryogenic gas separation technology for the Amur GPP". 'Gazprom Pererabotka Blagoveshchensk', Moscow, 2015.

Table 6.9: Comparison of the alternative technologies considered for the Project

	Air Liquide/Kriogenmash technology		Linde/Peton technology	
	Technical aspects	Environmental aspects	Technical aspects	Environmental aspects
Advantages	<ul style="list-style-type: none"> Cooling circuit in the case of Air Liquide/Kriogenmash is less reliable. 	<ul style="list-style-type: none"> The soil cover during construction phase will be disturbed over smaller area in the case of Air Liquide/Kriogenmash technology: 38 ha against 44 ha in the case of Linde/Peton technology. According to the requirements of the Terms of Reference, the methane content of discharge nitrogen should be not higher than 50 mg/st.m³. In the project design documentation of Air Liquide/Kriogenmash it is indicated that the methane content in the nitrogen stream will be equal to zero. 	<ul style="list-style-type: none"> The number of process units has been decreased in the case of Linde/Peton alternative by three units as compared with Kriogenmash alternative, as a result by uniting the processes for ethane extraction (NGL) and nitrogen removal from methane (NRU). Linde/Peton technology makes it possible to achieve the design capacity without exceeding the nominal permissible load. The hourly capacity of Linde/Peton is higher by 6% than that of Air Liquide/Kriogenmash alternative. The energy efficiency of Linde/Peton technology with regard to electricity and fuel gas requirements is 12% and 21%, respectively. Linde/Peton technology implies the use of water cooling with a significant saving of water resources as compared to the Kriogenmash alternative. 	<ul style="list-style-type: none"> Generation of wastes of Hazard Classes 1 to 4 is significantly smaller in the case of Linde/Peton technology: 705 t/year against 2,308.6 t/year in the case of Air Liquide/Kriogenmash technology. It is indicated in Air Liquide/Kriogenmash project design documentation that the methane content in the gaseous nitrogen stream is max. 5.0 ppmv, which corresponds approximately to 3.3 mg/st.m³, meeting thereby the requirement specified in the Terms of Reference (max. 50 mg/st.m³).
Disadvantages	<ul style="list-style-type: none"> Low degree of helium extraction: 95.2% instead of the required 98%. This alternative is more expensive with regard to the requirement of heat-transfer and refrigerating agents. Low pressure of the high-pressure methane fraction at the inlet to the booster compressor station: 1.34 MPa (exc.) instead of 1.9 MPa (abs.). 	<ul style="list-style-type: none"> Large quantities of recycled water will be used in the Air Liquide/Kriogenmash process for cooling the process streams. The water requirement for general and drinking needs is higher in the case of Air Liquide/Kriogenmash technology resulting as a consequence in generation of larger wastewater volume. 	<ul style="list-style-type: none"> The ethane content of ethane fraction is lower by 3.3% by mass than in the case of Kriogenmash technology, although both alternatives comply with the ToR requirements. Electric power requirement for cryogenic separation in the case of Linde/Peton technology is higher by 2.5 MW than in the case of Air Liquide/Kriogenmash. Single-stage nitrogen removal. Consumption of helium concentrate is higher by 5.5 times than in the case of Air Liquide/Kriogenmash technology. 	<ul style="list-style-type: none"> The soil cover will be disturbed over a larger area than in the case of the Air Liquide/Kriogenmash technology: 44 ha against 38 ha.

Table 6.10: Assessment of alternative technologies for AGPP by experts of Gazprom Pererabotka Blagoveshchensk

Assessed parameters	Factor of significance	Maximum number of points	Alternative technologies			
			Peton/Linde		Kriogenmash/Air Liquide	
			Points	% of Max	Points	% of Max
Level of bidders' qualification	15%	15	10.6	71%	5.5	37%
Technical factor	35%	35	25.7	73%	25.0	71%
Economic factor	35%	35	17.5	50%	17.5	50%
Commercial factor	15%	15	10.3	69%	9.6	64%
Total number of points	100%	100	64.1	64%	57.6	58%
Place			1		2	

Pursuant to the decision taken by Mr. A.B. Miller, Chairman of Gazprom Management Committee (No.01-3663 of 09.10.2015) as a response to the memorandum by Mr. V.A. Markelov, Deputy Chairman of the Management Committee (No.03-1842 of 09.10.2015), a decision was taken to select the technology for cryogenic natural gas separation for the Amur GPP proposed by the Linde/Peton consortium.

6.5 Implementation of Preferable Alternative

Certain aspects of the selected process alternative, for which alternative project design solutions can be adopted, are discussed in this Section.

6.5.1 Solid Waste Disposal

Currently, there are no landfills in the direct vicinity of the Project area for disposal of low-hazard solid wastes. The following alternatives have been considered for disposal of low-hazard wastes (comparative characteristics are presented below in Table 6.11):

- Temporary storage of wastes in the Project area with subsequent transportation to the municipal waste disposal facilities existing in the subject region;
- Construction of a landfill within the Project's license area for disposal of low-hazard solid wastes;
- Incineration of wastes.

Table 6.11: Comparison of alternatives for solid waste disposal

Alternative	Advantages	Drawbacks
Transportation to a remote landfill	<ul style="list-style-type: none"> • No need to ensure compliance of a landfill within the Project area with the applicable requirements; • Abatement of the overall environmental impact of the Project. 	<ul style="list-style-type: none"> • Need to meet the requirements related to temporary on-site waste storage and waste transportation; • Large transportation distance (logistic aspects).
Construction of a landfill in the Project area	<ul style="list-style-type: none"> • Less stringent requirements to temporary on-site waste storage; • No need to meet requirements related to waste transportation. 	<ul style="list-style-type: none"> • Additional land will be required within the Project's license area; • Construction of a landfill under permafrost conditions.
Waste incineration	<ul style="list-style-type: none"> • Smaller volumes of wastes to be disposed of; • Possibility for segregation of non-hazard wastes; • No need for meeting the requirements related to waste transportation. 	<ul style="list-style-type: none"> • Considerable amounts of pollutants released to the atmosphere.

A decisive factor for rejecting the alternative implying waste transportation to a remote landfill is the logistic difficulties associated with waste transportation. The summarized aspects mentioned above suggest a conclusion that it would be preferable to have a combination of construction of the Project's own landfill and waste incineration.

6.5.2 Electric Power Supply Alternatives

Currently, the main electric power source in the vicinity of the Project area is the 'Amurskaya' substation located at a distance of approximately 30 km from the production site. The following electric power supply alternatives have been considered:

- Connection to the existing power supply system of Amur Region and the United Electric Power Network of the East;
- Construction of the Project's own generating facilities.

A comparison of the above alternatives is presented in Table 6.12.

Table 6.12: Comparison of electric power supply alternatives

Alternative	Advantages	Drawbacks
Connection to the existing electric power supply network	Lower financial expenses for connection of AGPP to a power supply source.	<ul style="list-style-type: none"> • Dependence on electric power supply from the existing capacities of the Eastern United Electric Power Supply Network and Amur Region under conditions of predicted electricity shortage starting from 2021. • Insufficient free capacities in the electric power supply system of the region in the nearest future. • Possible reduction in hydropower generation in the Eastern United Electric Power Supply Network during years with water shortage.
Construction of the Project's own generating facilities	Independent electricity generation	<ul style="list-style-type: none"> • High capital cost of construction.

A decisive factor that influenced the selection was the prediction of possible electric power shortage starting from the year of 2021 due to delays with commissioning of new generating capacities in the region. Based on an analysis of the available alternatives, a decision was taken to construct an independent thermal power plant ("Power of Siberia" TPP) to supply electricity to the AGPP, using the external power supply network as a reserve power source; for this purpose the Project's own 220/110 kV substation "Zavodskaya" will be constructed and connected to the "Amurskaya" 500/220 kV substation.

6.5.3 Water Abstraction and Water Supply Alternatives

The normal water requirement for the operation of the AGPP will be 3,200 m³/day to be supplied into the water treatment plant. It should be taken into consideration that the Project site is located in an area with difficult hydrogeological conditions at the junction of second-order structures of the Amur-Zeya artesian basin and the Mamynsky hydrogeological complex massif.

A number of aquifers and complexes potentially suitable to serve as water supply sources for AGPP have been identified in this area:

- Present-time alluvial water-bearing horizon (aQIV);
- Middle and Upper Quaternary alluvial water-bearing horizon (aQII);
- Sazankovsky Miocene water-bearing horizon (N1sz);
- Buzulinsky Oligocene-Miocene water-bearing complex (P3-N1bz);
- Kivdinsky Paleocene water-bearing complex (P1kv);

- Sredne-Tsagayansky Upper Cretaceous water-bearing complex (K2cg2);
- (K1pk);
- Poyarkovsky Lower Cretaceous poorly defined water-bearing complex (K1pk);
- Localized water-bearing fissured zone of metamorphosed Middle and Upper Paleozoic formations (PZ₂₋₃).

Present-time alluvial water-bearing horizon is extensively developed within the river valleys of the district. Its thickness varies from 8m to 30m in the Zeya river valley and from 3m to 15m in the valleys of minor watercourses. The water resources of the aquifer in the Zeya river valley are abundant. The yields of drilled wells vary from 9.1 l/s to 17 l/s and in some cases were as high as 48.0 l/s. The seepage rate varies from 130 to 280 m/day. The underground water quality does not comply with the sanitary norms for potable water with regard to the iron and manganese content (19.25 mg/l and 0.79 mg/l, respectively). For the purpose of water supply for the town of Svobodny, Beregovoye and Ust-Perskoye underground water deposits had been explored. The resources of the Ust-Perskoye deposit are partially utilized for the water supply for the town of Svobodny. The Beregovoye deposit has not been exploited so far.

Middle and Upper Quaternary alluvial water-bearing horizon is associated with alluvial deposits of the 2nd and 3rd above-floodplain terraces. The underground water is unconfined and located at a depth of 1m to 25m. The yield of shallow wells and boreholes is normally 2-3 l/s. The underground water quality does not comply with the sanitary norms for potable water due to elevated iron and manganese contents. The underground water from the Upper Quaternary horizon is used in residential areas of the districts only as water supply source of individual households.

Sazankovsky Miocene water-bearing horizon extends throughout the district. In most areas it is the second water-bearing horizon from the ground surface. Its thickness varies from 15m to 46m. Underground waters are reported at a depth from 5m to 90m. They are unconfined, but in some cases, if the aquifer roof is composed of impermeable clays and siltstones up to 10m thick, the water has a head pressure of up to 20m. The yield of water wells varies from 2.22 l/s to 9 l/s. The underground water quality does not comply with the sanitary norms for potable water due to elevated iron and manganese contents and microbiological indicators. This water is widely used in the town of Svobodny and in some other residential areas without any pretreatment as a general and potable water supply source.

Buzulinsky Oligocene-Miocene water-bearing complex is reported as the third water-bearing formation from the ground surface over a large area. The complex comprises 1 to 3 aquifers from 5m to 40m thick. The yield of the wells drilled within the 'Urban' area of the Svobodnensky underground water deposit varies from 1.6 l/s to 8.6 l/s. The underground water quality does not comply with the sanitary norms for potable water due to elevated iron and manganese contents. Water from this complex is extensively used for water supply in the town of Svobodny and in rural areas.

Kivdinsky Paleocene water-bearing complex comprises 1 to 3 aquifers with relatively consistent extension. The total thickness of the aquifers varies from 21m to 64m. The underground waters are confined, with a pressure head of over 100 m. The yield of the wells varies from 1.3 l/s to 7.5 l/s with most typical values within 2.8 l/s to 6.8 l/s. The underground water quality does not comply with the sanitary norms for potable water due to an elevated iron content. The water from the Kivdinsky complex is used predominantly in combination with water from other aquifers for water supply for the town of Svobodny and other residential areas in the district.

Sredne-Tsagayansky Upper Cretaceous water-bearing complex extends virtually throughout the entire subject area with an exception of the northern part of the area allocated for the Project construction. The complex comprises 1 to 3 aquifers, the total thickness of which is not more than 36 m. the underground waters are confined, the water head pressure is as high as 185 m; the water abundance is characterized by the specific yields of operating water wells in the town of Svobodny reaching 0.3 l/s. The water quality does not comply with the sanitary norms for potable water due to elevated iron and manganese contents. The underground waters of the complex are used to a limited extent for water supply in the town of Svobodny, most frequently in combination with water from the Kivdinsky and Buzulinsky water-bearing complexes.

Poyarkovsky Lower Cretaceous poorly defined water-bearing complex in the area of the town of Svobodny has been exposed by wells down to a depth of 60 m. It is of no practical interest as a water supply source.

Underground waters from the fissured zone in the foundation formations are reported throughout the Mamynsky hydrogeological massif. The rocks composing the foundation have been exposed in the northern part of the subject area with wells drilled down to depths of 23m to 100m. The yield of the drilled wells is 1.61 l/s. These water resources have not been exploited.

When analyzing the potential alternatives for the water supply system for AGPP it should be pointed out that water in all aquifers considered has high iron and manganese contents. This is attributable most probably to the specific hydrogeological conditions of the subject area.

Based on the information provided above, the water supply alternatives have been assessed using a system of points, taking into account such parameters as water yield of wells (1 point for low; 2 points for medium and 3 points for high) and the extent of the aquifer usage for general and potable water supply (1 point for extensive use; 2 points for limited use; 3 points for aquifers not utilized at all). The assessment results are presented in Table 6.13.

Table 6.13: Comparison of different alternative water supply sources

Alternatives	Yield of water wells	Degree of exploitation
Present-time alluvial water-bearing horizon (aQIV)	3	2
Middle and Upper Quaternary alluvial water-bearing horizon	1	2
Sazankovsky Miocene water-bearing horizon (N1sz)	2	1
Buzulinsky Oligocene-Miocene water-bearing complex (P3-N1bz)	1	1
Kivdinsky Paleocene water-bearing complex (P1kv)	1	2
Sredne-Tsagayansky Upper Cretaceous water-bearing complex (K2cg2)	1	1
Poyarkovsky Lower Cretaceous poorly defined water-bearing complex (K1pk)	0	0
Localized water-bearing fissured zone of metamorphosed Middle and Upper Paleozoic formations	1	3

It follows from the above assessment that the most attractive alternative for the water supply system for AGPP facilities will be the alluvial water-bearing horizon (aQIV) in the Bolshaya Pera River valley. The decisive factors for selection of this alternative were large water reserves (17,400 m³/day), high yield of water wells (9.1 to 17 l/s) and high seepage rate (130-280 m/day).