

# Baimsky GOK, Peschanka Copper Project

## **ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT**

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## **BAIMSKY GOK, PESCHANKA COPPER PROJECT**

## ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

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This Report shall be written in Russian and in English. Both language versions are considered to be equally authentic. In the event of any discrepancy between the two aforementioned versions, the English version shall prevail in determining the content of the Report.

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#### LIST OF ABBREVIATIONS

AGP	Acid Generating Potential
ANP	Acid Neutralisation Potential
AO	Autonomous Okrug
ARD	Acid rock drainage
BAT	Best available techniques
BMZ	Baimka Metallogenic Zone
BFS	Bankable Feasibility Study
Bt	Billion tonnes
CBZ	coastal buffer zone
dmt/a	Dry metric tonnes per annum
EEI	Environmental Engineering Investigations
ESS	Ecosystem service
EPCM	Engineering Procurement Construction Management
EPT	Ephemeroptera, Plecoptera, and Trichoptera
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Programme
GHG	Greenhouse Gas
GRP	gross regional product
IFC	International Finance Corporation
ILO	International Labour Organization
IP	indigenous peoples
ktonnes	kilotonnes
l/a	litres per annum
LOM	life-of-mine
М	million
MPC	maximum permissible concentration
ML	metal leaching
Mt/a	megatonnes per annum
NAG	non-acid generating
NPP	Nuclear Power Plant





NPR	Neutralization Potential Ratio
OVOS	Otsenka Vozdejstviya na Okruzhayushchuyu Sredu (national EIA)
PAX	Potassium Amyl Xanthate
PMF	Probable Maximum Flood
PNA	protected natural areas
PS	performance standards
QA	Quality Assurance
QC	Quality Control
RAC	Russian-American Company
RF	Russian Federation
ROM	run-of-mine
RUR	Russian Ruble
SAG	semi-autogenous grinding
SEP	Stakeholder Engagement Plan
SER	State Environmental Review
SPZ	sanitary protection zone
TEO	Technical-Economic Substantiation [Feasibility Study]
t/a	tonnes per annum
ТРР	Thermal Power Plant
TSF	Tailings Storage Facility
VOIP	Voice-Over-Internet-Protocol
WPZ	water protection zone
WRD	waste rock dump





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#### 1. INTRODUCTION

#### 1.1. <u>Background</u>

GDK Baimskaya LLC (the Company) owns the license (AND 14673 TR) to survey, explore and mine non-ferrous and precious metals within the Baimka License Area in the Bilibinsky Municipal District of the Chukotka Autonomous Okrug (Chukotka AO). Geological exploration continues in the Peschanka Ore Field with a view to developing a project "Baimsky GOK, Peschanka Cooper Project". The Project is aimed at mining and processing of copper and gold reserves. The Project includes construction of Baimsky GOK in the Peschanka Ore Field and a marshalling yard at the port of Pevek– a facility that will be used for temporary storage of incoming goods and shipping out the finished product. Fluor Canada Ltd. (Fluor) was awarded Engineering, Procurement, and Construction Management (EPCM) services for the plant and infrastructure on the Peschanka Copper Project. The Owner is directly managing the design of the mine, and all other facilities are designed by third parties.

In parallel with the feasibility study for construction of the mine and processing plant, an environmental and social assessment on the Project and all associated infrastructure was conducted. Such assessments consist of two major components. The first component is a formalised Environmental and Social Impact Assessment (ESIA) that complies with international lender requirements and the International Finance Corporation (IFC) performance standards in particular. The second component is complying with the Russian regulatory requirements that are needed for approval of the Project, which are made up of the national Environmental Impact Assessment (in Russian – OVOS) and the preparation of Design Documentation.

This Environmental and Social Impact (ESIA) Report serves to present the main findings of the assessment process. The ESIA Report follows on from the Scoping Report, which served to define the scope of work for the impact assessment. This report also contains a detailed description of the proposed project together with an updated baseline assessment that follows some additional fieldwork conducted in 2019. Thereafter the assessment of the environmental and social impacts potentially associated with the Project are presented for both the Peschanka mine site and for the marshalling yard proposed for Pevek. The impacts are presented together with an assessment of the significance of the impacts for decision-making on the acceptability of the project and mitigation is proposed as appropriate, to prevent or reduce the negative impacts and to enhance the positive.

## 1.2. Objectives of the ESIA Report

The objective of the ESIA Report is to:

- Identify and evaluate environmental and social risks and impacts of the Project and to present the relative significance of each of these impacts;
- Proposed mitigation that follows the mitigation hierarchy to anticipate and avoid, or where avoidance is not possible, minimize, and, where residual impacts remain, compensate/offset for risks and impacts to workers, Affected Communities, and the environment.
- Establish a solid foundation for good practice environmental and social performance in implementing the Project through the effective use of management systems.



• Initiate the process of promoting and providing means for engagement with Affected Communities throughout the Project cycle on issues that could potentially affect them and to ensure that relevant environmental and social information is disclosed and disseminated.

It should be noted that the stakeholder engagement is detailed in a separate but related Stakeholder Engagement Plan (SEP). An issue often raised by stakeholders is why it is necessary to conduct both an ESIA (of which this ESIA Report forms part) as well as the assessment required by the Russian regulatory requirements. The two requirements (the ESIA and the OVOS and Design Documentation) seek to achieve the same broad purpose. The reason for the two processes is that the lenders do not always recognise the Russian regulatory requirements as fully subscribing to their requirements. As such an ESIA is conducted separately in accordance with the IFC requirements but draws extensively from the technical assessments done for the OVOS.

### 1.3. Activities to Date

The following activities have been conducted to date to inform the ESIA Report:

- Extensive baseline assessments conducted in August 2015 and August 2018 and updated in 2019 with the additional wintertime, springtime and summertime studies (see ANNEX 1); the field studies included *inter alia*:
  - Sampling of soils, surface water, and snow covers;
  - Groundwater well drilling and groundwater quality testing;
  - Winter route records of traces of game;
  - Spring survey of the migratory birds;
  - Summer surveys of the flora and fauna;
  - Radiological studies;
  - Social baseline studies; and
  - Integrated Environmental Engineering Investigations (EEI).
- The further development of the design of the mine and concentrator leading up to the completion of a Bankable Feasibility Report (BSF);
- Site visits to the Peschanka site and surrounding areas and Pevek; and,
- Preliminary engagements with selected stakeholders including competent state authorities.

## 1.4. Assumptions and Limitations

- This ESIA report has been completed in December 2019 and is based on information and the project design available at the time. The further development of the Project may introduce changes to the Project described in this document, which if significant in respect of changes to the environmental and social impacts that have been defined and quantified, or that creates a new footprint in areas previously not assessed, would need to be further assessed.
- The baseline information used in this report has been mainly sourced between 2015 and 2019. Baseline studies are continuing however, the results of which will be



incorporated as appropriate in the OVOS and design documentation (the Russian environmental and social impact assessment process) which would be completed during 2020.

## 2. LEGAL AND REGULATORY FRAMEWORK

The environmental assessment for the proposed Peschanka Copper Project has two broadly parallel components namely an Environmental and Social Impact Assessment (ESIA) and an *Otsenka Vozdejstviya na Okruzhayushchuyu Sredu* (OVOS) together with Design Documentation, which collectively forms the Russian regulatory equivalent of the ESIA. The key components of the respective processes are shown schematically in Figure 1.

## 2.1. Applicable International Lenders' Requirements

## 2.1.1. International Finance Corporation (IFC) Requirements

The International Finance Corporation (IFC) is the private sector component of the World Bank Group and has largely set the benchmark for environmental and social assessment and management for most international lenders. The IFC has a Sustainability Framework that articulates a commitment to sustainable development, and which is an integral part of their risk management. The framework consists of:

- A Policy on Environmental and Social Sustainability<sup>1</sup>;
- Performance Standards on environmental and social sustainability<sup>2</sup>, which define clients' responsibilities for managing their environmental and social risks; and,
- An Access to Information Policy<sup>3</sup>, which articulates IFC's commitment to transparency.

## Environmental and Social Sustainability Policy

IFC strives for environmental and social sustainability in the activities it supports in developing countries, and this key objective is the foundation of the policy. The policy itself is an expression of the IFC's commitment to sustainability, with reference to the environmental and social performance standards that must be met by borrowers, investees and other financial institutions).

<sup>1</sup> International Finance Corporation (IFC). 2012a. International Finance Corporation's Policy on Social & Environmental Sustainability, 01/01/2012. Available at:

https://www.ifc.org/wps/wcm/connect/7141585d-c6fa-490b-a812-

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226188c95454/PS English 2012 Full-Document.pdf?MOD=AJPERES&CVID=jkV-X6h.

<sup>3</sup> IFC. 2012c. International Finance Corporation Access to Information Policy, 01/01/2012. Available at <u>https://www.ifc.org/wps/wcm/connect/c8a61c48-32c2-49b2-8e46-</u>

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2ade87f774e0/IFCPolicyDisclosureInformation.pdf?MOD=AJPERES.
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<sup>&</sup>lt;sup>2</sup> IFC. 2012b. Performance Standards on Environmental and Social Sustainability, 01/01/2012. Available at: Available at: <u>https://www.ifc.org/wps/wcm/connect/24e6bfc3-5de3-444d-be9b-</u>



Figure 1. Schematic presentation of the relationship between the ESIA process required by international lenders (in green) and the E&S and technical project authorization process as per the Russian regulatory requirements (in blue)

## Environmental and Social Performance Standards

The IFC's performance standards on environmental and social sustainability (paraphrased as 'the performance standards' or PS) are a series of good practice requirements that highlight various environmental and social risks and detail good practice management of such risks. The performance standards are the gold standard for many lending and investor institutions and so even if the IFC is not approached directly for financing for the Project, it is highly likely that the PS would apply. As such the environmental and social assessment conducted on the Project will be based on the risks and good practice obligations detailed in the PS. The PS are:

- Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts;
- Performance Standard 2: Labour and Working Conditions;
- Performance Standard 3: Resource Efficiency and Pollution Prevention;
- Performance Standard 4: Community Health, Safety, and Security;
- Performance Standard 5: Land Acquisition and Involuntary Resettlement;
- Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources;
- Performance Standard 7: Indigenous Peoples; and,



• Performance Standard 8: Cultural Heritage.

The PS are not detailed here but will be elaborated in the ESIA.

#### Access to Information Policy

IFC's Access to Information Policy (AIP) requires the provision of accurate and timely information regarding its investment and advisory services activities to its clients, partners and stakeholders. The policy dictates that all projects that apply for financing must be publicly disclosed before a decision can be made on the application. It must also be recognised that the environmental and social impact assessments prescribed in the performance standards also require consultation and disclosure as part of the assessment process.

#### 2.1.2. The Equator Principles

The Equator Principles (EP) are defined as 'a risk management framework, adopted by financial institutions, for determining, assessing and managing environmental and social risk in projects and is primarily intended to provide a minimum standard for due diligence and monitoring to support responsible risk decision-making'<sup>4</sup>. Stated differently the EP are how commercial banks give effect to the commitment to sustainability espoused by the IFC. Some 96 Financial Institutions (FIs) from 37 countries have officially adopted the EPs, covering the majority of international project finance debt within developed and emerging markets. FI's that have adopted the EP are known as EPFI's. A key element of the EP is the adoption of the IFC's PS and the requirement for borrowers and/or investees to comply with the PS.

#### 2.2. <u>Russian Legal Requirements</u>

Russian EHS legislation is very diverse, and will be presented more fully in the Russian OVOS documentation. The brief points below aim to provide general information on the similarities and differences between the Russian legal requirements and the IFC/Equator Principles requirements that is important for the ESIA process.

#### **Environmental Impact Assessment and Public Consultations**

• EIA process in the RF

The requirement for conducting an assessment of environmental and related social and economic impacts of a planned economic and other activity is established by the RF Law on Environmental Protection<sup>5</sup>. The Project is subject to the State Environmental Review (SER)<sup>6</sup> provided by the competent authorities and the OVOS (national EIA) provided by the Project Proponent. The Federal Service for the Supervision of Nature Resource Management conducts the SER at the federal level. The national EIA procedure is set out in the

Federal Law of 28/12/2017 No. 422-FZ On Amending Article 14 of the Federal Law on the State Environmental Review and Article 12 of the Federal Law on Amending the Federal Law on the Environmental Protection and Certain Legal Acts of the Russian Federation.



<sup>&</sup>lt;sup>4</sup> The Equator Principles III, June 2013. Available at <u>https://equator-principles.com/wp-</u>content/uploads/2017/03/equator principles III.pdf.

<sup>&</sup>lt;sup>5</sup> Federal Law of 10/01/2002 No. 7-FZ On the Environmental Protection (as amended on 29/07/2018).

<sup>&</sup>lt;sup>6</sup> Federal Law of 23/11/1995 No. 174-FZ On Environmental Review (as amended on 25/12/2018).

'Regulation on the Environmental Impact Assessment of Planned Activities in the Russian Federation' (the OVOS Regulation)<sup>7</sup>. The OVOS is conducted in three phases:

- 1. Notification, preliminary assessment and the Terms of Reference for the OVOS (OVOS ToR) formulation;
- 2. Environmental impact assessment per se and preparation of the draft OVOS Report;
- 3. Finalisation of the OVOS Report.
  - o EIA Scope

The OVOS Regulation stipulates the need for considering environmental as well as socio-economic impacts of the proposed economic activity.

o Alternative analysis

The OVOS Report should include assessment of impacts for all Project alternatives including namely alternative sites and Project technologies, as well as a 'no-go' alternative.

• Impact management

The OVOS Report must include measures to mitigate or prevent potential adverse impacts of the Project, as well as analysis of their effectiveness and implementation perspectives.

• Stakeholder engagement and information disclosure

Public consultations and information disclosure are required at Phases 1 and 2 of the OVOS process.

The Project Developer ensures conducting the public consultation process; informing the public and access to information, addressing enquiries, and covering all related costs.

The local self-government authorities organize the public consultations (public meetings, if applied as a method for public consultations) including public hearings.

#### Environmental Management

• Environmental Management Systems

While the Russian Federation legislation does not specify compulsory requirements for environmental management systems, their development and introduction on a voluntary basis is encouraged. A set of recommended standards similar to ISO standards has been developed to include:

- GOST R ISO 14001-2016 Environmental Management Systems. Requirements and Guidance for Use;
- GOST R 54934-2012/OHSAS 18001:2007 Occupational Health and Safety Management Systems. Requirements;
- o GOST R ISO 9001-2015 Quality Management Systems. Requirements;
- GOST R 19011-2012 Guidance on Audit of Management Systems.

<sup>&</sup>lt;sup>7</sup> RF State Committee on the Environmental Protection Order of 16/05/2000 No. 372 On the Approval of the Regulation on the Environmental Impact Assessment of Planned Activities in the Russian Federation.



The list is not exhaustive with a number of other documents adopted that also support the introduction of environmental and social management systems.

#### Labour and Working Conditions, Occupational Health and Safety

The Russian Federation has signed and ratified virtually all International Labour Organization (ILO) conventions with requirements contained therein reflected in the RF Labour Code<sup>8</sup> in one way or another.

However, this applies only to employees hired on a labour contract basis while in many cases the civil law contracts are used as a form of employment (e.g. a contractor agreement). This form of employment is not covered by the provisions of the RF Labour Code.

The legislative provisions regarding child labour are well elaborated, consistent with ILO requirements and complied with. Prison labour is legal under Russian legislation; it is relatively widely used in a number of sectors, and whether it is used or not needs to be verified on a case-by-case basis.

The RF Labour Code is also the backbone legislation on occupational health and safety (OHS). It is supported by a broad range of regulations addressing general aspects and specific issues of occupational health and safety.

The key law on occupational safety is the Law on Occupational Safety of Hazardous Industrial Facilities<sup>9</sup>. The Minerals and Mining Safety Rules are the key regulations applicable to the Project<sup>10</sup>.

The RF occupational health and safety legislation is generally consistent with the relevant EU requirements though enforcement practice may vary.

## **Resource Efficiency and Pollution Prevention**

The RF legislation on pollution prevention and resource efficiency is extensive and includes many laws and regulations.

• Pollution prevention

RF legislation requires pollution prevention and abatement. Best available techniques (BAT) is gradually becoming embodied in national legislation. BAT has now been defined in the Law on Environmental Protection (Article 1)<sup>11</sup>. From 2019 onwards, Category I industries applying for an Integrated Environmental Permit will be required to implement BAT<sup>12</sup>. The development of Engineering and Technology References (ITS documents) is ongoing.

• Protection of water resources

 <sup>&</sup>lt;sup>11</sup> Federal Law of 10/01/2002 No. 7-FZ On the Environmental Protection (as amended on 29/07/2018).
 <sup>12</sup> Criteria for Being Qualified as Facilities that Have a Negative Impact on the Environment of Categories I, II, III and IV. Approved by the RF Government Resolution of 28/09/2015 No. 1029.



<sup>&</sup>lt;sup>8</sup> Labour Code of the Russian Federation of 31/12/2001 No. 197-FZ (as amended on 11/10/2018).

<sup>&</sup>lt;sup>9</sup> Federal Law of 21/07/1997 No. 116-FZ On Safety of Hazardous Industrial Facilities (as amended on 29/07/2018).

<sup>&</sup>lt;sup>10</sup> The Federal Service for Technological, Environmental and Nuclear Supervision (RosTekhNadzor) Order of 11/12/2013 No. 599 On the Approval of the Federal Industrial Safety Rules "Minerals and Mining Safety Rules" (as amended on 21/11/2018).

The RF Water Code governs the management and protection of water resources<sup>13</sup>. The term 'water resources' refers to surface and groundwater resources contained in natural and man-made water bodies and watercourses. As a general rule, all water bodies are federal property.

• Climate Change and GHG Emissions

The RF has signed (but not yet ratified) the Paris Agreement on Climate Change<sup>14</sup> on 22 April 2016.

Pursuant to the Russian Federation Greenhouse Gas (GHG) Emission Monitoring, Reporting and Verification System Development Concept<sup>15</sup>, the mandatory GHG reporting requirement came into effect in 2019 (Phase I) for major industrial and energy installations with direct annual GHG emissions over 150,000 tons of CO<sub>2</sub>-equivalent.

From 2024 onwards (Phase III), the mandatory GHG reporting requirement will apply to all organisations whose GHG emissions are over 50,000 tonnes of CO<sub>2</sub>-equivalent, and to all air, rail, maritime and river transport organisations.

### Community Health and Safety

The Law on the Healthy and Safe Community Environment<sup>16</sup> serves to ensure community health and safety in the country.

A key regulatory mechanism is the sanitary protection zone (SPZ), which is a buffer area, set around an industrial site and which provides additional space for the dispersion of emissions released from that site. Each industry is required to ensure compliance with the specified air quality and noise level guidelines on the SPZ boundary and conduct an assessment of community health risks.

#### Land Acquisition and Involuntary Resettlement

RF land legislation is very detailed and requires, *inter alia*, that compensation be paid for land acquisition for federal and municipal programmes. The national land acquisition process is generally consistent with the relevant EU requirements. However, significant differences may become apparent in the situations where a formal land title is missing for a plot that has been used for many years.

#### Biodiversity Conservation and Sustainable Management of Living Natural Resources

Russia is a party of the Convention on the Biological Diversity<sup>17</sup> and transposed the provisions of the Convention into the RF legislation. The key relevant national laws include the federal laws On the Environmental Protection<sup>18</sup> and On Wildlife<sup>19</sup>.

<sup>14</sup> The Paris Agreement on Climate Change official website. Available at: <u>https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement</u>.

 <sup>&</sup>lt;sup>18</sup> Federal Law of 10/01/2002 No. 7-FZ On the Environmental Protection (as amended on 29/07/2018).
 <sup>19</sup> Federal Law of 24/04/1995 No. 52-FZ On Wildlife (as amended on 03/07/2016).



<sup>&</sup>lt;sup>13</sup> The Water Code of the Russian Federation of 03/06//2006 No. 74-FZ (as amended on 27/12//2018).

<sup>&</sup>lt;sup>15</sup> Russian Federation Greenhouse Gas Emission Monitoring, Reporting and Verification System Development Concept, approved by the RF Government Resolution of 22/04//2015 No. 716-r. As amended by the Order of the RF Government of 30/04/2018 No. 842-r.

<sup>&</sup>lt;sup>16</sup> Federal Law of 30/03/1999 No. 52-FZ On the Healthy and Safe Community Environment (as amended on 03/08/2018).

<sup>&</sup>lt;sup>17</sup> Convention on Biological Diversity, 1992. Available at <u>https://www.cbd.int/doc/legal/cbd-en.pdf</u>.

### Cultural Heritage

Russia is a party to the Convention Concerning the Protection of the World Cultural and Natural Heritage (1972)<sup>20</sup>.

Russia is not a party to the Convention for the Safeguarding of the Intangible Cultural Heritage (2003)<sup>21</sup> and this is a major source of contradiction with lenders' requirements.

Key national requirements regarding the conservation of tangible cultural heritage are set out in the Russian Federation Law on Cultural Heritage Objects (Historical and Cultural Monuments) of the Peoples of the Russian Federation<sup>22</sup>.

#### **Indigenous Peoples**

The Russian Federation has a well-defined body of legislation concerning the indigenous peoples (IPs) of the North, Siberia and the Far East<sup>23,24</sup>. The legislation includes a number of bylaws and regional laws in place in the regions where IPs are concentrated.

The Russian legislation has distinct features compared to the relevant IFC requirements (including the definition and eligibility criteria that should be met by an ethnic group to be included in the national list of IPs.

According to Federal Law No. 82-FZ On the Guaranteed Rights of the Small-Numbered Indigenous Peoples of the Russian Federation, Indigenous Peoples<sup>25</sup> are considered as the nationalities occupying traditional lands of their ancestors and practicing traditional lifestyle, household and economy and having total number of less than 50 thousand people and identifying themselves as ethnic community (Article 1, para 1). The Chukotka AO has its own legislation on IPs.

#### 3. THE PROPOSED PROJECT

#### 3.1. Project History

The Peschanka gold-copper-molybdenum deposit was discovered in 1972 and explored in the 1970s–1980s. Since then, the property has been investigated and studied by different entities with the Company initiating its involvement in 2009. In 2011, the Company commissioned a TEO (the Russian equivalent of a feasibility study) to determine what would be required to commercially exploit the deposit. The Company under the guidance of the Regional Mining Company LLC, then conducted further exploration. IMC Montan<sup>26</sup>

<sup>&</sup>lt;sup>26</sup> IMC Montan. 2011. Scoping Study for the Development of Peschanka Deposit.



<sup>&</sup>lt;sup>20</sup> United Nations Educational, Scientific and Cultural Organization (UNESCO). 1972. The Convention Concerning the Protection of the World Cultural and Natural Heritage. Available at: http://whc.unesco.org/en/175.

<sup>&</sup>lt;sup>21</sup> UNESCO. 2003. The Convention for the Safeguarding of the Intangible Cultural Heritage. Available at: <u>http://unesdoc.unesco.org/images/0013/001325/132540e.pdf</u>.

<sup>&</sup>lt;sup>22</sup> Federal Law of 25.06.2002 No. 73-FZ On Cultural Heritage Objects (Historical and Cultural Monuments) of the Peoples of the Russian Federation (as amended on 18/07/2019).

<sup>&</sup>lt;sup>23</sup> Federal Law of 30/04//1999 No. 82-FZ On the Guaranteed Rights of the Small-Numbered Indigenous Peoples of the Russian Federation (as amended on 26/07/2019).

<sup>&</sup>lt;sup>24</sup> Federal Law of 20/06//2000 No. 104-FZ On the General Principles Underpinning the Organisation of Communities of the Small-Numbered Indigenous Peoples of the North, Siberia and the Far East of the Russian Federation (as amended on 27/06/2018).

<sup>&</sup>lt;sup>25</sup>Article 1 of the Federal Law of 30/04//1999 No. 82-FZ On the Guaranteed Rights of the Small-Numbered Indigenous Peoples of the Russian Federation (as amended on 26/07/2019).

estimated the mineral resources in the Peschanka deposit in October 2011 using 0.40 % copper equivalent cut-off grade and defined a Measured and Indicated Resource of 1.3 billion metric tonnes.

In 2016, a JORC geological model was developed, that indicates 1,428 Megatonnes (Mt) of Measured and Indicated ore and 774 Mt of Inferred and Unclassified ore.

In 2017, the Final Mining Feasibility Study<sup>27</sup> (in Russian 'TEO Postoyannykh Konditsiy') (further referred as TEO) was developed. The geologic reserves as for 01.01.2017 are presented in Table 1. The 2017 TEO estimates 1,237,813.8 ktonnes reserves of sulphide ore (cut-off grade of 0.4% of copper equivalent).

		Measured	Indicated	Inferred	Total
Mineral resources	Mt	139	1,289	774	2,202
Copper grade	%	0.72	0.44	0.36	0.43
Contained copper	Mt	1.0	5.7	2.8	9.5
Gold grade	g/t	0.39	0.26	0.16	0.23
Contained gold	Moz	1.7	10.8	4.0	16.5
Silver grade	g/t	4.0	2.4	2.0	2.4

Table 1. Peschanka deposit mineral resources

Source: <a href="https://www.kazminerals.com/our-business/baimskaya/">https://www.kazminerals.com/our-business/baimskaya/</a>

The Peschanka deposit is planned to be mined using open pit mining. The parameters for the permanent exploration conditions were developed and agreed upon by the State Commission for Minerals Reserves<sup>28</sup> to delineate and estimate ore reserves of the deposit. In addition, geological and economic assessment of the deposit development in the modern economic conditions was conducted.

The collected data allowed the Company to describe the geology of the deposit and to develop a structural model of the ore mineralization and tectonic conditions. Since that time there has been further exploration and the development of a mine plan and definition of the process that would be required to extract the minerals from the ore.

#### 3.2. Project Overview

## 3.2.1. Location of the Deposit and the Project Site

The deposit is located in north-eastern Siberia, Russia, in the Bilibinsky Municipal District of the Chukotka AO (also referred to as Chukotka). The main Project site (also referred to as the Peschanka site) is 187 km southwest of the district centre of Bilibino and 650 km west of the regional capital of Anadyr (Figure 2). The deposit lies in the valley of the Peschanka River at an elevation of +/- 400m.

<sup>&</sup>lt;sup>28</sup> The State Commission on Minerals Reserves is a division of the Federal Subsoil Resources Management Agency (Rosnedra) at the Ministry of Natural Resources and the Environment.



<sup>&</sup>lt;sup>27</sup> GIPRONIKEL INSTITUTE. 2017. The Final Mining Feasibility Study [Tekhniko-ekonomicheskoye obosnovaniye postoyannykh razvedochnykh konditsiy] for the Peschanka Deposit, Saint-Petersburg, GIPRONIKEL INSTITUTE, 2017.



Figure 2. The location of the Peschanka Copper Project in Northeastern Siberia

## 3.2.2. Geology

The Peschanka gold-copper-molybdenum deposit is a porphyry type deposit. Porphyry copper deposits are large volumes of hydrothermal alteration centered on porphyritic intrusive stocks. Typical of deep-level copper porphyry systems, Peschanka hosts significant Cu+Au+Mo mineralisation. The Peschanka copper porphyry deposit is located on the Chukotka Peninsula in Russia, at 66° 36'N 164° 30'E in far northeastern Siberia. As one of the largest of a group of deposits that define the Baimka Ore Field, the copper porphyry at Peschanka is confined to a north-south trending, eastward dipping, sheet-like stockwork (a complex system of structurally controlled or randomly oriented veins containing the mineralisation).

## Regional geology

The Peschanka deposit is located in the central part of the Baimskaya metallogenic zone and is genetically related to Late Jurassic – Early Cretaceous intrusive complex that forms a 40 km by 9 km north-north-east trending Yegdegkychsky massif<sup>29</sup>. Localized in the Baimka Ore Field, the Peschanka deposit is controlled by deep faulting that transects the outer part of the Cretaceous Okhotsk-Chukotka magmatic belt. The ore-bearing hydrothermally

<sup>&</sup>lt;sup>29</sup> IMC Montan. 2011. Scoping Study for Development of Peschanka Deposit.



altered Early Cretaceous intrusive rocks comprise of monzodiorite and monzonite, quartz monzonite, and seyenite porphyries.

#### Local geology

The Peschanka deposit is associated with multiphase stockworked quartz monzoniteporphyry, and quartz monzodiorite-porphyry hosted in a monzodionitic stock. It is a typical copper porphyry deposit with associated gold. Mineralisation is hosted in quartz stockworking, within and extending from the causative intrusives with predominantly bornite and chalcopyrite in the quartz stockwork and with potassic alteration extending into the host intrusion. The 7 km long, up to 1.5 km wide stockwork is broken by transverse and diagonal strike-slip faults into three blocks. The porphyry mineralisation is faulted and fractured in orthogonal directions to the regional structure with mineralisation primarily being oriented NW-SE.

The current 2016 JORC geological model indicates 1,428Mt of Measured and Indicated ore. The JORC model also indicates 774Mt of Inferred and Unclassified (IU) ore. A 2019 metallurgical testing program and 2019 supplementary drilling program have been designed to target the IU classified ore.

### 3.3. Project Schedule

The broad Project schedule is as follows:

- Project commencement: 2021;
- Construction: 2021 to 2026;
- Mine operations: 2023 to 2044; and
- Concentrator operations: 2025 to 2044.

#### 3.4. Project Components

The Peschanka Copper Project is made up of the following components:

- An open pit mine that will consist of three pits;
- Overburden and waste rock dumps;
- Ore stockpiles;
- A concentrator;
- A tailings storage facility (TSF);
- Accommodation, site offices, canteen and clinic facilities, vehicle and equipment workshops, stores, recreational facilities and so forth;
- A waste incinerator;
- Electrical power distribution;
- Industrial and potable water supply systems;
- Service roads connecting the various site components;
- An analytical laboratory;
- Sewage treatment plants for both construction and operations;



- A site refuelling facility;
- An aerodrome; and
- An explosives manufacturing and storage facility (for drilling and blasting purposes).

#### 3.5. <u>The Proposed Mine</u>

Given the geology described above, the mine would be established as an open pit operation using a conventional shovel and haul truck operation to mine 1,295Mt of ore over the 20-year life of the mine. The mine has a life-of-mine (LOM) grade of 0.47% and a central core of higher-grade material that will deliver copper content of 0.54% copper over the first ten years. The first activities in establishing the mine pit are pre-stripping which serves to expose the main ore body. Ore recovered during the pre-stripping will be stockpiled for later use as will be lower grade ores, as the mine plan is based on mining the high-grade ores first. This targeting of high-grade ores is done to maximise the revenue generated in the early part of the mine life so as to amortise the capital investment as quickly as possible. In the first years of establishing the mine it can be seen that there is a relatively low waste content in the ROM. From 2030, the ROM waste quantities increase.

Based on the cut-off grade, 2,533 Mt will be mined of which 1,163.9 Mt will be waste. A portion of that waste will be dumped on the waste rock stockpiles with the remainder ending up as tailings in the tailings storage facility (TSF). The difference between the total movement of materials and the total ROM is the ore that is double-handled through initial stockpiling and later reclaiming.

The mine layout is shown in Figure 3 showing the three mining pits that will be established (main pit, central and north pit) and the positions of the waste rock dumps and the oxide and low-grade stockpiles. The Company will undertake the mining with activities including pre-stripping, in-pit haul road construction and maintenance, excavation and haulage of ore and waste rock out of the pits. The in-pit works will also include drilling and blasting, loading, hauling, pit dewatering, in-pit dust control, in-pit electrical distribution, and pit slope monitoring. Mine works outside of the open pits will include mine haul roads, waste rock dumps, ore stockpiles and reclaiming and surface water monitoring. Facilities required for operation and maintenance of the mine will be constructed at the concentrator site approximately 2 km from the ultimate open pit limit. A contractor will provide blasting products and services.

The facilities will be designed in accordance with Russian codes and standards, as well as applicable international standards, as appropriate. Full compliance with Russian regulations will be ensured through the project documentation that will be developed during the detailed engineering. As the main Project site is located at a remote site with harsh climatic site conditions and minimal local infrastructure, simple and time-effective building erection utilising both regional and similar applicable international construction practices will be implemented.





Figure 3. Mine pits, ore stockpiles and waste dump locations for the Peschanka Copper Project



#### 3.6. <u>The Concentrator</u>

#### 3.6.1. Introduction

The minerals processing plant (also referred to as the concentrator) is designed to be capable of processing around 60 megatonnes per annum and producing approximately 250 kt per annum of payable copper in concentrate and 400 koz of gold on average over the first ten years of the project. This product will be transported by truck and ship to smelters, primarily in China. The process design criteria for the concentrator are summarised in Table 2.

Table 2. Process design criteria for the concentrator proposed for the Baimsky GOK, PeschankaCopper Project

Parameter	Unit	Value
Ore throughput	dmt/a	ca. 60 mln
Overall plant availability	%	92
Operating schedule	days/a	365
Annual plant operating hours (considering availability)	h/a	8,059

### 3.6.2. An Overview of Generic Concentrator Processing

In general terms, the ore processing is one of crushing and grinding the ore that is mined to grain size sufficient such that a sufficient number of grains will contain the desired mineral only. The undesired grains with no commercial value are known as gangue and are a waste product. Flotation processes are then used to separate out the desired minerals from the gangue by using the hydrophilic (water seeking properties) of the gangue versus hydrophobic (water repelling properties) of the minerals. The crushed material is mixed with water to create a slurry, to which reagents are added to enhance the hydrophobicity of the minerals. The slurry is also aerated, and the minerals then attach themselves to the air bubbles and ultimately end up in the froth that forms on the surface. That froth is a concentration of the required minerals. The flotation process has three stages namely rougher, cleaning and scavenging phases.

The rougher stage is a 'first pass' stage and produces a rougher concentrate. Here the principle is to remove as much of the valuable mineral as possible with relatively coarse particles even though the quality of the concentrate may be poor and require further processing. Importantly, the rougher stage separates some but not all gangue from the minerals leaving a smaller mass of material for further grinding without wasting energy on grinding what is ultimately a waste. The principle is then one of trying to maximise the mineral recovery with as coarse a grain as possible so that further grinding targets principally the mineral particles.

The rougher concentrate is then moved on to the next stage, which is the cleaner stage. The rougher concentrate is first passed through a regrind mill to further reduce particle size where after the slurry again undergoes flotation. In the cleaner phase, the principle is one of maximising the quality of the concentrate by removing more of the gangue. The final stage is the scavenging stage, which is applied to the waste from the rougher tailings to try and recover any minerals that may still be contained in the tailings. The minerals are



recovered using either further regrinding or more rigorous flotation processes. Similarly, the tailings from the cleaner process may also be put through the scavenger process also to recover minerals that might still be contained in the tailings.

### 3.6.3. The Concentrator Proposed for the Peschanka Copper Project

### Parallel processing lines

The concentrator is designed with two parallel processing lines of equal capacity that are sufficiently independent to allow for the processing of different ores from different sources. The description that follows is for a single line, but it should be remembered that such a line is duplicated for the project.

### Run-of-mine

Run-of-mine (ROM) ore, which is the unprocessed ore that has been mined, will be transported from the mining area to the concentrator by haulage dump trucks.

### Primary crushing and coarse ore stockpile

The haul trucks will dump ore into a primary crusher dump pocket enclosure which is open but protected from the wind. The primary crusher will reduce the ore to a size 80 % passing 153 mm. The dump pocket enclosure combined with water sprays will serve to contain dust generated during dumping. The sprays will only be operational in the summer, otherwise the water will freeze. The primary crusher will be enclosed in a heated structure installed to provide maintenance services to the crusher. This subgrade structure will be equipped with a dust collection system.

The stockpile conveyor will then move the crushed ore from the primary crusher to the coarse ore stockpile. This conveyor will be covered to contain dust and spillage as well as provide protection from the elements during maintenance. The conveyor will not be fully covered but will have half-moon covers to provide wind protection. The conveyor discharge point will be equipped with water sprays to minimize dust generation. The sprays will only be operational in the summer, otherwise the water will freeze. The coarse ore stockpile will not be covered.

#### Coarse ore reclaim

Underneath the coarse ore stockpile there will be a chamber (tunnel) holding three reclaim feeders and a portion of the SAG mill feed conveyor. The reclaim feeders will retrieve ore from the stockpile at a suitable rate and deliver it to the semi-autogenous grinding (SAG) mill feed conveyor. The reclaim tunnel will be equipped with dust collection systems. Upon exit of the reclaim tunnel, the SAG mill feed conveyor will have wind protection to contain dust and spillage as well as provide protection from the elements during maintenance.

At the exit of the reclaim tunnel, an above grade structure will provide storage and handling systems for the addition of grinding media (steel balls) and dry pebbled lime to the ore on the SAG mill feed conveyor. The SAG mill feed conveyor will deliver ore, grinding media and lime into the SAG mill located in the grinding area of the main concentrator building.



#### Grinding

The process of grinding is one of further reducing the size of the ore to physically separate grain sizes for the further processes used to extract the desired elements of copper and gold. The grinding circuit will comprise a SAG mill, two ball mills, hydro cyclones, and pebble crushing equipment.

The reclaimed ore and process water will enter the SAG mill (a large rotating drum containing ore slurry and grinding media (steel balls referred to earlier). Upon exiting the SAG mill, the SAG screen will separate oversized particles (pebbles) from the finer slurry. The pebbles will be harder material that has been resistant to breakage. These pebbles will be fed to cone crushers and subsequently to high pressure grinding rolls for breakage as these processes are more energy efficient than milling.

The SAG mill discharge slurry will be combined with crushed pebbles and ball mill discharge in the cyclone feed pump box. The hydro cyclones will classify the solid particles by size. Particles that are fine enough will proceed to flotation while particles that are too coarse will be returned to the ball mill for further grinding. Ball mills operate in a similar fashion to SAG mills except that the grinding media is smaller leading to a smaller grind size. To prepare the ore for flotation, potassium amyl xanthate and dithiophosphate aqueous (collectors), and fuel oil (collector) will be added in the grinding circuit.

As the pebble crushing circuit will operate "dry", dust collection systems will be used. The conveyors in the pebble handling circuit will be covered to contain dust and spillage as well as provide protection from the elements during maintenance. The grinding and pebble crushing areas will be equipped with containment and area sumps for cleanup. The grinding and pebble crushing circuits will be located in heated buildings.

#### **Rougher flotation**

Product from the grinding circuit will report to the rougher flotation circuit. There will be two banks of rougher flotation circuits per processing line. To enable the flotation process, sodium sulphide, potassium amyl xanthate and dithiophosphate aqueous (collectors), lime slurry, and pine oil (frother) will be added in this step. These reagents are routinely used in concentrators globally. The bulk rougher flotation step will target maximum recovery of target metals into a concentrate stream for further upgrading. The tails (waste stream) from the rougher flotation step will report to the tailings storage facility. The rougher flotation areas will be equipped with containment and area sumps for cleanup, and will be located in the heated main concentrator building.

#### Rougher concentrate regrind

The rougher concentrate will be further ground to a smaller size to increase the degree of mineral liberation and facilitate removal of additional gangue (waste) such that the concentrate can be upgraded to the desired metal concentration. The regrind circuit will comprise hydro cyclones and grinding mills. These grinding mills will utilize ceramic grinding media (beads) instead of steel balls. To prepare the ore for subsequent flotation steps, potassium amyl xanthate, sodium sulphide and dithiophosphate aqueous (collectors), fuel oil (collector), and lime slurry will be added in the regrinding circuit. The concentrate regrind areas will be equipped with containment and area sumps for cleanup, and will be located in the heated main concentrator building.



## Cleaner/scavenger flotation

Re-ground rougher concentrate will report to the cleaner/scavenger flotation circuit for further concentration. Product from this circuit will be concentrate slurry. It is further concentrated in the 2<sup>nd</sup> stage cleaner flotation. Waste from the circuit (tailings) will report to the TSF. To enable the flotation process, potassium amyl xanthate and dithiophosphate aqueous (collectors), lime slurry, and pine oil (frother) will be added in this step. These reagents are routinely used in concentrators globally. The cleaner/scavenger flotation areas will be equipped with containment and area sumps for cleanup, and will be located in the heated main concentrator building.

#### Concentrate thickening

Final cleaner concentrate will be pumped to the bulk concentrate thickener where a portion of the process water in the slurry will be recovered for reuse within the process water circuit. The thickened slurry will report to the copper concentrate filters. To facilitate the thickening processes, flocculent will be added to the thickeners. The concentrate thickening areas will be equipped with containment and area sumps for cleanup, and will be located in the heated main concentrator building.

### Copper concentrate handling

The thickened copper concentrate will be pumped to the copper concentrate filters where it will be dewatered in vertical pressure filter units. The filter filtrate (removed water) will be recycled and the filter cake (concentrate) will be conveyed to the bagging plant. The bagging plant will package the copper concentrate into 2 tonne bulk bags for shipment to Pevek and ultimately to the customer.

The conveyors in the copper concentrate handling circuit will be covered to contain dust and spillage as well as provide protection from the elements during maintenance. The copper concentrate filters will be located in the heated main concentrator building. The bagging plant will be housed in a dedicated heated building equipped with dust collectors.

#### Tailings thickening

Tailings from the rougher flotation and cleaner/scavenger circuits will be collected in the tailings thickeners. There will be two high-density tailings thickeners (also called high compression thickeners) per line, producing tailings underflow at 62% solids. At 62% solids, it is likely that the tailings will need to be pumped to the TSF. To facilitate the thickening process, flocculent will be added to the thickeners.

The tailings thickeners will be covered and located outdoors at a lower elevation than the concentrator to facilitate gravity flow of tailings to the thickeners. The thickener cones will be in the ground and subterranean pumping chambers will be located under each thickener. The chambers will be heated and equipped with containment and area sumps for cleanup. The tailings thickeners will recover process water, which will report to the process water tanks by gravity flow. Thickened tailings will be pumped to the TSF.

## Containment of liquids and slurries

All process liquid and slurry containing vessels will be provided with secondary containment designed according to regulatory requirements. Surface runoff (precipitation) from the concentrator area will report by gravity to the TSF where it will be contained.



### Indoor air quality

Processing buildings will be heated to maintain a minimum temperature of 5°C. Fresh air exchanges will be supplied per regulations to maintain worker health. Dust collection, tank lids and overflow pipe seal pots, wet scrubbers, partitioning walls and enclosed flotation cells will be utilised to maximize indoor air quality.

#### Reagents

The reagents needed for the concentrator are summarized in Table 3 along with delivery formats and relevant safety precautions that will be taken. The reagents will be mixed and stored in annexes to the main concentrator building. Each processing line will have dedicated reagent systems including separate buildings for the handling of flammable/combustible reagents. Each reagent will have a dedicated secondary containment and spill collection sumps.

 Table 3. Chemicals used at the concentrator together with their purpose, how they are delivered to the site and then dosed, and applicable safety requirements

Chemical	Purpose	How Delivered and Dosed	Safety Requirements
Antiscalant	To prevent scale formation in pipes, pumps and tanks	Delivered in liquid form in bulk containers, unloaded into storage tanks and then distributed to the process water circuits using pumps	The storage tank will be covered and vented. Safety showers and eyewash stations provided.
Dithiophosphat e Aqueous	A secondary collector used in the flotation circuits	Delivered to site in liquid form in bulk containers, unloaded to storage tanks and pumped to the grinding and flotation circuits.	Safety showers and eyewash stations provided.
Potassium Amyl Xanthate (PAX)	A primary collector used in the flotation circuits	Delivered in granular form in 1 tonne bulk bags, dissolved in reclaim water and pumped to the grinding and flotations circuits.	Safety showers and eyewash stations provided. Dust control of the PAX is provided through a dedicated dust collection system
Oxanol (Oxal T- 92) and Pine oil mixture	Frother used in the flotation circuits	Delivered to site in liquid form in bulk containers, unloaded to storage tanks and pumped to the flotation circuits.	The storage tanks are covered and vented. Safety showers and eyewash stations provided. Area is classified for fire protection (electrical grounding etc.)
Sodium Sulphide (Na <sub>2</sub> S)	Collector used to float the oxide component of the ore	Delivered in 1 tonne bulk bags, dissolved in reclaim water and pumped to the flotation and regrind circuits.	Safety showers, hydrogen sulphide gas detectors and alarms. An independent scrubbing system treats fumes from both the covered and vented mixing and



Chemical	Purpose	How Delivered and Dosed	Safety Requirements
			distribution. Safety showers and eyewash stations in area.
Flocculent (Tailings)	Used to aid solids/ liquid separation in the thickeners	Dry polymer, supplied in 1 tonne bulk bags, will emptied into a feed hopper and mixed with reclaim water before being added to the tailings thickeners by pump	The flocculent system is contained in independent containment areas with sump pumps and emergency safety shower units Safety showers and eyewash stations in area
Coagulant	Used to aid solids/liquid separation in the thickeners	Dry polymer, supplied in 1 tonne bulk bags, will emptied into a feed hopper and mixed with reclaim water before being added to the tailings thickeners by pump	The coagulant system is contained in independent containment areas with sump pumps and emergency safety shower units Safety showers and eyewash stations in area
Flocculent (Concentrate)	Used to aid solids/ liquid separation in the thickeners	Dry polymer, supplied in 1 tonne bulk bags, will emptied into a feed hopper and mixed with reclaim water before being added to the concentrate thickeners by pump	The flocculent system is contained in independent containment areas with sump pumps and emergency safety shower units Safety showers and eyewash stations in area.
Test Reagent	Unknown	A circuit will be provided for an unknown reagent. The circuit is designed to receive either dry solids or liquids and dosing pumps will be provided. The destination of the reagent is unknown.	Dust control of the test reagent is provided through a dedicated dust collection system and the mixing and storage tanks are covered and vented. Safety showers and eyewash stations in area.
Lime	Increase pH in the flotation process to suppress iron	Delivered in bulk bags and pneumatically transferred into a storage silo. Some of the lime will be added dry and some will be slaked with reclaim water and added to the grinding and flotation circuits as lime slurry by pump.	Safety showers and eyewash stations in area. Dust control of the lime is provided through a dedicated dust collection system





Figure 4. Process flow diagram for the minerals processing planned for the Peschanka Copper Project (the process is described in detail in the text)


# 3.7. Other Facilities on the Plant Site

#### 3.7.1. Site Water Facilities

#### Raw water

Raw water will only be used for potable water production. Potable water uses will include drinking, bathing, safety showers and the analytical laboratory. Potable water will not be used in the metallurgical process.

Raw water will be sourced from a raw water dam that will collect water from spring melt every year, located in the valley of Levaya Peschanka River. The raw water will be pumped from the water dam and stored in a raw water tank. The raw water tank will supply the potable water treatment plants. Raw water for construction needs will be sourced from taliks (year round unfrozen ground) within the Baimka River valley. Water from taliks will be treated using a potable water treatment plant. The potable water treatment plants will use a calcium hypochlorite system to achieve potable water standards. The mine operations complex, process complex, operations camp and construction camp will each have independent potable water treatment plants.

#### Process water

Process water is defined as water that is used in the metallurgical process. Process water will be used throughout the concentrator for:

- Dilution and slurry density control,
- Flocculent dilution, and,
- Slurry line flushing.

Both types of process water will be recovered at the concentrator using the concentrate and tailings thickeners. The process water is sourced from the tailings storage facility. The process water circuit will be replenished via the reclaim water system as a portion of the process water will report with the tailings to the tailings storage facility. The process water storage tanks will be located outdoors with adjacent heated pump houses. The process water tank areas will have secondary containment and spill collection sumps.

### Reclaim and treated reclaim water

The Peschanka Copper Project has maximized the use of reclaim water to minimize the consumption of raw water. Reclaim water is defined as water that is pumped from the tailings storage facility to the metallurgical processing facility and the mine operations complex. As such, reclaim water comprises of process water that has been discharged with the tailings to the TSF, and precipitation from the catchment. Reclaim water will be pumped from the tailing storage facility (TSF) to the reclaim water tank where it will be further distributed. A portion of the reclaim water (approximately 15%) will be treated (filtered) and distributed to:

- Gland water
- Reagent mixing, Nf
- Filter cake and filter cloth washing,
- Cooling water service,



- Other uses (dust suppression and wash down)
- Fire water make-up.

# **3.7.2.** Domestic Sewage Treatment

The mine operations complex, process complex, operations camp and construction camp will each have independent domestic sewage treatment plants. Treated grey water from the sewage treatment plants will be pumped to the tailings storage facility. Solids will be treated by incineration.

# 3.7.3. Cooling Tower System

The grinding circuit equipment in each parallel processing line will use mechanical draft type cooling towers (one system per line). A glycol water mixture will be circulated in a closed system as the heat transfer fluid. Reclaim water will be used as the evaporating liquid. During winter months, the water sprays and fans in the cooling towers will be stopped, and a heat recovery system will reclaim heat for use in the concentrator to reduce the overall building heating costs. Treated reclaim water is sprayed in the summer over cooling tower coils to utilize evaporative cooling feature and increase cooling capacity of the cooling towers.

### 3.7.4. Analytical Laboratory

The analytical laboratory will be housed in a standalone building. The laboratory will be equipped to provide chemical and physical analysis of the process materials as well as environmental analysis such as water quality. Various streams from within the concentrator will be analysed for process control and environmental samples will be analysed to ensure compliance with regulations. The laboratory will be equipped with appropriate fume extraction and dust collection, as well as chemical storage.

### 3.7.5. Transport infrastructure

### Road

There is currently no permanent road connection outside of the Project site. There is a long-term state plan to develop a permanent road from Magadan to Anadyr, which will pass close to the main Project site and the mine will then build a connecting road to that new road. The construction of the road has commenced from the port of Pevek and so far approximately 230 km has been completed. The Project is assuming that the permanent road to Pevek and the connection to the plant site to be completed at the start of the operation of the processing facility. During the construction period the Project will use winter roads.

### Air

Air transportation to the region is currently available with an existing airport at Keperveyem near the town of Bilibino. The company will build an aerodrome for transportation of personnel during construction and operations. The aerodrome will be located in close proximity to the plant site at a suitable topographic location north of the plant site. A helicopter pad will be located near the plant site to provide emergency evacuation to Bilibino until the site aerodrome is built.



# 3.7.6. Tailings disposal

The disposal of tailings is generally considered to be a significant source of environmental and social risk for any mining operations such as the Peschanka Copper Project. Tailings are the waste product from the concentrator and have negligible economic value. The safe disposal of tailings is key to overall Project sustainability and long-term success of the Peschanka mining operations.

## Tailings

Tailings (mineral waste) from the Peschanka concentrator will consist of a crushed rock and water slurry together with any of the reagents from the flotation process that remain in the slurry after the minerals processing. The treatment of up to 70Mt of run of mine ore per year is expected to lead to approximately 68Mt/a of tailings material for a total life of mine disposal requirement of approximately 2.349 Bt. The tailings will be sent to thickeners to reduce the water content and then transported to the tailings storage facility.

# Tailings storage facility

The safe, permanent disposal of the tailings requires a purpose-built facility that will not only contain all the tailings for the life of the operation, but indeed well into the future after the mine operations cease. The tailings storage facility (TSF) will take the form of a dam on the downslope side of the valley (Figure 5). The tailings are deposited into the TSF on the upslope side and as the tailings flow downhill the solid material settles out of the slurry with the 'clean' water (referred to as 'supernatant') continuing downhill to where it is contained by the embankment (essentially the dam wall). A large portion of the supernatant is transported back to the concentrator via a water reclaim pumping and pipeline systems. The embankment is progressively raised over time as the TSF fills always maintaining sufficient dam freeboard to avoid any spills. A secondary containment will also be constructed downslope of the embankment to contain seepage that may flow under the main embankment.

Surface runoff from the catchment within which the TSF is situated also flows into the facility, as does precipitation that falls directly over the facility (Figure 6). Water is also lost from the facility as a result of evaporation and sublimation. Since Peschanka is located in a permafrost environment, seepage into the ground is expected to be lower than a typical TSF in non-permafrost environment. The water that is contained by the embankment is also pumped from the TSF back to the concentrator. As such it is necessary to determine a 'water balance' that details the inflows into the TSF, the outflows and the remaining volume of water over the life of the Project so that the TSF can be designed accordingly and provision made for the various safety margins need for safe operation. The water balance also includes probable climatic events especially heavy rainfall events so that the TSF. The amount of make-up water is minimized by maximizing the reuse, recycling, and treatment of process water especially return of the supernatant from the TSF to the concentrator.

For recovery of the supernatant a floating pumping station in the TSF will reclaim water using vertical turbine pumps and direct the water via overland pipeline to a reclaim water storage tank at the concentrator site. The TSF pond will be sufficiently large to allow for proper sedimentation (settlement of the solids from the tailings) operation of the supernatant reclaim system and to ensure the pond volume can sustain winter operations.





Figure 5. Schematic presentation of the major components of a tailings storage facility (TSF) that will be required at the Peschanka Copper Project



Figure 6. Schematic presentation of the major components of the tailings storage facility (TSF) together with the inflows into and outflows from the facility

In addition to the water saving requirements, the TSF must comply with two key environmental and social management requirements, namely:

- To ensure that there is no release of contaminated wastewater; and,
- That the facility retains its structural integrity.

# The TSF proposed for the Peschanka Copper Project

The TSF will be formed by an embankment that is approximately 110 m high (elevation 330 m) at the end of life of the mine. An initial (starter) embankment will be constructed to contain the initial 4 years of tailings deposition. The facility will be designed to hold runoff from spring melt and inflow from 7-day Probable Maximum Flood (PMF). The TSF will be a zero discharge TSF during operations.

The embankment will be designed as a rockfill structure with an impervious liner on the upstream face to prevent water from percolating through the embankment. A seepage collection system located downstream of the main embankment will collect seepage that may percolate through the embankment foundation. The embankment will be raised sequentially from the initial starter dam elevation to the final approximately 330 m elevation.

The foundation of the embankment will be excavated to eliminate soils from the footprint allowing the foundation of the embankment to be constructed over sound foundation materials hence significantly improving geotechnical performance and stability.

### Water balance

Water delivered to the facility with the tailings materials will remain partially entrapped with the tailings. A portion of the water will be free and available to be returned to the plant for re-use in the concentration process. Additional water from rainfall run off will be



managed within the facility, temporarily accumulating against the main embankment before is pumped back to the plant.

Geothermal Modelling indicates permafrost conditions will not be lost. It is expected therefore that seepage into the ground will be minimal and long-term seepage through the embankment foundation will be minimal if at all and will reduce to zero once permafrost of the foundation materials and the embankment base is re-established.

The TSF pond will be sufficiently large to allow for proper sedimentation, operation of the supernatant reclaim system and to ensure the pond volume can sustain winter operations when there are no natural inputs to the TSF. The runoff from the mine pit and the concentrator will be collected in the TSF.

# Location of the TSF

The TSF for the Peschanka Copper Project is proposed to be established in the Yegdegkych River valley and extend in a north northwesterly direction from the mine pits and concentrator. The final area of the TSF will be some 45 km<sup>2</sup> within a total catchment area of some 173 km<sup>2</sup>. The TSF design is still under development. The alternative TFS sites with the preferred facility location option are shown in Figure 10.

# 3.7.7. Waste Rock Dumps

Runoff captured from the waste rock dump (WRD) sites and the surrounding areas will not be allowed to discharge directly into existing natural streams due to potentially elevated suspended solids from the WRDs. The runoff water from each WRD site and their surrounding catchments will be routed to the TSF.

### 3.7.8. Electrical Power Supply and Distribution

The primary electrical utility (Magadan) will supply a maximum of 350 MW of permanent electrical power for the Project. In addition, a secondary electrical utility of 110 kV from Pevek, will supply 20 MW of construction and emergency electrical power for the Project from a 110 KV power line from Pevek. A 220 kV transmission line from Magadan will deliver the electrical power to the site substation at the concentrator. The transmission line will be delivered by the responsible power authorities, as necessary to support the Project construction and operation, but is not considered part of the Project being assessed here. The plant will have an emergency diesel generating system that will supply 50 MW of power into the plant, when the main source of power from the 220 KV pole line is interrupted.

### 3.7.9. Fuel Supply

Diesel fuel will be transported from Pevek by tanker truck to tanks located adjacent to the mine operations complex area. Diesel will be trucked to other on-site storage sites as needed. Diesel fuelling stations will be located near the fuel storage tanks for dispensing fuel to light and medium vehicles, and for filling fuel dispensing vehicles used for in-pit fuelling of equipment and other ancillary equipment, such as generators. The fuel storage and dispensing areas will include secondary containment. Construction diesel fuel will be transported from Pevek by tanker truck to fuel storage bladders on the site until the permanent tanks can be fully utilized.



## 3.7.10. Communications

In general, the communications systems will comprise plant wide fibre optic network with link to Magadan by a digital trunked radio channel; and a plant wide business LAN complete with Voice-Over-Internet-Protocol (VOIP) telephone. The plant site will have Wi-Fi and LTE coverage.

### 3.8. Marshalling Yard at Pevek

Export of the finished products will take place via the port at Pevek some 550 kms north east of the Peschanka site. There is an existing port at Pevek, but it is understood that there will be a general upgrade to the port facilities independent of the Project export requirements. The mine and processing plant would simply capitalise on the upgraded facilities and will not play a direct role in the upgrade.

To facilitate the export of products via Pevek, a stand-alone marshalling yard will be constructed close to the town, which would include an office, warehouse and segregated storage areas. This facility, which is a direct component of the Peschanka Copper Project, would be established at an early stage of the construction programme to facilitate import of goods and equipment needed for the Project via the port: they will be stored at the yard before transporting to the site of the mine and processing plant. During the operations phase marshalling yard will be used for storage of incoming goods and equipment and finished products delivered from the Peschanka site.

#### 3.9. Project Execution

#### 3.9.1. Overview

The Owner's Project Management team will manage the Engineering Procurement Construction Management (EPCM) Contractor and various project interfaces; engineering contracts; construction contracts; and coordination of services to complete all project scope Inside Battery Limits (ISBL) of the Project. This will include all project controls, Quality Assurance/Quality Control (QA/QC) and health, safety and environment (HSE) functions to confirm that all contracts and services are controlled and executed in a safe manner.

### 3.9.2. Mining Rights

In accordance with the license agreement on the license for subsoil use AND No. 14673 (license type TR) GDK Baimskaya LLC undertakes to provide for the following:

- Engineering design for development of the Peschanka Copper deposit and its approved reserves in a manner such that the design will be approved by the state expert reviewers;
- Construction of the infrastructure facilities necessary for the support of the mining operations and process facilities;
- Commercial mining of copper and associated minerals in accordance with the approved engineering design and in a manner to achieve full design throughput of the metallurgical operations; and
- A TEO Konditsi and a report with the estimate of resources for the state expertise as per set procedures, which has been completed and approved.



# 3.9.3. Mineral Resources Conservation and Subsoil Protection

GDK Baimskaya LLC (the subsoil user) is obliged to provide for the following:

- Perform a geological survey to confirm accurate evaluation of the mineral reserves and proper procedures for mining operations
- Compliance with the law and approved standards (rules and regulations) for operation methods related to subsoil use and prevention of subsoil pollution during operations
- Extraction of copper and other associated minerals in accordance with the approved process procedures. Accurate recording of extracted copper and other minerals and reconciliation of those left in the subsoil
- Protection of the license area from flooding or and other situations which might affect the quality of minerals and commercial value of the deposit.

# 3.9.4. Industrial and Occupational Safety

The subsoil user (the company) undertakes to provide for industrial and occupational safety requirements viz:

- To provide for health and safety of production staff during exploration and construction and operation of the mining facility in accordance with the law;
- Develop guidelines for industrial and occupational safety for the personnel employed at hazardous production facilities and to provide personal protection equipment to persons working there; and
- Control air quality and containment of hazardous and explosive gases and dust over the pits. Provide special measures to ensure safety of mining operations and to protect the environment in case of industrial accidents.

### 3.9.5. Environmental Protection

In terms of environment protection, the subsoil user undertakes to provide for the following

- Perform a study to provide baseline state of the environment within the license area in accordance with the programme;
- Monitor the environment (atmosphere, subsoil, water bodies, soil) within the license area in accordance with the programme;
- Construction of industrial runoff collection and treatment facilities to prevent industrial pollutants from entering the environment; treatment of pit and mine water prior to discharge;
- Arranging waste rock dumps and processing facilities with minimal effect on the environment; and,
- Using overburden for technical and biological reclamation.

### 3.9.6. Participation in Social and Economic Development

The Company plans to provide for the following activities for social and economic development of the region:



- Compensate the land (forest or pasture) owners for any losses and damages in the manner and within the terms prescribed by Russian legislation for land and forestry;
- Engage enterprises of the Chukotka AO as contractors or suppliers for manufacture of equipment, facilities and performance of various services; and
- Create employment opportunities for the population of the region in which the mine is located and make maximum use of local labour during development and operation of the deposit.

# 3.9.7. Associated Facilities

Associated facilities are those facilities that appear external to the main Project site such as road and electricity supply infrastructure, but which have been established specifically for the Project and would not be established in the absence of the project. The international lender requirements dictate that such associated facilities must be assessed in the same way as the other Project components. For the Peschanka Copper Project the following associated facilities are identified: two dedicated transmission lines will be constructed to supply electrical power to the Peschanka site (a 200kV primary facility from Magadan and a 100kV secondary facility from Pevek), and access road to the site from the all weather road b from Pevek to Magadan (currently being constructed as per the governmental plan), and some upgrade of the Pevek port facilities. For all these are not included in the scope of this ESIA.

### 3.10. Environmental and Social Aspects for the Peschanka Copper Project

### 3.10.1. Environmental and Social Aspects Defined

For each of the identified activities it is necessary to list the associated environmental and social aspects. Environmental and social aspects are defined as 'an element of an organisation's activities, products or services that can interact with the environment', and it is the identification and quantification of the aspects that provides the key to assessing impacts. The environmental and social aspects of the proposed Peschanka Copper Project are presented in Table 4 below.

Category	Aspect	Aspect	Estimated Construction Quantity	Units
	Water	Industrial	600 to 650	m³/annum (m³/a)
		Potable	25 to 470	m³/a
Resource use	<b>F</b> igure 1	Mining	173,400	MWh/a
üse	Energy	Liquid fuels	36	m³/a
	Raw	Explosives	160,000	tonnes per annum (t/a)

Table 4. List of the principal environmental and social aspects associated with construction activities on the Peschanka Copper Project



Category	Aspect	Aspect	Estimated Construction Quantity	Units
	materials	Lubricants	190	litres per annum (I/a)
		Sewage	69,000 to 1,272,670	m³/a
		Non-hazardous	2,267,388	kg/a
	Waste	Hazardous	1,221	kg/a
		Medical waste	132	kg/a
		Waste oil	4,571	l/a
Outputs	Energy emitted	Maximum noise (from construction machinery)	120	maximum dBA
		Maximum noise (from blasting)	105 to 135	1,000m from blast in dBl
Socio-	Jobs	Jobs	up to 5,000 (peak quantity)	
Economic	Spending	Total Capital Expenditure	4,061	million USD

Note: the environmental and social aspects have been estimated as a function of available information and should be viewed as indicative only

Table	5.	List	of	the	principal	environmental	and	social	aspects	associated	with	operational
activit	ties	on tl	he P	Pesch	anka Cop	per Project						

Category	Aspect		Estimated Operations Quantity	Units
		Industrial*	57,000,000	m³/a
	Water	Potable (From River)	25 to 470	m³/a
		Mining	191,000	MWh/a
	Energy	Concentrator	1,953,000	MWh/a
		Other Infrastructure	256,000	MWh/a
Inputs		Tailings storage facility	87,000	MWh/a
		Liquid fuels	140	m³/a
	Land	Mine pits	497	hectares (ha)
		Stockpile areas	566	ha
		Waste rock dump areas	1,371	ha
		Overall mine area including concentrator	182	ha



Category	Aspect		Estimated Operations Quantity	Units
		TSF	4,874	ha
		Aerodrome	207	ha
		Explosives	46,000	t/a
		Antiscalant	1,542	m³/a
		Dithiophosphate Aqueous	6,000	t/a
		Potassium Amyl Xanthate (PAX)	12,000	t/a
		Oxanol, Oxal T-92 & Pine Oil Mixture (50:50)	14,000	t/a
	Raw	Sodium Sulphide (Na <sub>2</sub> S)	41,000	t/a
	materials	Flocculent (Tailings)	3,000	t/a
		Flocculent (Concentrate)	38	t/a
		Test Reagent	12,000	t/a
		Sodium Hydrosulphide (NaHS)	9,000	t/a
		Lime	68,000	t/a
		Lubricants	275	1000 l/a
		Coolant	38	1000 l/a
	Products	Payable copper in concentrate	250,000	t/a
		Gold in concentrate	400,000	koz/a
	Effluent	Mine water	1,035 to 2,235	m³/day
		Storm water **	28	Mm³/a
		Sewage (after 2026)	199,000 to 220,000	m³/a
		Waste rock	1,164	million tonnes (LOM)
Outputs		Tailings	69,000,000	t/a (dry solids)
		Waste oil	813,000	l/a
	Waste	Domestic waste	2,555	t/a
		Sewage sludge	2,400	t/a
		Industrial waste	215	t/a
		Hazardous waste	100	t/a
	Enormy	Maximum noise (plant)	105	dBA
	emitted	Noise (blasting)	105 to 135	1,000m from blast in dBl



Category	Aspect		Estimated Operations Quantity	Units
		Maximum vibration	<170	kN
		Total CO <sub>2</sub> emissions	447,000	t/a
	Atmospheric emissions	PM emissions (Mine site)	300	t/a
		NO <sub>x</sub> emissions (Mine site)	6,300	t/a
		SO <sub>2</sub> emissions (Mine site)	800	t/a
		PM emissions (Off site)	50	t/a
		NO <sub>x</sub> emissions (Off-site)	900	t/a
		SO <sub>2</sub> emissions (Off site)	100	t/a
Socio- Economic	Jobs	Jobs (operations)	200 to 1,000	
	Spending	Spending Total Operating Costs		million USD

\* Reclaim water from TSF to plant at 5,070 m<sup>3</sup>/hr

\*\* From run-off either diverted as non-contact water or collected in the TSF for process use

Note: the environmental and social aspects have been estimated as a function of available information and should be viewed as indicative only.

Manpower is expected to grow quickly through 2020 to a level of +/- 1,000 by early 2021, rapidly ramping up thereafter at increments of 1,000 -1,500 per annum to peak at ca. 5,000 during the period 2024/ 2025. The Project is expected to achieve mechanical completion in 2026.

### 4. THE ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) METHOD

#### 4.1. Overview

Environmental and Social Impact Assessment (ESIA) is an assessment of possible impacts of a proposed activity such as the Peschanka Copper Project on the natural environment and society. In some ways ESIA is best understood as an assessment of the 'unintended' or 'unwanted' consequences of a particular project. Development projects have economic growth, wealth creation and even job creation as objectives but these have to be weighed up against the negative effects of the same project. ESIA is a process of identifying impacts, both positive and negative, and determining the significance of such impacts for decisionmaking on the acceptability of the proposed project. In assessing the impacts, mitigation that could reduce or prevent negative impacts or enhance the benefits is also identified for inclusion in the implementation of the project. Last but by no means least, public consultation is a key element of the ESIA process with a particular focus on people who may be directly affected by the project, especially where such people may be vulnerable to impacts as a result of poor socio-economic circumstances.

#### 4.2. Activities, Aspects and Impacts

The concept of activities, aspects and impacts derives from the early development of the ISO14001 Environmental Management Systems standard and is conceptually powerful in



describing how impacts are assessed. Activities refer to the physical activities that would occur during all project phases (construction, operations and decommissioning) and are the activities required to make the project work. Environmental and social aspects are defined as 'elements of activities that can *interact* with the receiving environment' and have been defined and quantified in the project description presented in Chapter 3. Finally impacts are defined as '*changes* in the receiving environment that would be brought about by the activities and associated aspects'. In short, the ESIA process is one of assessing what would change in the environment and society as a result of the implementation of the proposed project and what would be the significance of those changes. The concept of activities, aspects and impacts is illustrated in Figure 7.

# 4.3. Environmental and Social Baseline

It can be seen from the figure that a key part of any ESIA is a detailed characterisation of the environment and society baseline (before start of project implementation) that would be affected by the proposed project. This detailed characterisation is referred to as the environmental and social *baseline* (presented in Chapter 6 and Chapter 7). Importantly the environment and society can never be understood as a series of discrete, unrelated components but rather should be viewed as a system. The receiving environment is now, and will always be a dynamic system where change is the only constant. 'Impact Mapping' is an approach to mapping the components of the receiving environment highlighting the key elements and how these are related to one another in cause-effect relationships. A proposed impact map for the Peschanka Copper Project is shown in Figure 8.





Figure 7. Schematic portrayal of the concept of activities, aspects and impacts, where impacts are defined as changes in the environment and society bought about the proposed project (negative and positive) and the significance of those changes

### 4.4. <u>The Assessment Process</u>

The assessment process is then one of determining which environmental and social aspects of the project activities would affect components of the receiving environment and the degree to which they would change compared to the baseline. In addition, the Impact Map serves to illustrate knock on effects too within the environmental and social system where changes to one component can bring about changes in another and so forth. For example, changes in water quality affecting aquatic habitat and resultant changes in aquatic fauna. In some ways such knock-on effects can also be thought about as answering the 'so what' question viz. if water quality changes then the real concern is reductions in aquatic fauna. These knock-on effects are then defined as the 'consequence' of the changes to the system (impacts).





Figure 8. Systems depiction of the environment and society that would be affected by the proposed Peschanka Copper Project. Connecting arrows depict cause effect relationships between the different variables



# 4.5. Ascribing Significance for Decision-Making

The best way of expressing these cost benefit implications for decision-making is to present them as risks. Risk is defined as the consequence (implication) of an event multiplied by the probability (likelihood)<sup>30</sup> of that event. Many risks are accepted or tolerated on a daily basis because even if the consequence of the event is serious, the likelihood that the event will occur is low. A practical example is the consequence of a parachute not opening, which is potentially death, but the likelihood of such an event happening is so low that parachutists are prepared to take that risk. The risk is low because the likelihood of the consequence is low even if the consequence is potentially severe. It is also necessary to distinguish between the event itself (as the cause) and the consequence. Again, using the parachute example, the consequence of concern in the event that the parachute does not open is serious injury or death, but it does not necessarily follow that if a parachute does not open that the parachutist will die. Various contingencies are provided to minimise the likelihood of the consequence (serious injury or death) in the event of the parachute not opening, including a reserve parachute. In risk terms this means distinguishing between the inherent risk (the risk that a parachutist will die if the parachute does not open) and the residual risk (the risk that the parachutist will die if the parachute does not open but with the contingency of a reserve parachute) i.e. the risk before and after mitigation.

### 4.6. <u>Consequence</u>

The ascription of significance for decision-making becomes then relatively simple. It requires the consequences to be ranked and a likelihood to be defined of that consequence occurring. It should be noted that there is no equivalent 'high' category in respect of benefits as there is for the costs. This high category serves to give expression to the potential for a fatal flaw where a fatal flaw would be defined as an impact that cannot be mitigated effectively and where the associated risk is accordingly untenable. Stated differently the high category on the costs, which is not matched on the benefits side, highlights that such a fatal flaw cannot be 'traded off' by a benefit and would render the proposed project to be unacceptable.

Environmental Cost	Inherent risk
Human health – morbidity / mortality, loss of species	High
Material reductions in faunal populations, loss of livelihoods, individual economic loss	Moderate – high
Material <sup>31</sup> reductions in environmental quality – air, soil, water. Loss of habitat, loss of heritage, amenity	Moderate
Nuisance – implying that there is a disturbance that may be annoying to people but that will not result in adverse health effects as such.	Moderate – Iow
Negative change – with no other consequences	Low

#### Table 6. Ranking of consequence

<sup>&</sup>lt;sup>31</sup> By 'material' is implied a percentage change of 15% or greater or where the change results in moving from compliance with a standard to not complying. The term is used to recognize that any emissions, wastewater discharge and so forth will bring about some change, but the concern is where there is a major change.



<sup>&</sup>lt;sup>30</sup> Because 'probability' has a specific mathematical/empirical connotation the term 'likelihood' is preferred in a qualitative application and is accordingly the term used in this document.

Environmental Benefits	Inherent benefit
Net improvement in human welfare	Moderate – high
Improved environmental quality – air, soil, water. Improved individual livelihoods	Moderate
Economic Development	Moderate – Low
Positive change – with no other consequences	Low

# 4.6.1. Likelihood

Although the principle is one of probability, the term 'likelihood' is used to give expression to a qualitative rather than quantitative assessment, because the term 'probability' tends to denote a mathematical/empirical expression. A set of likelihood descriptors that can be used to characterise the likelihood of the costs and benefits occurring, is presented in Table 7.

### Table 7. Likelihood categories and definitions

Likelihood Descriptors	Definitions
Highly unlikely	The possibility of the consequence occurring is negligible
Unlikely but possible	The possibility of the consequence occurring is low but cannot be discounted entirely
Likely	The consequence may not occur but a balance of probability suggests it will
Highly likely	The consequence may still not occur but it is most likely that it will
Definite	The consequence will definitely occur

### 4.6.2. Residual risk

The residual risk is then determined by the consequence and the likelihood of that consequence. The residual risk categories are shown in Table 8 where consequence is shown in the rows and likelihood in the columns. The implications for decision-making of the different residual risk categories are shown in Table 9.



#### Table 8. Residual risk categories

		Residual risk				
	High	Moderate	High	High	Fatally flawe	d
Consequence	Moderate – high	Low	Moderate	High	High	High
	Moderate	Low	Moderate	Moderate	Moderate	Moderate
	Moderate – Iow	Low	Low	Low	Low	Moderate
	Low	Low	Low	Low	Low	Low
		Highly unlikely	Unlikely but possible	Likely	Highly likely	Definite
Likelihood						

#### Table 9. Implications for decision-making of the different residual risk categories shown in Table 8

Rating	Nature of implication for Decision – Making
Low	Project can be authorised with low risk of environmental degradation
Moderate	Project can be authorised but with conditions and routine inspections
High	Project can be authorised but with strict conditions and high levels of compliance and enforcement
Fatally Flawed	The project cannot be authorised

#### 5. ASSESSMENT OF ALTERNATIVES AND ASSOCIATED PROJECTS

The following alternatives have been considered within the ESIA:

- 'Zero' alternative;
- Alternative locations of the mine within the license area and in close proximity to it;
- Alternative technology solutions;
- Energy supply options; and
- Traffic flow options.

Based on the consideration of these options, the optimal project configurations are then selected for detailed design.

#### 5.1. <u>'Zero' Alternative</u>

The 'Zero' option implies that the Project does not go ahead. In the case of non-activity, the negative environmental impacts associated with its implementation will not take place. However, the positive impacts, such as social (related to social and economic development of the area and the Chukotka AO in general) and environmental (associated with the use of land disturbed by large-scale Project-related geological exploration activities and subsequent restoration of this land) will not take place as well. In this case, the disturbed land will recover very slowly, and a progressive decline in socio-economic development of



the region will occur (which otherwise could have benefitted from the Project over at least the project lifetime).

# 5.2. <u>Alternative Locations of the TFS</u>

During the early project feasibility stage GDK Baimskaya LLC considered several options for locating the various Project facilities within the Baimka License Area and its immediate vicinity. A preliminary recommendation was to exclude the areas transferred to the Burgakhchan tribal community, from the layout design. The most significant changes, from an environmental and social point of view, related to the choice of the location of the TFS. Some 18 alternative TFS sites were assessed. During the primary screening, 7 sites (Figure 9) were selected within a radius of 15 km from the concentrator<sup>32</sup>.

At this stage, sites A, G, and F were excluded based on various technological criteria, whereas sites B, C, and E were selected for further screening.

Then the TFS sites were analysed against the following criteria:

- Dam crest height;
- Distance from the mill to the TSF dam;
- Potential pipeline route;
- Access/haul route for construction;
- Catchment and river diversions; and
- Other proposed considerations.
- Dam volume (ultimate and starter);

The locations of sites B, C and E are presented below (Figure 10).

Based on a suite of technical parameters option B was selected as the base case for the design process. It should be noted that only three of the selected technical assessment criteria are directly related to the manifestation of environmental impacts namely:

- 1. Dam footprint area (land acquisition);
- 2. Total area of disturbed land; and
- 3. Energy consumption required to pump tailings from the PP to the TSF dam.

Comparing the proposed TSF location options based on the first criterion appears quite difficult due to the close similarity of estimated areas.

<sup>&</sup>lt;sup>32</sup> Klohn Crippen Berger. 2016. Peschanka Pre-Feasibility Study - Progress on TSF Site Selection. 10/03/ 2016.





Figure 9. The site selection process for the tailings storage facility: primary screening

Option B appears preferable based on the second criterion because all planned ore mining and processing facilities will be located within one catchment, namely the Peschanka-Yegdegkych River catchment, while two other options (C and E) feature facilities located in the Chernaya and Agnautala River catchments that are part of the Bolshoy Anyuy River Basin. This means that the development of the tailings storage facility would require constructing access roads in the river valleys not affected by previous ore mining and processing activities. Options C and E would also affect the ecosystems of the Chernaya and Agnautala rivers, as a result of the significant alteration of their hydrological and hydrochemical regimes.

Based on all environmental criteria, Option B is considered as the preferred location option for the tailings storage facility (Figure 10) and so the further design of the TSF is based on this location.

# 5.3. <u>Alternative Technology Options</u>

The selection of optimal technology options has continued in parallel to the compilation of the ESIA. The optimal technology option has largely been driven by finding the optimum means of processing the ore – maximising the possible ore yield whilst minimising the use of resources including water, energy and reagents. As such the different configurations have not been compared to one another, but rather the optimum configuration has been accepted as that likely to generate the greatest economic return whilst reducing the consumption of resources.





Figure 10. Alternative sites for location of the tailings storage facility

# 5.4. Assessment of alternative sites for the Marshalling Yard at Pevek

The marshalling yard planned for Pevek includes containers and temporary bulk storages for food, reagent containers, copper concentrate; offices, and so forth. The marshalling yard location options are shown in Figure 11 and discussed below.

Options 1 and 3 cannot be further considered, as they are not supported by the local administration. In addition, the only way that Option 2 can currently be accessed is via the town of Pevek. Thus, it makes more sense to use Options 4 or 5 for the marshalling yard as they would allow product delivery from the mine to be marshalling yard with least possible



disturbance to Pevek residents. For incoming materials during the construction phase, Option 2 would imply transporting materials from the port to the marshalling yard along the road that is on the western (sea) side of the town and using the same route to bring the materials and products back along that road towards the port and then out through the town. The use of Options 4 or 5 would envision products and materials to be transported from the port and then along the road leading out of the town towards the mine while the marshalling yard would be *en route* to the mine. As such the site deemed to have least impact is Site 6 which is well away from the town and will therefore be the least disruptive to people living in the town.



Figure 11. Proposed sites for the marshalling yard at Pevek

# 6. ENVIRONMENTAL BASELINE

### 6.1. Geology and Topography

The Peschanka gold-copper porphyry<sup>33</sup> deposit is one of the twenty largest deposits of that type in the world. A series of lode (minerals contained within rock) and placer deposits (minerals liberated by erosion and deposited in rivers) extends along the deep submeridional Baimka (Yegdegkych) Fault to form the Baimka Metallogenic Zone (BMZ) (Figure 12). In 2015, baseline studies were conducted in and around the proposed mining area. The

<sup>&</sup>lt;sup>33</sup> Porphyry is a variety of igneous rock consisting of large-grained crystals, such as feldspar or quartz, dispersed in a fine-grained matrix (groundmass).



information presented in this baseline draws on the open sources (the general information) together with site-specific data obtained during the 2015 baseline studies.

The Project area lies within the BMZ, which has the following regional structures:

- Geotectonic division: the Aluchinsky Massif within the Oloysky Depression of the Chukotka Fold System;
- Orographic division: Anyuysk Low Mountain Range in the Yano-Chukotka Highlands;
- Engineering and geological division: Oloysky Region of the Alazeysky Fold System; and,
- Geo-cryological division: Yukagir-Anyuysk Region of the Verkhoyan-Chukotka Fold System.

The Peschanka deposit is confined to the central part of the BMZ located in the southeastern marginal zone of the Yegdegkych Pluton in the Peschanka River Basin. The deposit extends north-south for 7 km and is 0.9-1.3 km wide. There are three relatively large ore bodies confined to the Cretaceous Yegdegkych monzodiorite complex. The southern part of the deposit constitutes the main stockwork containing over 78% of ore stock, the central and northern parts form the Central and Northern Ore Runs, respectively.

The Project area comprises the following geological formations:

- Late Jurassic (J3) to Early Cretaceous (K1) country/host rocks and soils;
- Late Pleistocene (QIII) to Holocene (QIV) unconsolidated/dispersed rocks and soils.

Within the host rock is a coherent copper/molybdenum/porphyry ore formation with mineralization mainly confined to porphyry bodies. The main ore reserves of BMZ (copper, molybdenum, gold and silver) are concentrated in the Peschanka deposit and adjacent Nakhodka Ore Field and Yuriakhsky Potential Ore Field.

The Peschanka deposit is located in an area of continuous permafrost of mountain type. The significant features of which, with regards to the hydrogeology of the area, are the variation of permafrost thickness with relief and development of continuous thaw zones under rivers and streams. The permafrost thickness ranges from approximately 150 m to 280 m, with the elevation of the base of the permafrost between 111 m and 263 m RL.

# 6.1.1. Orographic Setting and Landforms

The area is part of the Anyuysk Plateau within the Northeast Highlands, which comprises fold and block mountain structures of varying size and height. Typical landforms are alpine and ancient glacial features, barren tundra areas and lava plateau formations with young, extinct volcanoes. The area is medium to slightly dissected with low to moderate altitude mountains.





1-3 Intrusive formations: 1-Yegdegkych Massif ( $\xi K_1 e$ ); 2-Baimka Massif ( $vJ_3$ - $K_1 b$ ); 3-Aluchinsky Massif ( $\sigma T_1 a$ ); 4-Cretaceous igneous and sedimentary rocks associated with the Agnautalsky Fault trough; 5-6 Ruptures: 5-magma and ore conduits (1-Anyuysky, 2-Yegdegkych, 3-Baimsky); 6-ore-confining fault structures (4-Nakhodka ore field, 5-Peschanka ore field, 6-Levaya Peschanka ore field, 7-Yurakhsky ore field); 7-placer gold deposits; 8 ore occurrences and deposits: a) gold, 6) copper; 9 - Baimka License Area.

#### Figure 12. The tectonic setting of the Baimka License Area

### 6.1.2. Ore and Rock Composition

The Peschanka deposit contains porphyry-copper ores<sup>34</sup> with low sulphur content (less than 1%). The deposit's resources comprise about 80% sulphide ore and 20% oxide ore. The sulphide ore includes mainly chalcopyrite and bornite with oxide ore resources being

<sup>&</sup>lt;sup>34</sup> The Conceptual Mining Study of the Peschanka Site within the Baimka Deposit, Bilibino District, Chukotka AO, October 2011.



dominated by malachite and azurite. The mineral composition of sulphide and oxide ores is presented in Table 10.

# 6.1.3. Assessment of Acid-Base and Metal Leaching Potential of Ore and Rock

Acid rock drainage and metal leaching (ARD/ML) may occur when sulphide bearing minerals in waste rock, tailing waste and cut-off grade ore are exposed to air and water, resulting in acid drainage and subsequent metals leaching<sup>35</sup>. As such an assessment was completed which assessed the ARD/ML risk.

Sulphide Ore		Oxide Ore		
Ore Minerals	Other Minerals	Ore Minerals	Other Minerals	
Bornite	Rutile	Cuprite	Plagioclase feldspar	
Chalcopyrite	Anatase	Malachite, azurite	Muscovite, sericite	
Pyrite	Sphene	Chrysocolla	Potash feldspar	
Sphalerite	Carbonates	Bornite	Biotite	
Galena	Zeolites	Chalcopyrite	Quartz	
Molybdenite	Barite	Chalcosite	Rutile	
Enargite	Fluorite	Covellite	Anatase	
Magnetite	Plagioclase feldspar	Fahl ore	Sphene	
Hematite	Muscovite	Molybdenite	Carbonates	
Marcasite	Potash feldspar	Pyrite, marcasite	Zeolites	
Fahl ore	Biorite	Hematite, goethite	Barite	
Argentite	Quartz (several generations)	Limonite	Fluorite	
Silver sulphides	Sericite	Native gold, silver, copper		
Arsenopyrite		Galena, sphalerite		
Stannite		Magnetite		
Native gold		Pyrolusite		
Native silver		Cassiterite		

Table 10. Sulphide and oxide ore mineralogy

Source: IMC Montan. 2011. Scoping Study for the Development of Peschanka Deposit

Static and kinetic tests were conducted on both ore and waste rock samples. Results indicate that waste rock in the Peschanka deposit mainly consists of monzodiorite (~80%) and monzodiorite porphyry (~20%). The Peschanka deposit comprises three primary ores, namely oxide ore, transition (mixed) ore and sulphide ore, accounting for 30%, 10% and 60%, respectively. All these ore types were therefore sampled with the quantity of samples

<sup>&</sup>lt;sup>35</sup> International Network for Acid Prevention. 2014. The Global Acid Rock Drainage Guide. Available at <u>http://www.gardguide.com/index.php?title=Main\_Page</u>.



of each of three types of ore adjusted to reflect their distribution in the deposit. The composition of ore processing tailings will be also tested statically and kinetically once these are produced.

The Neutralization Potential Ratio (NPR) = Acid Neutralisation Potential (ANP) / Acid Generating Potential (AGP) is widely used to assess the acid rock drainage risk. The higher the ratio the lower the ARD risk. Static tests on samples revealed the following:

### Waste rock

The NPR estimates are presented in Figure 13 indicating that 92% of waste rock samples have NPR>1 and 83% have NPR>2 meaning that the majority of samples are classified as non-acid generating (NAG). The NAG-pH and NPR for each of the waste rock samples is summarised in Figure 14. It can be seen from the figure that 77 samples (including 4 duplicate samples) are classified as NAG. These classification results are consistent with the NPR estimates suggesting that the tested waste rock samples have limited ARD potential.



Figure 13. Distribution of NPR for waste rock samples

#### Ore samples

Sulphide sulphur content correlates poorly with the total sulphur content likely due to the presence of sulphur oxides in the ore. The average sulphide sulphur to total sulphur ratio is lowest for the oxide ore, increasing through transition ore to sulphide ore samples (Table 11). Sulphate sulphur is highest in the oxide ore samples.

Оге Туре	Average Sulphide S / Total S, %
Sulphide	131.8
Transitional	69.0
Oxide	27.2

Table 11. Sulphide sulphur to total sulphur ratio in ore samples

Source: International Network for Acid Prevention (2014). The Global Acid Rock Drainage Guide



The NPR values for the ore samples are shown in Figure 15 and NAG-pH and NPR summarised in Figure 16. It can be seen from the figure that the NAG-pH and NPR values used to classify rock samples indicate that 33 samples (including 2 duplicate samples) are classified as non-acid generating (NAG). These results correlate well with relatively low NPR values seen in Figure 15.



Figure 14. Classification of waste rock from NAG-pH and NPR



Figure 15. Distribution of NPR for ore samples





Figure 16. Classification of ore from NAG-pH and NPR

# Rapid leach test for rock and ore sample

Twenty rock samples and two ore samples were selected for 1-day rapid leach tests. With some exceptions, metal concentrations are generally small. Relatively larger concentrations of Mn, Mo and other metals are evident in oxide ore samples. The elevated metal concentrations could be attributed to the presence of dissolved secondary minerals.

# Kinetic tests of rock and ore samples<sup>36</sup>

Based on the static test results, 6 samples from the Peschanka deposit were subjected to kinetic testing in humidity cells (Table 12). Changes in key acidity and alkalinity properties of samples (pH, alkalinity, electrical conductivity, and concentrations of sulphates and copper) were assessed. The pH values of leaching solutions remained within the near neutral to slightly alkaline range highlighting the presence of compounds promoting alkalinity. Elevated metal concentrations (e.g. Cu, Co, Mo, Ni, Pb, and Zn) were recorded initially which then decreased to below detection limit. These results are consistent with an earlier (2015) assessment conducted by VNII-1<sup>37</sup> that ore materials are potentially acid-generating while waste rock samples are non-acid generating.

<sup>&</sup>lt;sup>37</sup> Report on the Assessment of Baseline Environmental Conditions and Environmental Component of the Peschanka Project Mining Feasibility Study. Assessment of the Natural Environmental Baseline. Volume 1. 0318-15-IEI.PZ. VNII-1 LLC. Magadan, 2015.



<sup>&</sup>lt;sup>36</sup> Hatch. 2017. Geochemical Characterisation of Waste Materials. H349341-00000-210-066-0003, Rev. B. Report for Regional Mining Company LLC – Baimskaya Project Pre-Feasibility Study.

Sample	DIHD	Rock Type	Alteration	Sulphide-S (%)	SO4-S (%)	Total S (%)	AP (kg/t)*	NP (Sobek) (kg/t)*	NP/AP
GCW- 36	DHP15- 037a	Monzonite	Sulf	0.25	0.18	0.43	7.8	10.9	1.4
GCW- 17	DHP15- 062	Monzonite porphry	Sulf	0.99	0.37	1.36	30.9	23.8	0.8
GCW- 39	DHP15- 037a	Monzonite	Sulf	0.37	0.12	0.49	11.6	59.7	5.2
GCW- 75	DHP15- 051	Altered monzonite	transition	0.26	0.04	0.30	8.1	7.2	0.9
GCW- 70	DHP15- 1059	Monzonite	OX fin	0.27	0.07	0.34	8.4	35.6	4.2
GCW- 30	DHP15- 1019	Monzonite porphry	Sulf	0.08	0.27	0.35	2.5	22.7	9.1

Table 12. Acid base	e accounting for s	samples undergo	ing kinetic testing
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# Evidence of ARD-ML in surface water

Notwithstanding the static and kinetic test results, some surface water in the vicinity of the proposed mine is an unnaturally blue colour suggesting dissolved copper and, potentially, molybdenum, at elevated concentrations. Such blue-coloured streams imply acid rock drainage and metals leaching may occur, but may also indicate other physio-chemical processes such as freeze-thaw; this issue will be specially studied within further investigations.

Blue-coloured water samples were collected and tested during the field studies in summer 2019 in order to determine their composition and potential origin (see ANNEX 1).

### 6.1.4. Radiological Properties of Bedrock Strata

Airborne and ground-based radiometric surveys were conducted as part of the geological exploration using both methods indicating natural radioactivity was within background levels without any signs of abnormal radioactivity.

### 6.1.5. Geological Hazards

### Seismic activity

The Peschanka site and adjacent area lies within the area of influence of the Chersky Ridge seismic zone that extends for about 8,000 km. No earthquakes with magnitude of M>5 have been recorded within a 100-km area around the Peschanka site between 1928 and 2015 but a 5.2 degree earthquake occurred to the south east of the Project site in April 2009 at a depth of 10 km. As such provision would need to be made in the design of the



mine and associated facilities for earthquake risk and operational procedures developed to protect staff from injury.

## Erosion

The extreme climate of the area, results in a variety of erosive processes including fluvial erosion and surface runoff, thermal erosion such as frost heaving, frost fracturing, solifluction and creep processes and bog formation.

# 6.2. <u>Climate</u>

The Project area belongs to a subarctic zone of the Siberian region. The climate is distinctly continental with long-term severe winter lasting for 7 - 8 months, and short cool summer. The massive melting of snow happens in late May to early June. Breakup of ice at rivers and streams occurs at the same time. In summer, especially in August, fogs and long rains leading to flash floods are often. The first frosts begin in late August and the snow falls in late September. The duration of summer period is 2.5 to 3 months.

The climate information presented below is based on the Baimka Weather Station Daily Data from 1966 to 2017 provided in the report CSA Global: Technical Review: Preliminary Hydrological and Hydrogeological Report from 4 July 2019<sup>38</sup>.

# 6.2.1. Solar Radiation

The Project area is featured by 1,941-2,058 sunshine hours per year; the number of cloudy days is 106-138. Mean monthly albedo values reach their maximum between January to March (77-84%) while the average annual values are around 37-38%.

### 6.2.2. Temperature

Air temperature values from the Baimka weather station have been used to characterize the Peschanka site conditions. The average annual air temperatures range from -13.5°C to - 8.0°C, with an average air temperature for the entire dataset of -11.2°C. The monthly air temperature statistics estimated based on the average daily temperature is presented in Table 13. The absolute minimum temperature is -57.5°C. The absolute maximum temperature is +33.5°C.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average	-34.9	-32.2	-24.0	-12.9	1.4	11.4	13.6	9.7	2.2	-11.2	-25.3	-32.7
Minimum	-52.5	-53.9	-44.2	-33.4	-18.4	-3.4	1.1	-0.7	-11.1	-33.1	-48.6	-52.1
Median	-35.5	-33.2	-25.3	-13.3	1.6	11.6	13.9	9.7	2.1	-10.5	-26.2	-33.7
Maximum	0.3	0.4	2.5	5.1	16.6	24.8	25.9	21.8	15.4	6.0	30.2	1.5
Low (30%ile)	-40.8	-38.5	-29.6	-17.2	-1.4	9.1	10.9	7.3	-0.4	-15.3	-31.2	-39.3
High (70%ile)	-30.9	-28.4	-19.6	-9.1	4.6	14.1	16.5	12.3	4.6	-6.5	-20.6	-28.0

#### Table 13. Temperature characteristics

<sup>&</sup>lt;sup>38</sup>CSA Global. 2019. Technical Review: Preliminary Hydrological and Hydrogeological Report – Peschanka Copper Project, Russian Federation (CSA/FLU-A9PK-90-K023-002T-A) CSA Global Report № R185.2019, 04/07/ 2019.



# 6.2.3. Humidity

The average annual relative humidity over the extents of the dataset range 69% to 79% with a dataset average of 72%.

### 6.2.4. Precipitation

The annual total precipitation ranges from 188mm in 1994 up to 469mm in 2016, with an average annual precipitation of 297mm. The wettest months on average occur over the summer period, with average monthly precipitation of approximately 30mm or greater from June to October; average monthly precipitation is typically significantly below 30mm for the months outside this period. The largest monthly precipitation recorded within the data set was 136mm in July 1990.

The monthly precipitation statistics are presented in Table 14. July and August are the wettest months with the highest average, median, typical wet and dry month precipitation. The driest months are January, February, March, and April with the lowest average, median, maximum and typical wet and dry month precipitation.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average	14.4	10.7	7.5	8.8	12.5	30.8	55.5	54.3	35.6	29.8	21.2	16.3
Minimum	0.6	0.0	0.0	0.2	1.9	8.0	6.0	15.5	7.1	7.0	4.6	2.6
Median	12.5	10.1	6.6	7.9	10.6	28.8	52.8	51.3	33.3	29.1	17.3	16.3
Maximum	59.9	40.6	19.9	26.3	36.5	69.0	135.7	118.0	89.5	106.8	57.9	40.9
Low (30 <sup>th</sup> percentile)	9.2	6.8	4.4	5.5	8.2	21.8	44.9	37.6	26.5	18.9	13.4	8.4
High (70 <sup>th</sup> percentile)	18.1	12.9	9.7	10.4	15.1	35.8	63.9	68.0	41.7	34.4	23.4	19.9

Table 14. Monthly precipitation statistics (mm)

Note: percentile is a measure in which the percentage of total values is equal to or less than this measure

The 30<sup>th</sup> and 70<sup>th</sup> percentile estimates provide typical dry and wet precipitation estimates, respectively, which are likely to occur regularly, representing +/- 20<sup>th</sup> percentile estimates of the median, and do not represent extreme low and high values, which would be a much rarer occurrence. Approximately 40% of all monthly precipitation in the dataset falls within the range of the typical dry and wet monthly precipitation estimates, while 80% of annual rainfall precipitation in the dataset falls within the range of the annual cumulative typical dry and wet precipitation estimates.

### Snow cover

Snow cover is an important determinant of climate in the area reflecting away the small amounts of solar radiation received during the winter, especially fresh snow which reflects some 70-80% of solar radiation. The thermal insulation of snow protects the soil against overcooling and helps maintain soil moisture. The first (temporary) snow cover sets in late



September (Table 15). On average, snow cover lasts for about 8 months (and typically completely disappears by late May.

The snow cover appearance date varies by 29 days in the dataset, with an average appearance date of the 28th of September, while the snow cover melting date varies by similar amount (28 days) in the dataset, with an average melting date of the 19th of May. The snow cover details are provided in Table 16.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average	46	49	51	50	21	0	0	0	3	16	31	40
Minimum	21	27	31	19	0	0	0	0	0	0	9	14
Median	45	48	49	50	18	0	0	0	0	15	31	38
Maximum	68	73	73	72	68	11	4	3	30	59	61	66
Low (30 <sup>th</sup> percentile)	40	45	45	46	0	0	0	0	0	9	26	32
High (70 <sup>th</sup> percentile)	49	53	54	55	38	0	0	0	0	21	35	49

Table 15. Monthly snow cover height statistics (cm)

Table	16.	Snow	cover	data
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Snow Cover Ap	opearance	Date	Snow Cover N	Velting Da	te	Duration (days)			
Average	verage Early Late			Early	Late	Mean	Min	Max	
28-Sep	14-Sep	13-Oct	19-May	02-May	30-May	233	212	252	
-	2012	2014	-	2013	2005	-	2009	1993	

The snow cover depth grows at the fastest rate between December and March, reaching its maximum in March. The snow is compacted due to the daytime thawing at the end of April and by the beginning of May its height begins to decrease sharply while its density reaches its maximum value (Table 17).

Table 17.	Snow	cover	depth
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Month	Decade	Avg	Min	Max	Month	Decade	Avg	Min	Max
	1	45	21	67		1	0	0	4
January	2	46	28	68	July	2	0	0	0
	3	47	28	68		3	0	0	0
	1	48	27	72		1	0	0	0
February	2	50	35	71	August	2	0	0	3
	3	50	35	73		3	0	0	0
	1	51	34	73		1	0	0	15
March	2	51	35	71	September	2	2	0	26
	3	50	31	72		3	6	0	30
April	1	51	30	72	October	1	9	0	35



Month	Decade	Avg	Min	Max	Month	Decade	Avg	Min	Max
	2	50	29	70		2	16	0	47
	3	48	19	69		3	23	5	59
	1	40	0	68		1	28	9	57
May	2	22	0	60	November	2	32	10	54
ividy	3	3	0	52		3	34	13	61
	1	0	0	11		1	37	14	63
June 2 3	2	0	0	0	December	2	40	14	64
	3	0	0	0		3	43	17	66

Snowstorms usually occur with passing fronts when atmospheric pressure gradients increase, which also results in significant increases in wind speeds. Fine grain snow that can be easily transported by wind ends up being blown away to hollows and depressions, resulting in an uneven snow cover.

#### Fog

Fog has been observed mainly during the cold periods. Ice fog, which is composed of small ice crystals suspended in the air, has been observed during the winter months. Ice fog is most intense during periods with very light or no wind. Horizontal visibility in ice fog is typically 100-150 m but can drop to as low as 10 m. Ice fog tends to last for 5-7 days at a time. The height of the fog cover usually does not exceed 100-200 m. There is no advection fog in the winter. The distribution of fog days throughout the warm season is complex and variable due to the chaotic nature of atmospheric circulation.

#### 6.2.5. Wind

In the winter, the strong cooling of the regions to the West of the Peschanka site creates a high pressure area. The Asian winter anticyclone has a significant influence on the cold season climate. A low pressure area develops at this time in the north part of the Pacific Ocean, causing a powerful movement of cold continental air.

The analysis of the wind direction data indicates that the predominant wind is from the southeast direction, accounting for approximately 24% of the wind direction. At certain times of the year the wind frequently occurs from the northwest, especially during the summer period. The conditions are on average calm for approximately 32% of each year, however this varies seasonally with calm conditions observed for approximately 50% of the time in November, December, January and February, while calm conditions are observed for approximately 20% of the time from April to August. The monthly average wind direction and the percentage calm observations are summarised in Table 18 with monthly and annual average wind rose diagrams provided in Figure 17.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
N	5%	4%	5%	5%	5%	7%	7%	6%	5%	5%	4%	6%	6%
NNE	4%	4%	4%	4%	5%	5%	5%	4%	4%	4%	3%	3%	4%
NE	2%	1%	2%	2%	3%	3%	3%	2%	2%	1%	1%	1%	2%

Table 18. Average	wind direction
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Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
ENE	1%	1%	1%	1%	2%	1%	1%	1%	1%	1%	1%	1%	1%
E	3%	3%	3%	4%	4%	4%	4%	3%	2%	2%	2%	3%	3%
ESE	11%	9%	10%	11%	10%	7%	8%	7%	7%	9%	10%	11%	9%
SE	28%	31%	30%	27%	21%	18%	18%	19%	21%	27%	31%	29%	24%
SSE	9%	9%	9%	10%	11%	9%	9%	9%	9%	11%	11%	12%	10%
S	5%	5%	5%	5%	8%	8%	7%	6%	6%	6%	6%	5%	6%
SSW	3%	2%	2%	2%	3%	4%	2%	2%	3%	2%	3%	2%	3%
SW	1%	2%	1%	2%	3%	4%	2%	2%	2%	1%	2%	2%	2%
WSW	2%	2%	1%	1%	1%	1%	1%	1%	2%	2%	2%	1%	1%
W	3%	3%	2%	3%	3%	3%	4%	4%	4%	5%	4%	2%	3%
WNW	3%	4%	4%	3%	4%	4%	6%	5%	5%	5%	5%	4%	4%
NW	14%	13%	12%	12%	10%	13%	15%	17%	15%	11%	10%	11%	13%
NNW	7%	7%	9%	8%	7%	9%	9%	11%	9%	8%	6%	6%	8%
Calm	51%	48%	33%	22%	19%	18%	21%	22%	24%	31%	47%	52%	32%

The average mean wind and gust speeds are highest outside the winter season, with the highest monthly average mean wind speed occurring in May, and the highest monthly average gust speed occurring in June. The wind and gust speed statistical summary are provided in Table 19.

jMonth	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Average	1.92	2.05	2.15	2.27	2.43	2.42	2.27	2.18	2.18	2.22	2.09	1.86	2.20
Low (30%ile)	1	1	1	1	1	1	1	1	1	1	1	1	1
High (70%ile)	2	2	2	3	3	3	3	3	3	3	2	2	3
Median	1	2	2	2	2	2	2	2	2	2	2	1	2

Table 19. Average wind speed (m/s)





Figure 17. Wind rose diagrams



## 6.2.6. Severe Weather

Chukotka is synonymous with severe weather ranging from strong winds, intense rainfall, blizzards, icing of infrastructure, fog and extremely low temperatures in winter to hot days and high fire risk in summer. Key climatic characteristics of the Project area are presented in Table 20. These characteristics are being used as the design basis for the proposed mine, concentrator and ancillary facilities.

Parameter	Value
Mean air temperature, <sup>o</sup> C	-11.2
Mean warmest month (July) air temperature, <sup>o</sup> C	+3.6
Mean coldest month (January) air temperature, <sup>o</sup> C	-34.9
Absolute maximum air temperature, <sup>o</sup> C	+33.5
Absolute minimum air temperature, <sup>o</sup> C	-57.5
*Estimated coldest day temperature, <sup>O</sup> C,98%probability	-48.7
*Estimated coldest day temperature, <sup>o</sup> C,92%probability	-44.1
*Estimated coldest five-day temperature, <sup>O</sup> C,98%probability	-47.2
*Estimated coldest five-day temperature, <sup>o</sup> C,92%probability	-42.9
Maximum duration of no-frost period, days	146
Relative air humidity (summer/winter/year), %	70/75/72
Average annual precipitation, mm	297
Maximum total annual precipitation, mm	469
Minimum total annual precipitation, mm	188
Days with precipitation per year(≥10mm)	4
Recorded maximum daily precipitation, mm	45.9
Maximum monthly precipitation, mm	136
Evaporation from the water surface, mm	280
Evaporation from the land surface, mm	75
Average days with snow cover	233
Average start date of permanent snow cover	28/09
Average end date of snow cover	19/05
Maximum average snow cover thickness over a 10-day period, cm (open space)	51
Maximum highest snow cover thickness over a 10-day period, cm (open space)	73
Estimated snow load, kgf/m <sup>2</sup>	320
Average wind velocity, m/s	2.20
Maximum wind/gust velocity, m/s	18/25
Predominant annual wind direction	SE
Standard wind pressure, kPa (m/s)	0.23
Standard icy crust thickness, mm	20



# 6.3. Ambient Air Quality

Ambient air quality of the Project area has not been studied. As there are no human settlements in the Project area, the only existing emissions sources are those from the fledgling mine itself (electricity generating power plants, vehicles and machinery, and dust). Given an almost complete absence of industrial sources of emissions within the Project area the current air quality is considered to be good.

#### 6.4. <u>Noise</u>

Again, it is only the mine that is a source of noise and there are no immediate human receptors. Fauna occurring in the area may well be affected by noise from the mine. Shortduration (several minutes) noise measurements were conducted during the engineering and environmental investigations in 2018 to characterise noise levels generated by the diesel power plant at the base camp, drilling and blasting works, motor vehicles and off-road transport. The results of those measurements slightly exceeded guideline levels for residential areas and were within the workplace noise guidelines. Findings of these studies will be taken into account during development of parts of the Project design documentation focused on occupational health and safety and siting the construction and operations camps.

### 6.5. Soil Structure, Composition and Properties

The Project area is part of the marginal zone of the Yana-Kolyma and Kolyma Mountain Cryogenic and Arctic Tundra Soil Provinces (Figure 18).

Cryogenic podzolised brown peat and humic soil; cryozem peat gley tundra soil; and peaty and humic embryozem soils occur in the area. Apart from the areas occupied by watercourses and water bodies and those covered with rubble and pebble scatterings, these soil combinations cover an area of 14,200 ha (87% of the total mapping area of 16,500 ha). The thickness of the soil layer does not exceed first tens centimeters getting thinner at slopes of and slightly increasing at the bottoms of the river valleys Concentrations of toxic compounds in soil samples are generally negligible, but the guideline levels for lead and chromium (VI) and baseline levels for some other substances were exceeded in the Peschanka valley. No waste materials that could cause parasitic contamination of soil exist in the area but there are remnants of now abandoned mining operations.

Additional soil sampling was carried out during the engineering and environmental investigations in summer 2019 in those areas that were not covered during the 2015 and 2018 surveys. This include the accommodation camp, aerodrome, and marshalling yard at Pevek (see ANNEX 1).




East Siberian Taiga Region

Γ12 - Yana-Kolyma Mountain Gley Cryogenic Taiga Semi-bog and Cryogenic Bog Soil Province
Γ1ε1 (63) – Kolyma Mountain Tundra, Mountain Cryogenic Taiga, Mountain Deep Cryogenic Taiga
and Cryogenic Bog Soil Province

Figure 18. The location of the Project area on the USSR Soil Geography Division Map (1979) and Russia Soil Ecology Division Map (2014)

# 6.6. <u>Water Resources (Surface Water and Groundwater)</u>

Surface water is principally of the Bolshoy Anyuy River of the Kolyma River basins. Groundwater belongs to the Mesozoic Oloy Artesian Basin System within the Kolyma-Omolon Hydrogeological Massif of the Omolon Hydrogeological Folded Region and are typical of Northeast Asia.

### 6.6.1. Hydrological Conditions

Surface water of the Project area comprises rivers, numerous ephemeral streams, small lakes and temporary water courses in ravines. The Project area is located within the catchments of the Peschanka, the Levaya Peschanka and the Baimka rivers, which form part of the Bolshoy Anyuy River basin<sup>39</sup>. The Levaya Peschanka River inflows the Peschanka River and the downstream part of the river is named the Yegdegkych River. The Peschanka-Yegdegkych River and its tributaries are seasonal and freeze up in winter.

<sup>&</sup>lt;sup>39</sup> CSA Global. 2019. Technical Review: Preliminary Hydrological and Hydrogeological Report – Peschanka Copper Project, Russian Federation (CSA/FLU-A9PK-90-K023-002T-A) CSA Global Report № R185.2019, 04/07/2019.



River flow surveys were undertaken in the Project area in 2010, 2015 and 2016 and include flow monitoring measurements from the Yegdegkych River, Levaya (Left) Peschanka River, Pravaya (Right) Peschanka River, Baimka River, Sokhatinskiy Stream, and Meteo Stream. Flow measurements and river condition observations from the various rivers across the Project area from May/June 2015 and August 2015<sup>40</sup>, and in April and July 2016<sup>41</sup>) show actual flow measurement data from specific points at specified date/times. These data provide useful insight into the hydrological characteristics and flow regimes of the various water courses at the time of survey but unfortunately cannot be used to generate probabilistic flow data required for appropriate surface water management design purposes.

The characterisation of hydrological conditions will be updated based on the results of the survey conducted by CSA Global in 2019.

### 6.6.2. River Network

The river network from the Peschanka River to the East Siberian Sea is illustrated schematically in Figure 19.



Figure 19. The network of rivers from the Peschanka River to the East Siberian Sea

### 6.6.3. River Morphology and Water Regime

Watercourses are classified as typically very small and small (in terms of both catchment area and river flow) mountainous rivers<sup>42</sup> rising at altitudes ranging from 650 m to 800 m. Key hydrological characteristics of the surface watercourses in the project area are presented in Table 21.

Watercourse	Catchment Area, km2	Length, km	Watercourse Order (Horton- Strahler-Filonov)
Pravaya Peschanka River	29	12	Ш
Peschanka River	51	16	111

Table 21. Key hydrological characteristics of surface watercourses in the Project area

<sup>42</sup> GOST 17.1.1.02-77. Environmental Protection. Hydrosphere. Water Body Classification.



<sup>&</sup>lt;sup>40</sup> HYDEC. 2016a. Investigation of the Hydrogeological Conditions of the Peschanka Deposit, the Baimka License Area in 2015 (Chukotka Autonomous Okrug). Report on Findings of the Study. HYDEC Hydrogeological and Geo-ecological Company (HYDEC) CJSC, Moscow, 2016.

<sup>&</sup>lt;sup>41</sup> HYDEC. 2016b. Hydrogeological Substantiation of the Development of the Peschanka Deposit, the Baimka License Area (Chukotka AO). HYDEC Hydrogeological and Geo-ecological Company (HYDEC) CJSC, Moscow, 2016.

Watercourse	Catchment Area,	Length, km	Watercourse Order (Horton-
Belosnezhka Stream	8	6	1
Lenivy Stream	11	5	1
Levaya Peschanka River	34	13	111
Yegdegkych River	223	42	IV
Baimka River	1,172	80	V

The water regime of these watercourses is snowmelt-dominated (65% of annual river flow). Rain and groundwater account for 25-30% and 5-10% of the total annual river flow, respectively. There are obvious seasonal changes in the prevailing sources of river flow with spring and summer flow accounting for over 90% of the total annual flow with spring floods contributing over 55%. Estimated maximum Spring flow conditions are presented in Table 22.

Table 22. Probability-weighted estimated maximum spring flood flows in the Peschanka River (the Pravaya Peschanka River confluence)

Probability, P(%)	0,1	1	5	Average
Q, m³/s	105,6	69,5	47,4	21,3

# 6.6.4. Surface Water Quality<sup>43</sup>

Water quality is driven by the geochemistry of the Peschanka ore field, current geological exploration activities, and historical placer mining operations. Water is predominantly hydrocarbonate-chloride calcium-sodium-magnesium and calcium-magnesium-sodium with pH values ranging from 5.7 to 7.1 (slightly acidic to neutral). Mineralisation levels vary from 39 mg/l to 1292 mg/l (175 mg/l on the average), i.e. from sweet to brackish water.

Previous test work on the river water indicates that surface water not affected by anthropogenic activities has high dissolved oxygen levels ranging from 9 to 13 mg/l and BOD<sub>5</sub> values not exceeding 1.4 mg/l. Water turbidity varies broadly from 1 to 1890 NTU units as do suspended solids levels (from 0 to 560 mg/l). Ammonium, total iron, aluminium, copper, zinc and manganese concentrations exceed the maximum permissible concentrations (MPC) for fisheries and drinking water quality guidelines together with elevated concentrations of sulphates, calcium, lead, strontium, nickel, cobalt, vanadium, mercury, molybdenum and tungsten being seen in various samples. Thus, surface water quality in the Project area does not meet the fisheries and drinking water quality guidelines, especially during flood flow periods.

Additional surface water quality sampling was conducted during the field studies in summer 2019 to cover those surface watercourses that have not been sampled before. These include the Chernaya and Bolshoy Anyuy Rivers (see ANNEX 1).

<sup>&</sup>lt;sup>43</sup> HYDEC. 2016a. Investigation of the Hydrogeological Conditions of the Peschanka Deposit, the Baimka License Area in 2015 (Chukotka Autonomous Okrug). Report on Findings of the Study. HYDEC Hydrogeological and Geo-ecological Company (HYDEC) CJSC, Moscow, 2016.



# 6.6.5. Hydrogeology

The hydrogeology is shaped by faults and fractures in aquifers, presence of permafrost and river morphology. Groundwater dynamics are driven by water table levels in the talik (unfrozen ground), zones confined to the major river valleys and faults and the Bolshoy Anyuy River that controls the regional drainage network.

### Supra-permafrost Water of Continuous and Seasonal Thaw Zones

Supra-permafrost water occurs widely within the active seasonally thawed layer and in the talik zones of river valleys. The water is associated with unconsolidated Quaternary deposits covering watersheds, slopes and river valleys, confined to porous zones in the alluvial strata and fractured bedrock aquifers under the river channels. The top of the permafrost forms the base of the supra-permafrost water layer and generally follows the shape of the surface topography. Water levels within the supra-permafrost aquifer were measured in the Baimka River valley. Groundwater levels were generally less than 1m below ground level for the period July to November 2016 and showed no significant fluctuation over that period

### Sub-permafrost Groundwater

Sub-permafrost aquifers are associated with bedrock having varying fracture density and underlying the permafrost layer<sup>44</sup>. Water level is at an elevation of between 208 to 366mRL across the site. The water level is between 60 to 212m below ground level. The water level is between 30 to 200m above the base of the permafrost, indicating that the sub-permafrost aquifer is confined by the permafrost within the project area. There is no significant seasonal fluctuation in the groundwater level in the sub-permafrost aquifer.

Locally the sub-permafrost groundwater flow follows topography with flow from high elevations to low elevations. The regional groundwater flow is from the south to the north and north-east, towards the regional drainage basin of the Bolshoy Anyuy River.

### 6.6.6. Groundwater Composition and Quality

### Supra-permafrost aquifer

The water quality of the supra-permafrost aquifer is reported to be fresh, very soft and soft with the salinity and total hardness values ranging within 0.03 - 0.32g/l and 0.24 - 2.2 Hardness units, respectively. The pH of the water is in the range pH 5.8-7.3. The water ranges from sulphate-hydrocarbonate to sulphate and from calcium- magnesium to calcium type. Comparison of the water quality results with SanPiN 2.1.4.1074-01 Potable water. Hygienic requirements for water quality of centralized drinking water supply systems. Quality control indicates exceedances of the maximum permitted concentrations for ferrous iron, manganese, aluminium, lead, copper and tungsten (in some instances).

### Sub-permafrost aquifer

Water within the sub-permafrost aquifer ranges from fresh to brackish. Salinity increases with depth with the deeper aquifer (500-700 m) having salinity of more than  $5g/l^{45}$ . The

<sup>&</sup>lt;sup>45</sup> HYDEC. 2016a. Investigation of the Hydrogeological Conditions of the Peschanka Deposit, the Baimka License Area in 2015 (Chukotka Autonomous Okrug). Report on Findings of the Study. HYDEC Hydrogeological and Geo-ecological Company (HYDEC) CJSC, Moscow, 2016.



<sup>&</sup>lt;sup>44</sup> Kalabin A.I. 1960. Permafrost and Hydrogeology of the Northeast USSR. - Magadan, VNII-1, 1960.

groundwater is sulphate-chloride calcium type with pH 6.8. The maximum value of total hardness is 27.1 Hardness units and the highest salinity value was 1.83g/l. Comparison of the water quality results with SanPiN 2.1.4.1074-01 Potable water. Hygienic requirements for water quality of centralized drinking water supply systems. Quality control indicates exceedances of the maximum permitted concentrations for ferrous iron and manganese. The concentrations of boron, bromine, strontium, lithium, beryllium, tungsten exceed the rated values; and the total salt content and hardness are elevated.

# 6.7. Landscapes

Landscapes of the Project area was characterised on the basis of the literature review and findings of the field studies conducted as part of the engineering environmental survey of August 2018 and environmental baseline study of August 2015 to support the preparation of the Mining Feasibility Study. The survey was performed using the transects and they key sites method.

### 6.7.1. Natural Landscapes

Based on the physical and geographical zoning map provided in the National Atlas of Russia (Figure 20), the study area comprises the sub-altiplanation sparse forest and permafrost taiga landscapes of the Kolyma Mountainous Area that are separated from the sub-altiplanation sparse forest and permafrost taiga landscapes associated with the Anyuy Mountainous Area by the Bolshoy Anyuy River. Both areas are within the Northeast Siberia Physiographic Region.

The Peschanka site and surrounding areas comprise a mix of landscape and vegetation features that are typical for the Anyuy-Chukotka barren tundra upland area extending along the border between the low-mountain Southern Anyuy (Anyuy-Chukotka Upland) and western part of the Northern Kolyma (Okhotsk-Kolyma Tundra/Sparse Wood Upland) Physiographic Provinces<sup>46 47 48</sup>.

The mountain areas in Eastern Siberia have a relatively monotonous landscape structure consisting of tundra and permafrost taiga landscapes. Glacial and bald-mountain complexes are typical of higher ridges with Alpine-type terrain and recent-age glaciers, while stony-lichen and moss-lichen tundra formations dominate the lower lying zones. Sporadic larch trees and dwarfed pine/alder tree thickets in combination with lichen-shrub tundra formations form a distinct sub-altiplanation belt. The mid-elevation and low-elevation mountain slopes are covered with sparse larch forests. The fragments of relic meadow and steppe vegetation and poplar-chosenia forests growing along the riverbanks form an important and distinct component of the local landscapes<sup>49</sup> (Figure 22– Figure 24).

A local landscape is dominated by mid-altitude and low-altitude mountains. The topography of the Anyuy Upland is one of medium-altitude mountain area with prominent cones of young dead volcanoes. Mountain and valley glacier features including glacial troughs and deep valleys, cirque glaciers, karsts and moraine ridges intersect the Anyuy Upland ridges. The landscape morphology is shaped and governed by latitudinal mountain

<sup>&</sup>lt;sup>49</sup> ООО «Инжгео». Технический отчет по результатам инженерно-экологических изысканий для подготовки проектной документации. Т.1. 2018.



<sup>&</sup>lt;sup>46</sup> USSR Physiographic Division Map. Scale 1:8000000. - Moscow, MSU, GUGK, 1986.

<sup>&</sup>lt;sup>47</sup> Rakita S.A. Natural Zoning. – In: Northern Far East. Moscow, Nauka, 1970.

<sup>&</sup>lt;sup>48</sup> Parmusin Yu.P. North East and Kamchatka. – M., Mysl, 1967.

ridges and heavily dissected low/medium altitude mountains. Accordingly, the most typical landscapes identified in the area are presented in Figure 21.

The differentiation of local landscapes is governed by the nature of zonal exogenous processes and cold wet climate with extremely severe weather conditions, widespread distribution of loose sediments of different origin (proluvial/diluvial, diluvial, and alluvial). The mountainous topography determines the altitudinal zoning of physiographic conditions and rock weathering processes caused by water and physical factors, and depressed and complex vegetation cover characterized by low species and taxonomic diversity.



Source: National Atlas of the Russian Federation, 2012

Physical and Geographical Regions and Areas: XI - Northeast Siberia Region, 50 – Anyuy Mountainous Area, 51 – Kolyma Mountainous Area.

Figure 20. Section of the physical and geographical zoning map





<u>Legend:</u>

- 1. East Siberia Northern Taiga lowland outwash boreal plains
- 2. Uplands and Highlands (sloping foothill alluvial, diluvial and proluvial landscapes)
- 3. East Siberia Northern Taiga low-mountain sparse larch boreal landscapes:
- 3a Fold and fold block zones on Mesozoic structures
- **3b** Hilly glacier ice and water accumulation zones on Palaeozoic and Mesozoic structures.

### Figure 21. Regional landscape structure of the Project area<sup>50</sup>

In line with the current views on the differentiation of landscapes and their structure<sup>51 52 53</sup>, the following three altitudinal landscape belts can be distinguished in the Project area:

• 500-750 m: Arctic-mountain desert and tundra belt lying on cryostructured rubble/stone ridge-top primary deposits with little or no vegetation (Figure 22);

<sup>51</sup> Isachenko A.G. Landscape Science and Physiographic Division. Moscow, Vyschaya Shkola, 1965.

<sup>&</sup>lt;sup>53</sup> Yegorova G.N. Morpholithosystems and Landscape Structure (Omolon River Basin). – Vladivostok, FESC USSR AS, 1983



<sup>&</sup>lt;sup>50</sup> USSR Landscape Map. Scale 1:4000000. / Isachenkov A.G., Shlyapnikov A.A. Roboserova O.D., Filipetskaya A.Z. – SRI of Geography, LSU, L., 1998.

<sup>&</sup>lt;sup>52</sup> Solntsev N.A. Morphology of Natural Geographic Landscape. – Voprosy Geografii, 1949, No. 16.

- 400-500 m: Larch forest tundra belt extending over primary slopes, fluvioglacial trails, upland terraces, and loose Quaternary deposits of various origin (Figure 23); and,
- 200-400 m: River valley bottom belt composed of pebble/stone and sand/pebble alluvial deposits (Figure 24).

The topographic setting and morphology of each landscape belt promotes the development of the following landscape types and groups:

- Zonal (eluvial and trans-eluvial);
- Eluvial-accumulative; and,
- Intrazonal-alluvial (floodplain).

Based on the analysis of survey route data and satellite imagery covering a total area of 16.500 ha, the landscape unit structure has been described as a percentage of the total mapping area occupied by each landscape unit:

- Arctic-mountain desert and tundra 39;
- Larch forest tundra 58; and,
- River valley bottom areas 3.

Burnt patches in the landscape are widespread in the areas covered with dwarf cedar and larch shrubs (Figure 25).





Figure 22. Arctic-mountain desert and tundra





Figure 23. Larch forest tundra





Figure 24. River valley bottom areas



Figure 25. Disturbed natural landscapes and vegetation cover due to fires



1) Hilltop subhorizontal plains and slopes covered with boreal forest vegetation growing on alfehumic soils;

2) Hilltop subhorizontal plains and slopes covered with shrubs and dwarf cedars growing on alfehumic soils;

*3)* Gentle hillsides with and foothills dissected by ravines and covered with sparse boreal forest vegetation growing on gley soils.

Figure 26. A general view of the mountain tundra landscape in the study area



The typology of landscapes in the Project area is generally determined by the local geology, topography, moisture regime and material migration routes. For example, hilltop subhorizontal plains of low to mid-altitude mountains, as well as middle and upper sections of mountain slopes are characterised by eluvial and transeluvial processes. The wash-down of loose materials and slow pace of soil formation processes in the low temperature conditions result in the development of various alfehumic soils (gley cryogenic podzolised brown soil, illuvial humic soil, and illuvial ferruginous soil). The following two landscape types can be visually distinguished based on 126 plant associations prevailing in these areas: boreal forest landscape (1) and dwarf cedar shrub landscape (2) (Figure 26).

Gentle hillsides and foothills dissected by ravines are periodically waterlogged. Permafrost is present at a depth of 0.5-0.6 m and permafrost exposure occurs most frequently in these areas. These conditions harshly suppress plant growth and promote the development of sparse boreal forests gley soils. Alluvial processes occur in the major river valleys (Peschanka, Levaya Peschanka, and Yegdegkych rivers), causing the accumulation and redeposition of sediments and promoting the formation of alluvial peat-gley soils (Figure 27).





Figure 27. Sparse boreal forests growing in the Peschanka and Yegdegkych rivers on alluvial gley and mobile humus soils

Key landscape features dominating the area are the main river valleys (the Baimka and Bolshoy Anyuy rivers) and mountain summits located at different distances of the Peschanka Project site occupying the Peschanka River: Vesennyaya Mountain (1,134 m to the south) and Zesyunya Mountain (869 m to the north).

### 6.7.2. Anthropogenically Transformed Landscapes

Anthropogenically modified landscapes have been principally related to mining. Landscapes shaped by geological exploration are widespread in the Peschanka River valley (Figure 32). They have hills, exposed sand deposits, and no or little vegetation consisting of grass and shrub patches. Mineral soil stockpiles also exist that derive from mining activities. These areas have no natural soil and vegetation cover. Pioneer ruderal species are gradually colonising the lowland areas. The landscape units described above comprise areas containing technogenic landforms that occupy at least 1.5% (307 ha) of the assessment area. The landforms have developed as a result of past placer deposit exploration and mining operations undertaken in the 1960–70s (Figure 28, Figure 31). The total area occupied by the historical technogenic landforms is about 160 ha. Natural vegetation of varying intensity is found in all technogenically transformed areas.

The present-time geological exploration activities at the Peschanka site and in its surroundings that are part of the Baimka metal ore zone (BMOZ) are concentrated in the



river valleys (the Gnom Stream, and Levaya Peschanka, Pravaya Peschanka, and Yegdegkych rivers), and the larch forest tundra, Arctic-mountain desert and tundra areas (Figure 29). Apart from those areas that are occupied by winter and temporary summer roads, the total area occupied by current technogenic landforms is about 460 ha. Natural vegetation successions of varying intensity and alignment occur in all technogenically transformed areas.





Figure 28. Historical Placer Mining Sites (Without Restoration)





Figure 29. Present-time geological exploration activities at the Peschanka site

Transport is another source of anthropogenic impact on the natural landscapes. Tracks left by heavy-duty vehicles can be seen everywhere. In foothill areas and lower sections of river valleys, water accumulates in the ruts, causing localised waterlogging (Figure 30).



Figure 30. Land disturbed by transport operations in the Peschanka Project area





Figure 31. Directly disturbed areas and technogenic landforms developed as a result of historical placer mining activities in the river valleys: Yegdegkych River (1), Levaya Peschanka River (2) and Pravaya Peschanka River (3)





Figure 32. Directly disturbed areas and technogenic landforms developed as a result of geological exploration activities in the Peschanka River valley



# 6.7.3. Landscape Resilience to Anthropogenic Impacts<sup>54</sup>

Widespread distribution of permafrost is a key natural factor underpinning all other risks for landscapes in the areas affected by human activities. Permafrost is affected by external (anthropogenic) impacts through the multiple-layer system (comprising vegetation cover, soil, and supra-permafrost layer), i.e. through the landscape and its components.

The results of historical studies on the tundra landscape resistance demonstrate that it may vary from high elastic resistance (landscape is able to resist external impacts and restore its initial state) to high plastic resistance (landscape changes due to external impacts while retaining its key structural characteristics) of tundra and mountain-tundra landscapes to various anthropogenic/mechanical and chemical impacts<sup>55 56</sup>.

Typical taxa representing different landscape types and varying by restoration ability were identified in the Project area<sup>57</sup> and described below.

**Taxa associated with water divides and foothill areas:** the most part of the Baimka License Area is classified as **vulnerable** to anthropogenic impacts. Processes and factors that are actively shaping the landscapes of the area include water and Aeolian deflation, little or no soil cover, extremely scarce vegetation (10-30% coverage), and downslope alignment of denudation processes. The geo-cryological processes in these taxa are much more intensive and could be irreversible. These trans-eluvial taxa take **a very long time to restore themselves** (50-100 years and even more).

**Taxa associated with the larch forest tundra** are classified as sensitive to soil cover transformations. Topsoil stripping and interception trench construction promotes permafrost thawing and deformation, reduce soil viscosity, and trigger denudation processes. These taxa could be able to **restore themselves in 15-35 years**.

**Intrazonal alluvial (floodplain) taxa** are associated with river valleys and their depressed sections and can be classified as **relatively resistant** in the natural environment. While Aeolian erosion processes are weak, placer mining activities cause the profound transformation of these taxa. After the completion of post-mining restoration, vegetation cover restores itself in 25-30 year.

### 6.7.4. Fire Resistance of Landscapes

Tundra fires are hazardous events with relatively high likelihood. The forest sections No. 350, 317 and 349 are classified as Fire Danger Class 2, and section No. 378 (the former the Vesenny Settlement) as Class 1.

The fire danger period lasts from June through October and can be as long as 150 days in some years. Unlike the forest fire danger zoning, there is no tundra fire danger zoning system in the Chukotka AO. The Chukotka AO Government adopted special procedures to

<sup>&</sup>lt;sup>56</sup> Tregubov O.D. Tundra Resistance to Technogenic Impacts and Global Environmental Change // Vestnik DVO RAN No. 4, 2010. P. 79-89.



<sup>&</sup>lt;sup>54</sup> State Standard GOST 17.8.1.01-86. Nature Protection. Landscapes. Terms and Definitions.

<sup>&</sup>lt;sup>55</sup> Tregubov O.D., Bio-geochemical Aspects of the Chukotka Tundra Landscape Resistance and Predicting the Consequences of their Anthropogenic Transformation (RFFI Grant No. 98-05-64001), 1998. Available at: <u>http://www.rfbr.ru/rffi/ru/project\_search/o\_128953</u>.

prevent natural fires<sup>58</sup>. The scope and severity of restrictions depend upon a fire danger class set based on different weather conditions and types of activity and include, inter alia:

- Ban on all fires in the open and visits to certain sections of reindeer pastures;
- Maximum restrictions for all vehicles entering fire danger areas;
- Cancellation of all tourism and sports activities; and,
- Ban on plant/berry picking and research activities.

It is the Chukotka AO Government authority to impose restrictions, define boundaries within which the restrictions are active, their duration and justification. These restrictions may affect traffic flows associated with the construction and operation of the proposed mine and processing plant.

### 6.7.5. Summary

The landscapes in the Project area (the Peschanka site and surrounding areas) are generally weakly resistant to anthropogenic disturbance. Various human activities (historical exploration and placer mining, present-time geological exploration, construction of winter and temporary access roads, temporary geologist and driller camps etc.) have caused a decrease in the landscape resistance and local-scale destabilization of the natural environment. Vegetation cover is considered to be most sensitive to impacts due to progressively developing geo-cryological processes.

# 6.8. Vegetation

Vegetation cover of the Project area was characterised on the basis of the literature review and findings of the field studies (geobotanical surveys) conducted as part of the engineering environmental survey of August 2018 and environmental baseline study of August 2015 to support the preparation of the Mining Feasibility Study. The surveys were carried out using transect and key site methods. In addition, snow cover sampling and studies at the Peschanka site, and an additional vegetation survey at the proposed s aerodrome were performed in 2019.

### 6.8.1. Plant Species Composition

Plant life in the study area is dominated by species typical of the Chukotka altitudinal belt and heavily influenced by the Pacific Ocean. The dwarf cedar belt forms a distinct component of the Okhotsk-Bering zone. The Bolshoy Anyuy River valley is covered by boreal vegetation typical of the northern taiga larch tree forests growing in Eastern Siberia. Based on the geo-botanical division of the Northeast Asia (Figure 33), the Project site and surrounding areas extend into the following geo-botanical areas:

• Mountainous Anyuy-Chukotka Geo-Botanical District of the Arctic Tundra Region characterized by widespread occurrence of Arctic and typical tundra vegetation; and,

<sup>&</sup>lt;sup>58</sup> Chukotka Government AO Resolution of 22/04/2011 No. 158 On the Approval of Restrictions Imposed During the Fire Danger Periods on Citizens and Vehicles Visiting and Staying in the Forests and Reindeer Pastures in Chukotka AO and Preventive Actions Designed to Ensure Fire Safety and Compliance with Restrictions Imposed.



• Chaun Floristic District of Arctic Province within the Circumboreal Region of the Holarctic Kingdom.

Based on the results of the field geo-botanical survey (2015, 2018) and analysis of herbarium materials, the local plant life comprises 251 plant species, broken down by associations as follows:

- Lichen species 19;
- Moss species 7;
- Herb species 180;
- Bush and shrub species 41;
- Tree species 4.

The baseline condition of vegetation cover in the Project area is characterised by the widespread presence of shrubs and mixed grasses including halberd willow (Salix hastate L.), Middendorf birch (Betula middendorffii Trautv. et. Mey), dwarf cedar (Pinus pumila (Pall.) Regel) and marsh Labrador tea (Ledum palustre L.) species dominating the shrub layer and bladder sedge (Carex vesicata Mein.) and great willow herb (Chamaenerium gustifolium (L.) Scop.) species present in the grass layer.

Kayander larch (Larix cajanderi) is the main tree species occurring in the area. The moss and lichen layer mainly consists of bog moss (Sphagnum sp.) and cladonia (Cladonia). Low lying and poorly drained areas have no or little tree vegetation which is in very suppressed condition. Low-productive sparsely standing larch trees and dwarf cedar shrubs are key elements present in forest areas.

Based on the analysis of survey results and space imagery, the distribution of key plant associations has been estimated as a percentage of the total mapping area (16,500 ha) occupied by each association (Table 23).

Vegetation Type	%
An association consisting of sparsely standing larch woods, dwarf birch thickets, moss mats and burnt areas	26
An association consisting of dwarf cedar trees, shrubs and lichens with sparsely standing larch tree inclusions and burnt areas	19
Crustaceous lichens	15
Sparsely standing larch woods with green moss mats	14
Sparsely standing hummocky larch woods	9
Larch woods with green mosses and shrubs	7
An association consisting of dwarf cedar trees, lichen-covered stones, grass/lichen spots and stand-alone larch trees	5
Park-like larch woods comprising poplar trees and chosenia plants with meadow willow shrubs	3
Ruderal vegetation covering disturbed areas	0.4

Table 23. Vegetation type and percentage of occurrence





72 – sparse larch forest

316 – open larch forest

8 – mountain desert and sparse forest tundra in the western part of the Anyuy-Chukotka Upland

### Figure 33. Proposed Project site location on the USSR Vegetation Map (left) and Northeast Asia Geo-Botanical Division Map (right)

No rare and/or protected species listed in the RF and Chukotka Red Data Books<sup>59 60</sup> were recorded at the Project site and in its surroundings during the geobotanical surveys in 2015 and 2018.

<sup>&</sup>lt;sup>59</sup>RF Red Data Book. Volume 2. Plants. – M., ROSAGROPROMIZDAT, 1998.



### 6.8.2. Key Vegetation Communities of the Study Area

The four main types of vegetation communities, which are predominant in the Project area, are described below.

### Boreal forest vegetation

This vegetation community includes only one tree species - Kayander larch. Vegetation covering well drained elevated sections of terraces and hillsides is composed of relatively dense, standing trees with a canopy density of some 30-40%. The trees range from 8 to 15 metres in height and from 12 cm to 35 cm in diameter.



Figure 34. Larch-red bilberry-blueberry vegetation in the study area

### Sparsely standing boreal forest vegetation

Waterlogged gentle hillside and foothill areas dissected by ravines and major river valleys are home to hillocky and sparse forest vegetation communities.

<sup>60</sup>Chukotka Autonomous Okrug Red Data Book. Red and Endangered Plant Species (Angiospermae, Filiciformis, Lycopodiophyta, Bryophyta, Lichenes, Fungi) / Chukotka Autonomous Okrug Department of Industrial and Agricultural Policy, IBPS DVO RAN. – DIKIY SEVER, 2008.





*Figure 35. Larch-shrub-green moss vegetation in the study area* 

# Shrub and dwarf cedar vegetation

There are no trees in the lower lying waterlogged areas apart from the sporadically occurring Kayander larch, dwarf cedar and Middendorf birch trees ranging from 0.5 to 5 m in height. The shrub layer consists of densely growing dwarf cedar and halberd willow shrubs with various berry shrubs (red bilberry, blueberry, and cloudberry).



Figure 36. Shrub-dwarf cedar-motley grass vegetation in the study area

### Arctic mountain desert vegetation

The Arctic mountain desert vegetation grows sparsely on stony hilltops and is dominated by dwarf cedar tree and crustaceous lichen species, with vegetation completely lacking in some areas.

The crustaceous lichen associations occur as fragments along the water divide between the Peschanka and Baimka rivers where they occupy over 50% of stone surfaces. Associations consisting of dwarf cedar trees, lichen-covered stones and grass/lichen spots form the transition zone marking the boundary of the mountain tundra. The forest stand is absolutely dominated by dwarf cedar trees mixed with Kayander larch (Lárix cajánderi). The grass and shrub storey are dominated by the heath family shrubs (ledum, bearberry, and dryad). The co-dominant species include alpine azalea, bilberry, net-leaf willow and bog willow; various motley grass species occur in abundance. The soil surface is predominantly covered by Iceland moss and reindeer moss, with crustaceous lichen being the co-dominant species.





Figure 37. Arctic mountain desert vegetation in the study area

Associations consisting of dwarf cedar trees, shrubs and lichens occur in the uppermost parts of the hard rock mountain slopes. They are completely dominated by larch and dwarf cedar mixed with the Kayander larch. The shrub storey comprises dwarf Labrador tea (Ledum decumbens) with blueberry, bilberry and alpine azalea inclusions. The soil surface is covered by shrubby lichen vegetation comprising reindeer moss, Iceland moss and cineraria instead of green moss. Overall, the dwarf cedar associations comprise 125 plant species including 12 lichen species, 7 moss species, 80 grass species, and 26 shrub and tree species.

Sparse larch woods cover fluvioglacial and proluvial landforms and middle/bottom sections of hard rock mountain slopes. The upper storey in these woods is completely dominated by Kayander larch mixed with dwarf cedar. The shrub storey mainly comprises Middendorf birch thickets blanketing well drained upland surfaces and crests. On the northward slopes, green moss is replaced with sphagnum moss. Lichen inclusions in the green moss cover mainly consist of Iceland moss and reindeer moss. Park-like larch woods comprising poplar trees and chosenia plants with meadow willow shrubs form narrow strips extending along the lower and higher sections of the river floodplains composed of sand and pebble. This association also occurs on the cone-shaped outwash hills and undulating plains marked by sags and swells and composed of washed silty/sand fluvioglacial deposits.

In these associations, the tree species composition is dominated by Kayander larch, Mongolian poplar and chosenia mixed with dwarf cedar. The shrub and grass storey comprises swamp red currant, Alaska spiraea, prickly wild rose, Middendorf birch, willow (Salix krylovii and Salix alaxenis), pine purple grass, and polar grass. Various motley grass species occur in abundance. The soil surface is mainly covered by green moss. Ruderal vegetation covering disturbed areas includes secondary willow thickets and motley grasses mixed with cereal grasses. Other species occurring in this association are Middendorf birch and stand-alone dwarf cedar shrubs. Chosenia occurs as a subdominant species along with the Mongolian poplar inclusions. The grass layer is well developed in some areas (covering



up to 40% of the surface area), and dominated by great willowherb and pine purple grass. Other grass species present in the area include sagebrush, northern dune tansy, bitter fleabane, steppe bluegrass and other grass species.

The motley grass and cereal associations include young trees and shrubs that are up to 1 m tall and cover less than 10-15% of the surface area. The commonly occurring tree species include willow and chosenia mixed with Mongolian poplar and young larch and dwarf cedar trees. Shrubs are represented by Middendorf birch, Beauverd's spiraea and prickly wild rose. Grass may cover up to 30-50% of the total surface area in some places. The most common grass species include steppe bluegrass, sagebrush, broad-leaved willowherb mixed with northern dune tansy, locoweed and others.

# 6.8.3. Summary

The plant species composition and distribution, as well as the structure of vegetation cover, are considered to be typical of the mountainous Anyuy-Chukotka geo-botanical district of the Arctic Tundra Region. The geo-botanical survey results indicate that sparse larch woods dominate the area with their type depending upon the soil moisture levels in local habitats. Dwarf cedar woods play a secondary role. The least commonly occurring are plant communities associated with the bottom sections of river valleys. Areas with no vegetation or those covered by ruderal vegetation and concentrated in the disturbed sections of river valleys account for less than 1.5% of the total mapping area.

# 6.9. <u>Animal Life</u>

### 6.9.1. Terrestrial Animal Species Composition and Distribution

The Project site and surrounding areas are part of the Euro-Siberian Subregion of the Forest Tundra Zone<sup>61</sup>. The bird fauna belongs to the Chukotka District of Bering Sub-Province of the Arctic Tundra Province of Arctic Subregion of the Holarctic Region<sup>62</sup>, and mammals fauna – to the Chukotka District of Bering Tundra Province of the Arctic Subregion of the Holarctic Region<sup>63</sup>. This remote and sparsely populated part of Chukotka has not been extensively studied other than for environmental assessments for various development projects.

An initial survey of animal life in the Project area was carried out in 2015 and supplemented in 2019 by winter route records of traces of game and a spring survey of the migratory birds.

The characterisation of local animal life is based on the review of available literature and animal count records for similar areas. It is assumed that the species composition and populations of local animals have remained relatively stable in the almost pristine environmental conditions of the Project area.

An extensive bird fauna survey programme was undertaken between 1979 to 1994 in the upper and middle sections of the Bolshoy Anyuy and Maliy Anyuy river basins, around the Elgygytgyn Lake and in the upper section of the Enmyvaam River where 61 bird species

<sup>&</sup>lt;sup>63</sup> F.B. Chernyavsky. 1984. Mammals of the Far Northeastern Siberia. Moscow. Nauka, 1984.



<sup>&</sup>lt;sup>61</sup> National Atlas of the USSR. Moscow, Encyclopedia, 2007.

<sup>&</sup>lt;sup>62</sup> L.A. Portenko. 1973. Birds of the Chukotka Peninsula and the Wrangel Island. L., Nauka, Vol. 2. 1973.

were identified<sup>64</sup> <sup>65</sup> <sup>66</sup>. In 2003-2015, the bird and terrestrial mammal fauna composition was surveyed in the Kupol Mine Project area extending along the water divide separating the Anadyr River and Maliy Anyuy River catchments <sup>67</sup> <sup>68</sup> <sup>69</sup> <sup>70</sup>, where 62 bird species and 17 terrestrial mammal species were recorded.

The bird and mammal fauna of the Project site itself and its surrounding areas were surveyed as part of the 2015 field studies. Overall, 40 bird species representing 6 orders (Figure 38) and 12 terrestrial mammal species from 4 orders (Figure 39) were identified in the study area. More recent information on animal species is provided in the Chukotka AO's State of Environment Report of 2016, produced by the Chukotka Autonomous Okrug Department of Industrial and Agricultural Policy.

# Bird fauna

The bird fauna inhabiting the Project area (the middle reach of the Bolshoy Anyuy River including the Baimka River valley and Yegdegkych River, its right-bank tributary), has not been studied in detail. The first ornithological survey was conducted in July 2015 as part of the engineering environmental investigations<sup>71</sup>, when 40 bird species were encountered in the Project area. The survey showed no signs of the presence of rare and protected species listed in the RF and Chukotka Red Data Book. Additional bird surveys were carried out in the area of the proposed Peschanka aerodrome site between 12/04/2019 and 15/04/2019 from 09/05/2019 to 13/05/2019. The surveys were focused on the Yegdegkych River Basin (including Peschanka).



Rough-legged buzzard



Common ringed plover

<sup>67</sup> Dokuchayev N.E., Dorogoy I.V. New Data on Small Mammals Occurring in the Anadyr River Basin. – Zoological Journal, V. 85, No. 1, 2006.

<sup>&</sup>lt;sup>71</sup> VNII-1. 2015. Report on the Assessment of Baseline Environmental Conditions and Environmental Component of the Peschanka Project Mining Feasibility Study. Assessment of the Natural Environmental Baseline. Volume 1. 0318-15-IEI.PZ. VNII-1 LLC. Magadan, 2015.



<sup>&</sup>lt;sup>64</sup> Dorogoy I.V. Birds Occurring in the Elgygytgyn Lake and Upper Reach of the Enmyvaam River. – In: The Nature of the Elgygytgyn Lake Depression (Research and Conservation Issues). Magadan, 1993.

 <sup>&</sup>lt;sup>65</sup> Dorogoy I.V. The Occurrence of Some Bird Species in the Central Chukotka. – MOIP Bulletin, Biol. Section, V.
 99, Issue 1, 1994.

<sup>&</sup>lt;sup>66</sup> Cherniavsky F.B., Krechmar M.A., 1993. Large Terrestrial Mammals Occurring in the Elgygytgyn Lake Area. – In: The Nature of the Elgygytgyn Lake Depression (Research and Conservation Issues). Magadan. P. 190-198.

<sup>&</sup>lt;sup>68</sup> Dorogoy I.V. The Bird Fauna and Occurrence in the Water Divide between the Malyi Anyuy and Anadyr Rivers (Chukotka AO). – Vestnik of SVNC DVO RAN, 2008, No. 2..

<sup>&</sup>lt;sup>69</sup> Dorogoy I.V. The Bird Fauna in the Upper Section of the Malyi Anyuy River Basin (Chukotka AO) - Vestnik of SVNC DVO RAN, 2008, No. 3, 2012.

<sup>&</sup>lt;sup>70</sup> Dorogoy I.V. Additional Information on Birds Occurring in the Upper Section of the Anadyr River Basin. – Russian Ornithological Journal, V. 21, Special Issue No. 822, 2012.



Long-tailed jaeger



Common house martin



Dusky warbler



Heuglin's gulls



Eastern yellow wagtail



Field sparrow

# Figure 38. Types of birds identified during the survey

All key types of landscapes were covered by survey routes, both walking and vehicle transects. An area of about 65 km<sup>2</sup> was explored in detail and all bird species encountered were recorded, both native and migratory. Valuable information about bird migration patterns in the study area was provided by A.V. Tsvetkov, a resident of Angarka Village. The specialised ornithological surveys conducted in the study area in 2019 identified 14 bird species representing 5 orders. The local bird fauna is dominated by the representatives of the Anseriformes (6 species or 40% of the total number of species recorded) and Passeriformes (5 species or 33%) orders. The Galliformes, Falconiformes and Piciformes orders were represented by 1 species each (6.6% of the total number of species).

The systematised list of bird species recorded in the study area during the 2019 surveys is provided below:

- Order: Anseriformes;
- Greater white-fronted goose (Anser albifrons);



- Tundra swan or small Holarctic swan (Cygnus columbianus bewickii);
- Bean goose (Anser fabalis);
- Snow goose (Chen hyperboreus); and,
- Brent goose (Branta bemicla).

These bird species were observed near Angarka where they were flying to their nesting habitats. The total number of individuals recorded during the observation period was 163, including 18 snow geese, 4 tundra swans and 62 bean geese. Harlequin duck (Histrionicus histrionicus) is a representative of Anatidae family. A couple of birds was encountered in the lower reach of the Yegdegkych River on 12/05/2019.

### Order: Piciformes

Lesser spotted woodpecker (Dendrocopos minor): One individual was encountered in the Peschanka River floodplain near the proposed tailings storage facility dam site on the 13<sup>th</sup> of April.

### Order: Falconiformes

Eastern marsh-harrier (Circus spilonotus) representing the Accipitridae family. One individual was observed in the lower reaches of the Yegdegkych River on the 12/05/2019.

### Order: Galliformes

Willow ptarmigan (Lagopus lagopus) is widespread in the study area. In the Peschanka and Bolshoy Anyuy river basins, traces of willow ptarmigan were encountered every 0.5-1 km both in April and May. There are years when this game species becomes an essential livelihood component for local residents.

### Order: Passeriformes

Few snow bunting (Plectrophenax nivalis) individuals inhabit the rocky hillsides and anthropogenically disturbed areas near Peschanka. A small flock of 6 birds was encountered near the geological exploration site on 12/04/2019. Single adult Common raven (Corvus corax) representing the Corvidae family were regularly observed across the study area including the Peschanka, Baimka and Bolshoy Anyuy river basins throughout the observation period.

Single individuals of spotted nutcracker (Nucifraga caryocatactes) representing Corvidae family, were regularly observed across the study area in April and May. Small flocks of 2-3 Eurasian jays (Garrulus glandarius) representing Garrulus genus, Corvidae family, Passeriformes order, were encountered in the Peschanka River floodplain near the proposed tailings storage facility dam site on 12/04/2019 and near the geological exploration base on 14/04/2019.

Small flocks of 3-4 marsh tits (Poecile palustris) representing the Paridae family were encountered in the Peschanka River floodplain near the proposed TFS site on 12/04/2019 and 13/04/2019. The field survey results indicate that the bird population pattern in the study area includes the representatives of the following orders:

•	Passeriformes	21 species	52.5%

- Charadriiformes 10 species 25.0%
- Galliformes 3 species 7.5%



•	Anseriformes	2 species	5.0%
•	Falconiformes	2 species	5.0%
•	Gruiformes	1 species	2.5%
•	Strigiformes	1 species	2.5%

The following common bird species are present in the Project area: wood sandpiper, common sandpiper, Haiglin's gull, house martin, Eastern yellow and white wagtail, eastern tree pipit, European stonechat, dusky warbler, yellow-browed warbler, Arctic warbler, little bunting, and nutcracker. Other bird species that are likely to occur in the study area include northern hawk-owl (Surnia ulula), common cuckoo (Cuculus conorus), black woodpecker (Dryocopus martius), and some Falconiformes species.

Gyrfalcon (Falkoructicolus Linnaeus) is a rare nesting, nomadic or wintering bird species, which has a small population. The total population of gyrfalcon in the region is estimated as 3.5 - 5 thousand couples, including 1.1 - 1.5 thousand couples using Chukotka and Kamchatka as their nesting habitats<sup>15</sup>. In areas with favourable conditions, nesting gyrfalcon couples occur as frequently as 4-5 couples per 100 km of river valley, but the average density is not higher than 1 couple per 1000 square kilometres even in the areas supporting large populations of willow ptarmigan (Chaun Lowland and Anadyr). Gyrfalcon is included in the national list of protected species (Russian Federation Red Data Book) and enjoys protection status under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

The spring field survey carried out in 2019 covered the areas surrounding the proposed mines, the concentrator, and aerodrome sites, including the major rivers (the Bolshoy Anyuy, Angarka, and Baimka) and their floodplains, as well as the Peschanka, Chernaya and Agnautala rivers valleys and adjacent mountains. The area extending around the proposed Peschanka aerodrome runway for about 52 km in length and 26 km in width comprises seasonal (spring/autumn) migration routes used by larger birds (goose and duck) and located at a safe distance of 20 km and more from the aerodrome site. The birds were observed flying at altitudes ranging from 8 to 100 m. No large gatherings of birds were observed near the proposed runway site lying in the bald area of mountain tundra extending along the watershed. Migration routes run along the floodplain valleys of the Bolshoy Anyuy, Angarka and Baimka rivers.

The nearest water bodies with large waterfowl populations are the Figurnoye Lake (15.4 km north of the runway site) and Ulitka Lake (29 km north north-west of the runway site), as well as wetland areas surrounding these lakes and being part of the upper floodplain of the Bolshoy Anyuy River. In future, after completion of construction phase, ravens are likely to visit the area as part of their food seeking routine when they regularly check various parts of their habitats for food. However, they are not likely to gather in large numbers in places with little food and their presence will be limited to occasional visits. Nutcrackers may occasionally visit the area in the spring and autumn period. Other bird species observed in the Project area tend to dwell in places covered with shrubs and trees and near waterlogged lowland areas because mountain tundra landscapes have little or no food.

### Mammal fauna

As can be seen from the available literature and historical records, the most common animal species occurring in the Project area are those whose habitats are associated with



forest tundra and sparse forest areas (tundra shrew, Arctic ground squirrel, tundra vole, Arctic fox, lemming, glutton, northern red-backed vole and common vole, wolf, fox, ermine, weasel, and Laxmann's shrew). Mammal species recorded in the Project area and its surroundings (Figure 39) represent the following orders:

•	Carnivora	5 species	41.6%
•	Rodentia	3 species	25.0%
•	Lagomorpha	2 species	16.7%
•	Artyodactyla	2 species	16.7%

Field surveys and interviews with the base camp personnel have confirmed that the following predator species occur in the study area:

- Common fox (Vulpes vulpes). Signs and traces (tracks and droppings) left by foxes have been observed regularly in the study area; is a game species (on a small scale);
- Wolf (Canis lupus). The Company staff reported that wolves were seen on rare occasions around the Project site. In some parts of the Anadyr Plateau the number of animals does not exceed 1 individual per 100 km2;
- Brown bear (Ursus arctos). Signs and traces (tracks and droppings) left by brown bears have been observed regularly in the study area. Judging by the composition of droppings, the animals mainly feed on berries and arctic ground squirrels. Like in other parts of the Central Chukotka, the number of bears in the Project area does not exceed 1-2 individuals per 1000 ha. The brown bear is a game species (on a small scale);
- Glutton (Gulo gulo). According to the Company staff, glutton rarely occurs in the Project area;
- Ermine (Mustela erminea). A female ermine with 3 siblings were observed in the base camp; is a game species on a small scale;

The background terrestrial mammal species include northern pika, arctic ground squirrel and tundra vole. The following mammal species are also likely to occur in the Project area: tundra shrew (Sorex tundrensis), masked shrew (Sorex caecutiens), grey-sided vole (Clethtrionomys rufocanus), northern red-backed vole (Clethtrionomys rutilus), large-eared vole (Alticola macrotis) and least weasel (Mustela nivalis).



Northern pika



Arctic ground squirrel





Ermine (female)



Elk droppings



Bear droppings



Elk horn

# Figure 39. Evidence of terrestrial fauna identified during the survey

# Bird and mammal habitats

Bird habitats are associated with the following particular landscape types:

- River floodplains and first-level terraces (30 species);
- Lower sections of slopes and dry shrub tundra terraces (6 species); and,
- Anthropogenic habitats (abandoned settlements) (4 species).

Habitats of 10 terrestrial mammal species are associated with river floodplains and firstlevel terraces. The review of the available literature and historical records indicates that the most common animal species occurring in the Project area are those whose habitats are associated with forest tundra and sparse forest areas (tundra shrew, Arctic ground squirrel, tundra vole, Arctic fox, lemming, glutton, northern red-backed vole and common vole, wolf, fox, ermine, weasel, and Laxmann's shrew). Based on the field survey findings, the following 4 main habitat types can be identified in the study area:

### Forests and sparse forest areas

Forest ecosystems are rich in resources and provide food and habitat for many terrestrial fauna species including large hoofed and predator species, as well as various bird species. Key animal species inhabiting these areas are elk, wild reindeer, ermine, glutton, brown bear, wolf, fox, lemming, common vole, Arctic ground squirrel, northern pika, Arctic hare, tundra shrew, Laxmann's shrew, red-backed vole, grey-sided vole, lemming mouse, weasel, rock capercaillie, hazel grouse, willow ptarmigan, rough-legged hawk, fish duck, harlequin duck, ringed plover, whimbrel, common snipe, eastern tree pipit, and brambling.

### Elk (Alces alces)

According to information provided in the 2017 Chukotka State of Environment Report, the population of elk in Chukotka had increased in the recent years to 4 353 individuals (based on winter counts and interviews). Hunters reported that elk were seen to explore new



habitat. Elk hunting has been permitted since 2014 and the number of animals is sufficient to sustain the elk population. The planned total elk harvest limit for the 2014-2015 hunting season was limited to 60.

# Wild reindeer (Rangifer tarandus)

No aerial counts have been carried since 2001 for wild reindeer. In recent years, wild reindeer population estimates have been made on the basis of interviews; the most likely range of population size is 90-100 thousand individuals. During the 2018-2019 hunting season, the largest number of wild reindeer was concentrated in the Bilibinsky Municipal District and Pevek Urban District. The autumn migration started at the end of August and lasted till mid-December. In early April, reindeer returned to their fawning grounds. In autumn and winter, wild reindeer have no settled migration routes and their movements are difficult to predict. Availability and access to food are key factors driving these movements, and there have been no signs of decline in the population size of wild reindeer. It is difficult to estimate the scale of illegal reindeer hunting though it is a known fact that reindeer farmers and representatives of indigenous communities hunt reindeer. Reindeer are often killed during occasional encounters. Expert opinion put the total annual harvest of wild reindeer at some 1 000 individuals.

### Snow sheep (Ovis nivicola lydekkeri)

The snow sheep population is estimated as at least 350 individuals. Show sheep inhabit the Koryak Upland and mainly occur in the southern part of the Anadyrsky District.

### Sable (Martes zibellina)

According to the recent winter count, the sable population in the Anadyrsky and Bilibinsky Municipal District is 8 777 individuals. A minor decline in the population size as compared to the previous count is attributed to the fact that some animals in remote areas remained uncounted because of deep snow cover.

### Brown bear (Ursus arctos)

The brown bear population can be estimated only on the basis of expert opinion, interviews and literature. The estimated number of brown bear individuals inhabiting the region is 3.2 thousand with no significant fluctuations in the population size.

### Grassland and shrubland areas

Areas covered with grass and shrub vegetation have less abundant resources and less diverse fauna. Key species inhabiting these areas are glutton, wolf, common fox, tundra vole, Arctic ground squirrel, northern pika, white hare, tundra shrew, Laxmann's shrew, grey-sided vole, red-backed vole, lemming vole, weasel, common cuckoo, red-breasted merganser, willow ptarmigan, ringed plover, dusky warbler, and grosbeak. During the field survey, wolf traces were observed and a wolf was encountered on one occasion. Images of tracks left by animals in the forest and sparse forest habitats and encountered during the field surveys are shown in Figure 40.





Figure 40. Elk bones and tracks found on the edge of the forest area near the Peschanka River



Figure 41. Brown bear standing on the edge of the forest habitat in the study area

### Arctic mountain desert areas

The fauna of the Arctic mountain desert areas comprises the following species: ermine, glutton, fox, lemming, tundra vole, Arctic ground squirrel, northern pika, tundra shrew, Laxmann's shrew, lemming vole, weasel, white wagtail, Arctic warbler, and warbler. Species occurring in the anthropogenically modified areas include tundra vole, red-backed vole, lemming vole, grey-sided vole, red vole, Arctic ground squirrel and raven.

### Rare and protected animal species and their migration routes

According to information provided by the Animal Life Conservation and Management Division of the Chukotka Autonomous Okrug Department of Industrial and Agricultural Policy (the letter of 09/07/2018 No. 12-10/896 in Annex C), the following rare and protected species listed in the RF and Chukotka Red Data Books occur in the area of the proposed mining and processing plant site in the Bilibinsky Municipal District:



- Mammal species:
  - Snow sheep (Ovis nivicola lydekkeri);
- Bird species:
  - o Osprey (Pandion haliaetus),
  - White-tailed eagle (Haliaeettus albicilla),
  - o Blue hawk (Circus cyaneus),
  - o Gyrfalcon (Falco rusticolus),
  - Peregrine falcon (Falco peregrinus),
  - Eagle owl (Bubo bubo),
  - Boreal owl (Aegolius funereus).

Such rare and animal species were not encountered during the field surveys conducted as part of the engineering and environmental investigations in the study area

According to information provided by the Department of Industrial and Agricultural Policy, the entire area of the Bilibinsky Municipal District is crossed by migration routes used by wild reindeer. The autumn migration starts in the end of August and lasts till mid-December. In early April, reindeer return to their fawning grounds. In the recent years, wild reindeer have had no settled migration routes in autumn and winter, and their movements have been difficult to predict, being mainly driven by the availability and access to food. The results of the 2015 environmental survey show that the main migration routes used by virtually all migratory bird species lie along the Baimka and Bolshoy Anyuy River valleys and do not cross the catchments of the Peschanka and Yegdegkych rivers.

### Game

Chukotka's fauna comprises 64 mammal species and some 220 bird species. Key game species include elk, wild reindeer, brown bear, sable, wolf, glutton, ermine, fox, Arctic fox, American mink, squirrel, Arctic hare, water rat, bean goose, white-fronted goose, rock capercaillie, white grouse and ptarmigan, and over 10 duck species.

According to information provided by the Animal Life Conservation and Management Division of the Chukotka Autonomous Okrug Department of Industrial and Agricultural Policy (the letter of 09/07/2018 No. 12-10/896), the following game occur in the area of the proposed mine and processing plant in the Bilibinsky Municipal District: elk, wild reindeer, brown bear, wolf, glutton, white hare, fox, sable, ermine, willow ptarmigan and rock ptarmigan. Information on the number of individuals, distribution and densities of game species occurring in the District is shown in Table 24. The most widespread species are polar hare, partridge and wild reindeer.

Game Species	Average Population, Individuals	Density, individuals per 1000 ha
Wild reindeer	38 640	1,36
Brown bear	1 487	0,04
Wolf	2 161	0,17

Table 24. Game species populations in the Bilibinsky Municipal District



Game Species Average Population, Individuals		Density, individuals per 1000 ha	
Fox	2 363	1,00	
Glutton 1 221		0,26	
White fox	3 191	0,12	
Ermine	34 508	4,84	
Polar hare 156 049		28,87	
Partridge	106 073	264	

### Summary

The representatives of birds and mammals occurring in the Project area are typical of the zoo-geographic province in which it is located. Faunal habitats are concentrated in the floodplains of rivers and streams flowing in the area. The species recorded during the field surveys in 2015 and 2019 predominantly represent predators and small rodents. No rare and protected species were recorded in the Project area and its surroundings during these surveys.

### 6.9.2. Aquatic Fauna

Based on the zoo-geographic division of the Northern Far East, fish fauna habitats in the Project area which extends into the Yegdegkych and Baimka river basins belong to the Circumpolar Subregion of the Holarctic Region. The local fish fauna is dominated by the Northern Palaearctic species with minor influence of the American fish fauna<sup>72</sup>. According to the Chukotka AO Fisheries Zoning Map, water bodies in the Project area are part of the Western Chukotka Fisheries Area. Key fishing areas are located in the lower and middle sections of the Omolon, Bolshoy Anyuy and Malyi Anyuy rivers<sup>73</sup>. There is no official information on the present-time species composition, status and habitat conditions of fish fauna in the middle section of the Bolshoy Anyuy River and in the Baimka and Yegdegkych Rivers. The aquatic ecosystem survey was conducted in summer 2015 to assess the current status of aquatic fauna in the Peschanka and Baimka rivers<sup>74</sup>. Fish identified in an aquatic ecosystem survey conducted in summer 2015 in the Peschanka, Yegdegkych River and Baimka rivers are shown in Figure 42.

Based on the assessment of fish habitat conditions conducted during the field survey, watercourses in the Baimka and Yegdegkych river basins are classified as Category 1 fishery water bodies. According to the assessment of the commercial fisheries in Chukotka, dominated by semi-anadromous and freshwater fish species<sup>75</sup>, the study area is part of the Western Chukotka fisheries region. Key commercial species are various whitefish species, including broad whitefish (Coregonus nasus), humpback whitefish (Coregonus pidschian),

 <sup>&</sup>lt;sup>75</sup> S.B. Baranov and Yu. A. Dyachkova. The Current State of Semi-Anadromous and Fluvial Fishery at Chukotka.
 / TINRO Bulletin, vol. 179. – Vladivostok, 2014.



<sup>&</sup>lt;sup>72</sup> Berg L.S. Freshwater Fish Fauna of the USSR. V. 2, 1933.

<sup>&</sup>lt;sup>73</sup> Kischinsky A.A. Freshwater Fauna / In: Northern Far East. - M., Nauka, 1970.

<sup>&</sup>lt;sup>74</sup> VNII-1. 2015. Report on the Assessment of Baseline Environmental Conditions and Environmental

Component of the Peschanka Project Mining Feasibility Study. Assessment of the Natural Environmental Baseline. Volume 1. 0318-15-IEI.PZ. VNII-1 LLC. Magadan, 2015.

vendace (Coregonus albula), muksun (Coregonus muksun), round whitefish (Prosopium cylindraceum), and – in the lake systems – peled (Coregonus peled). Commercial species of local significance include lenok (Brachymystax lenok), East Siberian grayling (Thymallus arcticus pallasii), common pike (Esox lucius), burbot (Lota lota leptura), longnose sucker (Catostomus catostomus rostratus), Yakut crucian carp (Carassius carassius jacuticus), Siberian dace (Leuciscus leuciscus baicalensis), and common perch (Perca fluviatilis).

The environmental surveys carried out in 2015 and 2019 identified 3 salmon species in the Peschanka, Yegdegkych and Baimka river basins: lenok (Brachymystax lenok), East Siberian grayling (Thymallus arcticus pallasii) and round whitefish (Prosopium cylindraceum). During these surveys, no rare and protected fish species listed in the RF and Chukotka Red Data Books were within the Yegdegkych and Baimka river basins.

# Bottom fauna (zoobenthos)

Bottom organisms and their communities (benthos) represent an important food source for fish, being among the most objective and useful indicators for assessing the ecological status of water bodies. Little or no zoo- and phytoplankton occurs in the watercourses in the Northeast Asia<sup>76</sup>. During the field survey, 10 zoobenthic species and groups were recorded in the watercourses, which were dominated by *Ephemeroptera*, *Plecoptera*, and *Trichoptera* species (EPT index); the values of the *Oligochaeta* and *Chironomid* indices were estimated<sup>77</sup> (Table 25).

Indicator	Peschanka River Basin		Baimka River Basin	
	Range of Values	Mean Value	Range of Values	Mean Value
Density, cells/m <sup>2</sup>	227 - 747	385	12 - 773	304
Biomass, g/m <sup>2</sup>	0.59 - 4.54	2.15	0.75 - 7.86	2.51
Number of EPT species	6 - 10	8	4 - 10	7
EPT index	0.14 - 0.89	0.37	0.25 - 0.75	0.35
Oligochaeta index	0 - 11	6	0	
Chironomid index	0.00 - 0.26	0.12	0.00 - 0.15	0.09

Table 25. Zoobenthos development indicators for local watercourses

The Oligochaeta index values across all sampling locations were less than 20%, which means that water in these locations can be characterized as 'very clean'. The highest values of the Oligochaeta index were typically recorded in the lower sections of the Levaya Peschanka and Peschanka rivers. The absence of Oligochaeta cells and zero value of the

Chironomid index is a water quality index based on the abundance of Chironomid species relative to the total abundance of zoobenthos<sup>-</sup>



<sup>&</sup>lt;sup>76</sup> Levanidov V.Ya., 1981. Far East Salmon River Ecosystems // Invertebrates in the Far East Salmon River Ecosystems. - Vladivostok, DVNC AN USSR, 1981.

<sup>&</sup>lt;sup>77</sup> EPT index is a water quality index based on the abundance of Ephemeroptera, Plecoptera, and Trichoptera species relative to the total abundance of zoobenthos.

Oligochaeta index is a water quality index based on the abundance of Oligochaeta species relative to the total abundance of zoobenthos.

Oligochaeta index recorded in the Baimka River Basin indicate that water can be described as 'very clean<sup>78</sup>.

# Fish fauna (ichthyofauna)

The lower sections of the Kolyma River and its right-bank tributaries (Malyi Anyuy, Bolshoy Anyuy, and Omolon rivers) are home to more than 20 fish species representing at least 10 families <sup>79 80 81</sup>.

The ichthyologic survey of watercourses in the catchment areas of the Peschanka River, Yegdegkych and Baimka rivers identified only 3 salmon species, namely lenok (*Brachymystae lenok*), East Siberian grayling (*Thymallus arcticus pallasi*) and round whitefish (*Coregonus cylindraceus*) and assessed the distribution of these species. One <u>lenok</u> individual was recorded in the lower section of the Baimka River upstream of the Yegdegkych River inflow. Lenok is very sensitive to changes in water quality and composition, including increased turbidity levels due to higher concentrations of suspended solids in discharges. In the Kolyma River Basin, lenok is the first species to disappear from those watercourses where placer mining activities begin.

The survey results indicate that watercourses in the Baimka River Basin have low capacities as food sources due to small population numbers of amphibiotic insects (Ephemeroptera, Plecoptera, and Trichoptera species). Fish species occurring in these water bodies are not considered as aquatic biological resources of outstanding value. If any valuable fish species like muksun (Coregonus *muksun*), Siberian white salmon (Stenodus leucichthys), Siberian whitefish (Coregonus lavaretus pidschian) and broad whitefish (Coregonus nasus) are recorded in the surveyed watercourses at the subsequent stages of field investigations, these watercourses can be classified as the highest category waters designated as fisheries.

The ichthyologic survey results indicate that the surveyed water bodies are not inhabited by any rare or protected species listed in the RF and Chukotka AO Red Data Books, and these water bodies are not officially classified as fisheries<sup>82</sup>.

<sup>&</sup>lt;sup>82</sup> According to Letter by Russian Fisheries Agency of 26/09/2019 No. 705-2435, water bodies of the Project area are not listed in the State Register of Fishery Water Bodies and not assigned with a fishery category.



<sup>&</sup>lt;sup>78</sup> GOST 17.1.3.07-82. Environmental Protection. Hydrosphere. Water Quality Control Rules for Water Bodies and Watercourses.

<sup>&</sup>lt;sup>79</sup> Makoyedov A.N., Kumantsov M.I., Korotayev Yu.A., Korotayeva O.B. Commercial Fish Species Inhabiting Inland Water Bodies in Chukotka. - M., UMK Psychologia, 2000.

<sup>&</sup>lt;sup>80</sup> Chereshnev I.A. Biological Diversity of Freshwater Fish Fauna in the Northeast Russia. - Vladivostok, DALNAUKA, 1996.

<sup>&</sup>lt;sup>81</sup> Chereshnev I.A Vertebrate Species in the Northeast Russia. Vladivostok, DALNAUKA, 1996.

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Lenok 1+ and East Siberian grayling 1+.

Baimka River upstream of the Yegdegkych River inflow



East Siberian grayling 0+ (fingerling individuals). Lower Section of the Yegdegkych River



East Siberian grayling.

Baimka River upstream of the Yegdegkych River inflow



Round whitefish and East Siberian grayling.

Peschanka Technogenic water bodies at the historical placer downstream of a historical placer mining site mining locations



Round whitefish and East Siberian grayling.

Baimka River upstream of the Yegdegkych River inflow



East Siberian grayling 0+.

River and Yegdegkych River. Lower section of the Levaya Peschanka River,

Figure 42. Fish species inhabiting water bodies in the license area and identified during the survey



### Summary

The hydrobiological indicators characterizing zoobenthos composition, structure and habitat conditions in the surveyed water bodies appear to be typical and similar to those observed in other water bodies in the Bilibinsky and Anadyrsky Municipal Districts of the Chukotka AO. At the present time, virtually all surveyed watercourses in the Project area can be classified as 'clean' and 'very clean' by their water quality. Fish fauna comprises only three fish species that do not have significant commercial value. No rare or protected species of invertebrate and fish fauna have been recorded in the study area.

### 6.10. Protected Natural Areas

In the Bilibinsky Municipal District of Chukotka AO there are no municipalities that have protected natural areas (PNAs) of federal significance managed by the RF Ministry of Natural Resources and the Environment, their buffer zones and areas planned to be granted the federal protection status<sup>83</sup>. Any additional verification of presence/absence of any PNAs of federal significance in the Project area is not required<sup>84</sup>. According to information received from the regional and local authorities, there are no PNAs of regional or local significance in the Project's area of influence does not overlap spatially with any of the existing PNAs in Chukotka (Figure 43).

The nearest PNA of the federal significance is the Wrangel Island State Nature Reserve, the northernmost World Heritage Site<sup>86</sup>. It is located within the boundaries of the Iultinsky Municipal District in the Chukotka AO, about 1000 km north of the proposed main Project site. The nature reserve maintains a special protection regime for its habitats and fauna species.

The nearest PNAs of regional significance are the Lebediny State Nature Sanctuary (in about 300 south east of the proposed Project site), a prominent geological feature the Elgygytgyn Lake State Nature Sanctuary (in 230 km north east of the proposed Project site), and a Anyuysky Volcano Protected Geology Feature (in 75 km north of the proposed Project site).

<sup>&</sup>lt;sup>86</sup> The state nature reserve was established by the RSFSR Council of Ministers Resolution of 23/03/1976.



<sup>&</sup>lt;sup>83</sup> The List of Measures on Supporting the Implementation of the Federal Protected Areas Development Concept until 2020. Approved by RF Government Resolution of 22/12/2011 No. 2322-r.

<sup>&</sup>lt;sup>84</sup> Letter by the RF Ministry of Natural Resources and the Environment of 22/12/2017 No. 05-12- 32/35995.

<sup>&</sup>lt;sup>85</sup> Letter by the Natural Resource Management Committee of the Chukotka Autonomous Okrug Department of Industrial and Agricultural Policy of 06/07/2018 No. 13/01-01/50.

Letter by the Bilibinsky Municipal District Administration of 25/07/2018 No.14-02-05/1757.



Figure 43. Peschanka Project Location Relative to PNAs Established in the Chukotka AO


# 6.11. Assessment of Current Environmental Conditions of Peschanka site

Peschanka site, on which the facilities of Baimsky GOK are designed, is largely disturbed by the previous activities – placer gold mining, geological exploration, etc.

Based on the existing results the integrated assessment of current environmental conditions at the Peschanka site has been undertaken within the boundaries of the Yegdegkych River Basin with its upstream section lying within the Peschanka Stream catchment including its tributaries (Figure 44). The map reflects the types and zones of technogenic impacts associated with the geological exploration activities and historical placer gold mining operations, along with the sources of these impacts. The following zones of environmental conditions have been identified within the survey area: satisfactory, conflicting, stressful, critical, and crisis.

The qualitative assessment scale comprised the following five categories: satisfactory (1); conflicting (2); stressful (3); critical (4); and crisis (5), with the following respective score ranges: 10; 11-20; 21-30; 31-40; and 41-50. The territorial (spatial) division system (clusters) used for the assessment of the parameters and quality of the natural components of the environment features sections of catchment and sub-catchment areas (i.e. upper/middle/lower sections and tributaries (Figure 44)).

## **Clusters with Conditions Rated as Satisfactory**

Clusters where environmental conditions are rated as satisfactory are those where little or no technogenic and anthropogenic impacts, whether direct or indirect, have occurred due to previous geological exploration activities, placer mining operations, and cross-country vehicle movements on winter and summer roads. Characteristics and properties of environmental components and natural resources have remained virtually unchanged. Some areas within the clusters have been affected by natural and/or anthropogenic forest fires at different times. Environmental quality guidelines set for integrated indicators characterizing the condition of all environmental components are not exceeded apart from those areas that lie within the geochemical anomaly zone of the Baimka trend.

# Clusters with Conditions Rated as Conflicting

Clusters where environmental conditions are classified as conflicting are those where the insignificant and reversible degradation has affected certain environmental components and natural resources as a result of historical geological exploration activities. Some areas within the clusters have been affected by natural and/or anthropogenic forest fires at different times. Environmental quality guidelines are slightly exceeded for integrated indicators characterizing the condition of one environmental component. Clusters lie within the zone of direct and indirect impact on fauna.

### Clusters with Conditions Rated as Stressful

Clusters where environmental conditions are considered to be stressful are characterized by significant but reversible degradation of environmental components and natural resources. Some areas within the clusters have been affected by natural and/or anthropogenic forest fires at different times. Environmental quality guidelines (the Maximum Acceptable Impact Levels (MAIL) and Tentatively Safe Impact Levels (TSIL)) are slightly exceeded. Clusters lie within the zone of direct impact on fauna.



# Clusters with Conditions Rated as Critical

Clusters where environmental conditions are classified as critical are characterized by a threateningly high level of degradation of natural landscapes and resources which can only be restored through the implementation of specific restoration measures. The environmental quality guidelines are exceeded for integrated indicators characterising 2 or more environmental components. The multiple excesses of MAC limits (MAIL and TSIL values) are recorded in several environmental components. The cluster with critical environmental conditions includes the current geological exploration site located on the stream valley slope in the upper section of the Peschanka Stream.

	Cluster					Asse	ssmen	t Indic	ator/\	/alue*			
No.	A Section of a Catchment/Sub- catchment / Technogenic Landform	Ambient Air Pollution and Noise from Technogenic Sources	Surface Water and Groundwater Pollution and Depletion	Soil Contamination from Technogenic Sources	Alteration, Decline and Loss of Soil Fertility	Alteration of Habitats, Decrease in Biodiversity and Loss of Vegetation	Alteration of Habitats and Depletion of Aquatic Biological Resources	complex disturbance or land and depletion of mineral resources due to	Wind and water erosion	Alteration of Habitats, Decrease in Biodiversity and Depletion of	Decline and Loss of Natural and Recreational Capacity of Landscape	Total Score for Qualitative Indicators	Environmental Condition Category
Maxii	num score	5	5	5	5	5	5	5	5	5	5	50	
		Prava	ya Pes	chank	a Strea	m Cat	chmen	t					
PR.1	Source	1	1	1	1	2	1	1	1	2	2	13	Conflicting
PR.2	Upper section and tributaries	1	2	2	2	2	3	1	4	3	3	23	Stressful
PR.3	Historical placer mining site	1	3	3	4	4	4	5	4	4	4	36	Critical
PR.4	Middle section and right-bank tributaries	1	1	1	1	1	1	1	1	1	1	10	Satisfactory
	Lower section and right-bank tributaries												
		Ρ	eschar	nka Str	eam C	atchm	ent						
FN.1	Source	2	3	2	2	3	3	2	4	2	3	26	Stressful
FN.2	Upper section and tributaries	3	3	2	4	4	4	3	5	4	4	36	Critical
	Current geological exploration site	4	5	5	4	5	5	3	5	5	5	46	Crisis
	Middle section	3	2	2	2	2	3	2	4	3	3	26	Stressful
	Lower section	2	2	2	2	2	3	1	4	3	3	24	Stressful
Belosnezhka Stream Catchment													
ZV.1	Stream valley from the source to the lower section	1	1	1	1	1	1	1	1	1	1	10	Satisfactory
			Leniv	y Strea	m Cat	chmen	it						
	Stream valley from the source to the lower section	1	1	1	1	1	1	1	1	1	1	10	Satisfactory

Table 26. Current Environmental Conditions in the Peschanka Project Area and adjacent sites



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	Cluster	Assessment Indicator/Value*											
No.	A Section of a Catchment/Sub- catchment / Technogenic Landform	Ambient Air Pollution and Noise from Technogenic Sources	Surface Water and Groundwater Pollution and Depletion	Soil Contamination from Technogenic Sources	Alteration, Decline and Loss of Soil Fertility	Alteration of Habitats, Decrease in Biodiversity and Loss of Vegetation	Alteration of Habitats and Depletion of Aquatic Biological Resources	Complex disturbance of land and depletion of mineral resources due to	Wind and water erosion	Alteration of Habitats, Decrease in Biodiversity and Depletion of	Decline and Loss of Natural and Recreational Capacity of Landscape	Total Score for Qualitative Indicators	Environmental Condition Category
Maxii	num score	5	5	5	5	5	5	5	5	5	5	50	
		Levay	/a Peso	hanka	Strea	m Cato	hment	t					
ZV.2	Source	1	1	1	1	1	1	1	1	1	1	10	Satisfactory
ZV.3	Upper section and left-bank tributaries	1	1	1	1	2	1	1	1	2	3	14	Conflicting
ZV.4	Middle section	1	2	2	2	2	3	2	4	3	3	24	Stressful
ZV.5	Historical placer mining site	2	3	2	4	4	4	5	5	4	4	37	Critical
ZV.6	Lower section and right-bank tributary	3	2	2	2	2	3	2	4	3	3	26	Stressful
	Gnom Stream Catchment												
	Source	1	1	1	1	1	1	1	1	1	1	10	Satisfactory
	Upper section and right-bank tributaries	1	2	2	2	2	3	2	4	3	3	24	Stressful
	Historical placer mining site	1	3	3	4	4	4	5	3	3	3	33	Critical
	Middle section	1	2	2	2	2	3	2	4	3	3	24	Stressful
	Lower section	3	2	2	2	2	3	1	4	3	3	25	Stressful
	Yegdegkych River Catchment												
	Right-bank tributaries	1	1	1	1	1	1	1	1	1	1	10	Satisfactory
	Interfluve between the Listok and Gar' streams	2	3	2	2	2	3	1	2	2	2	21	Stressful
	Sources of left-bank tributaries	1	1	1	1	1	1	1	1	1	1	10	Satisfactory
	Left-bank tributaries	2	1	1	1	2	1	1	1	2	3	15	Conflicting
	Interfluve between the left-bank tributaries	3	2	2	2	2	3	1	3	2	2	22	Stressful
	Upper section	3	3	3	3	3	3	2	3	3	3	29	Stressful
	Historical placer mining site	2	3	2	4	4	4	5	5	5	5	39	Critical
	Middle section	2	1	1	1	2	1	1	1	2	3	15	Conflicting
	Lower section	2	1	1	1	2	1	1	1	2	3	15	Conflicting

Note: Environmental condition categories and score ranges<sup>87</sup>: 10 – satisfactory, 11-20 – conflicting, 21-30 – stressful, 31-40 – critical, 41-50 – crisis

<sup>&</sup>lt;sup>87</sup> Europe. Ecological problems in Russia: Map. S 1:5000000 – M, DROFA/DIK, 2008





Figure 44. Map Illustrating Current Environmental Conditions in the Peschanka Project Area



Natural / anthropogenic features, sources of impacts and impact zones:	Environmental condition categories:
Catchment / cluster boundaries	Satisfactory = 10 = 10
6 Planned Peschanka Project facilities	Conflicting=1120 1120
Historical placer mining sites	Stressful = 2130 2130
Current geological exploration (GE) sites	Critical = 3140 3140
t t t Areas of pyrogenic impacts	Crisis = 4150 4150
Historical and current roads, accesses	Baimka
Historical exploration trenches	KKB II: Cu Zn Mn NH4
Zone of direct impacts om wildlife (R, km) - GE sites and local roads R=0.5 km - Minine goerations R=1.5 km	cx3 =1,5: Pb
Zone of indirect impact on wildlife (D=3 km)	Zones where restrictions are applied to regulate nature resource uses, environtental impacts, and quality of environmental components
Lone of menece impact on theme (it of nin)	GE activity zone of influence on terrestial fauna (1000 m)
Erosion and emissions / discharges of suspended solids: - Water erosion of anthropogenic landforms and watercourse crossings - Delation of anthropogenic landforms	All to be a series of the series of
Quantifiable environmental condition objectives:	Dirty, very dirty and extremely dirty (WQC
TDL - Type of disturbed lands (GOST 17.5.1.02-85, GOST 17.5.1.03-84)	
WHC - Waste hazard class for natural environment (IV)	Mineralisation (mg/l) and predominant
DCC - Degree of chemical contamination of soils and sub-soil (1.56), >MAC Limit (Mn)	HCO3-SO4 Ca-Mg
LDC - Land degradation coefficient (0.01.0)	50-100
GRI - Gamma radiation intensity (>=10mr/h)	
	500-1000 HCO3 Ca-Na
	SO4-HCO3 Mg-Ca

### 6.12. Areas with Special Land Use Conditions

When designing the GOK facilities it is necessary to take into account the restrictions related to the current environmental conditions.

#### 6.12.1. Water Protection Zones and Coastal Buffer Zones

According to the existing maps, more than 40 watercourses (rivers, streams, including those of seasonal filling) flow across the Peschanka Project site. According to the laws of the Russian Federation<sup>88</sup>, the water bodies should have the coastal buffer zones (CBZ) and water protection zones (WPZ). The width of the CBZ of water bodies ranges from 30 to 50 m (depending on the slope of shore of a water body).

The width of WPZ of rivers or streams is set for the rivers or streams with a length of:

- up to ten kilometers in the amount of 50 meters;
- ten to fifty kilometres in the amount of 100 meters;
- fifty kilometers or more in the amount of 200 meters.

The RF legislation prohibits performing the following types of works within WPZ and CBZ (as applicable to the Project):

• placement of landfills for production and consumption waste;

<sup>&</sup>lt;sup>88</sup> Article 65 of the Water Code of the Russian Federation of 3/06/2006 No. 74-FZ (as amended on 27/12/2018).



• placement of dumps of eroded soil.

Within the boundaries of water protection zones, it is allowed to design, construct, reconstruct, commission, operate industrial and other facilities provided that such facilities are equipped with structures ensuring the protection of water bodies from pollution, contamination and depletion of water in accordance with water laws and laws in the field of environment protection. Protected water bodies with special environmental, scientific, cultural, aesthetic, recreational and curative value in the territory of the proposed activity are absent.

## 6.12.2. Sanitary Protection Zone of the Drinking Water Reservoir

The source of utility and drinking water supply to the designed GOK will be the designed reservoir in the Levaya Peschanka riverbed. In accordance with the RF Water Code the width of the water protection zone of the reservoir located on the watercourse is set equal to the WPZ width of such watercourse. Consequently, the WPZ width of the reservoir will be 50 m.

### 6.12.3.Aerodrome Environs

In accordance with RF requirements the aerodrome environs (ADE) should be organized around the aerodrome (or landing site)<sup>89</sup>.

On the aerodrome environs, the following subzones can be distinguished, for which restrictions are set on the use of immovable property items and performance of certain types of activities:

- The first subzone where it is prohibited to place facilities not designated for management of aviation traffic, provision of taking off, landing, taxiing and parking the aircrafts;
- The second subzone where it is prohibited to place facilities not designated for service of passengers and luggage, goods and mail management, aircraft maintenance, aviation fuel storage, aircraft fueling, electricity supply and the airport infrastructure;
- The third subzone where it is prohibited to place facilities whose height exceeds the limits set for the pertinent aerodrome environs by the by competent authorities;
- The fourth subzone where it is prohibited to place facilities that may interfere with land-based aviation infrastructure, navigation, landing and communications necessary for aviation traffic management located outside the first subzone;
- The fifth subzone where it is prohibited to place hazardous production facilities<sup>90</sup> whose operations may cause adverse impact on flight safety; boundaries are defined based on maximum width of affected areas in case of man-made accidents at the hazardous industrial facilities;

<sup>&</sup>lt;sup>90</sup> This applies to facilities classified as hazardous industrial facilities as per Federal Law of Federal Law of 21/07/1997 No. 116-FZ On Safety of Hazardous Industrial Facilities (as amended on 29/07/2018).



<sup>&</sup>lt;sup>89</sup> Federal Law of 01/07/2017 No. 135-FZ On Amendments to Certain Legislative Acts of the Russian Federation Regarding Improvement of the Procedure for Establishing and Using the Aerodrome Environs and Sanitary Protection Zone.

• The sixth subzone –on the boundaries established at a distance of 15 kilometers from the control point of the aerodrome, in which it is prohibited to place facilities that contribute to attraction and mass aggregation of birds;

Such facilities include waste landfills, livestock farms, slaughterhouses, etc.

- The seventh subzone on the boundaries established according to the calculations, taking into account the following factors:
  - electromagnetic exposure of radio aids to aircraft flight support and aeronautical telecommunication means;
  - air pollution and noise exposure due to take-off, landing and maneuvering of aircrafts in the vicinity of the aerodrome.

### 6.13. Ecosystem Services

#### 6.13.1.Introduction

The key challenge in environmental and social impact assessment is the difficulty in assigning an economic or monetary value to the resources that are lost as a result of the development that is being assessed. Were it possible to assign a monetary value to these lost resources then it would be a straight forward exercise to assess and compare the benefits of the proposed development (in monetary terms) with the costs and to determine whether on balance the development would leave the area richer or poorer. One of the ways that has been developed to 'value' the environment is in respect of the services that are provided to humankind by the natural environment and these are referred to as 'ecosystem services (ESS)'. Ecosystem services offered by coherent and undisturbed ecosystems can be grouped into the following four categories:

- **Provisioning**, i.e. resources required to produce goods and services including food, water, and raw materials;
- **Regulating**, i.e. services the ecosystems provide by acting as regulators (assimilation of pollutants, regulation of climate and water regime, ozone layer and so forth);
- **Cultural**, i.e. recreation, aesthetic appreciation, spiritual, ethical, moral and historical values; and,
- **Supporting services** include soil formation, photosynthesis, chemicals and water cycling. By contrast to other categories of ecosystem services that offer direct benefits, supporting services have indirect impacts on human lives (while supporting services provide the basis for all ecosystems and their services, they can be recognised as a separate category).

In the assessment that follows the ESS provided by the terrestrial and freshwater ecosystems in the Project area are presented together with the ecosystem service users.

#### 6.13.2. Provisioning Ecosystem Services in the Project Area

**Provisioning services** of the Project area include a broad range of specific services associated with the traditional lifestyle of local communities – pastures, game animals and fish, forest-fare (berries and mushrooms and medicinal plants) and firewood.



### Natural pastures

The livelihood of local communities is based on reindeer husbandry. As such, local communities rely on the availability of natural pastures for their reindeer and there are different types of pastures as a function of the season. Reindeer herds winter in vast forest tundra valleys with chosenia groves up to the areas where they are replaced with the dwarf Siberian pine communities. In spring, the reindeer migrate to calving grounds located on gentle slopes where cotton grass is available. In summer, they move to open spaces in the mouths of rivers. In autumn, reindeer graze on the upland lichen tundra pastures where they also eat snow to meet their water requirements<sup>91</sup>.

## Forest fare

Forest fare includes harvests of various wild plants including berries (blueberry, crowberry, cowberry, and cloudberry), mushrooms (birch mushroom and aspen mushroom), and medicinal plants (cladonia, cetraria, blooming sally, and astragalus). Yields in Chukotka include up to 0.5 kg per ha, and cowberry up to 0.08 kg per ha. Given that at least five species of berries are found in Chukotka total productivity of berries would be 0.4 kg per ha.

#### Game

The Project area provides habitat for game including elk, wild reindeer, brown bear, wolf, glutton, white hare, fox, sable, ermine, willow ptarmigan and rock ptarmigan. Their habitats mainly span the floodplains and slopes (first terraces) covered by larch forest. Using the typical game densities per 1,000 ha<sup>92</sup> of the larger area beyond the Project area, numbers of each of these games types can be calculated for the 9,000 ha Project area at some 2,700 capita of game.

### Fish

Three salmon species were identified in the Peschanka, Yegdegkych and Baimka rivers - lenok, East Siberian grayling (the most common) and whitefish. The East Siberian grayling catch for the West Siberian Fishery District estimated from polls of local residents<sup>93</sup> in 2010 was about 49 tonnes.

#### Firewood

Larch, birch, and dwarf Siberian pine provide timber for the needs of local communities (e.g. the Burgakhchan Community). The age of the dwarf Siberian pine trees ranges from 50 to 70 years; they are 2 m high and 4 cm in diameter; with a forest stand density of 0.4 and forest capacity is classified as 5B. The growing stock is approximately 10 m<sup>3</sup>/ha<sup>94.</sup> Estimated volume of the Project area offered ESS is therefore 90,000 m<sup>3</sup>.

<sup>&</sup>lt;sup>94</sup> VNII-1. 2015. Report on the Assessment of Baseline Environmental Conditions and Environmental Component of the Peschanka Project Mining Feasibility Study. Assessment of the Natural Environmental Baseline. Volume 1. 0318-15-IEI.PZ. VNII-1 LLC. Magadan, 2015. Chapter 7.5.1.



<sup>&</sup>lt;sup>91</sup> Yu.N. Golubchikov. The Geography of the Chukotka Autonomous Okrug. M., IPC Remote Information and Cartography, 2003.

<sup>&</sup>lt;sup>92</sup> Letter from the Chukotka Autonomous Okrug Agricultural Policy and Nature Management Department of 09/07/2018 No. 12-10/896.

<sup>&</sup>lt;sup>93</sup> S.B. Baranov and Yu. A. Dyachkova. The Current State of Semi-Anadromous and Fluvial Fishery at Chukotka. / TINRO Bulletin, vol. 179. – Vladivostok, 2014.

# 6.13.3. Regulating Ecosystem Services in the Project Area

**Regulating services.** As the Project area consists of mainly undisturbed or slightly disturbed ecosystems such ecosystems provide important regulating services (contributing to the global-scale regulation of surface runoff and erosion prevention, greenhouse gases balance, climate stabilization and so forth).

### Greenhouse gases flux regulation

Flux regulation of carbon dioxide refers to the net result of positive (deposition) versus negative (emission) balance of the gas annually. Different ecosystems contribute differently to the balance with some being net sinks while others are net sources. Current estimates show that flux for tundra is about zero<sup>95</sup>. Whether tundra ecosystems absorb or emit carbon dioxide depends on vegetation, season, temperature fluctuations, level of soluble organic matter (labile soil carbon) in soil and others that collectively balance one another.

#### Carbon sequestration

Natural ecosystems sequestrate (remove and store) carbon from the atmosphere and that would apply to the Project area too. There are different estimates of the storage capability of tundra so a figure of 140 tonnes of organic carbon per ha for soil and vegetation has been assumed here. Each tonne of sequestered carbon is equivalent to 3.7 tonnes of atmospheric carbon dioxide, which on global markets has an average value of approximately 40 USD. The estimated monetary value of the ESS for carbon sequestration is presented in Table 27.

The Project area, ha	Quantity of carbon stored, tonne (area, ha x 180)	Quantity of carbon dioxide deposited, tonne (carbon, tonne x 3,7)	Cost of the carbon dioxide deposited, USD (CO <sub>2</sub> , tonne x 40 USD)
9,000	1,260,000	4,662,000	186,480,000

Table 27. Estimated cost o	of carbon dioxide s	sequestered by soil and	d vegetation of the	e Project area
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The ESS is offered locally but the benefit exists globally in limiting climate change. The monetary value of the carbon sequestration across the Project area is more than 186 million USD. This ESS is highly significant given the monetary value, but it must be recognised that it constitutes only 0.0044 % of total Russian tundra soil carbon stock<sup>96</sup>.

### Water runoff management

Water runoff is managed by ecosystems in two principal ways. The first of these is accumulation of precipitation and the second is preventing the damage that would otherwise occur in soil loss as a result of uncontrolled runoff. The Project area includes the catchments of the Peschanka, Pravaya Peschanka, Levaya Peschanka, and Yegdegkych River with its tributaries. This contribution is shown relative to other important river systems in the region as shown in Table 28.

<sup>&</sup>lt;sup>96</sup> Ecosystem Services of Russia, 2016.



<sup>&</sup>lt;sup>95</sup> Ecosystem services of Russia, 2016.

River basins	Average annual runoff, km <sup>3</sup>	Catchment area, km <sup>2</sup>	Runoff formation, m <sup>3</sup> /ha/year
Yegdegkych	0.03585	172.16	2,082
Bolshoy Anyuy	9.026	57,300	1,575
Kolyma	121	647,000	1,870

Table 28. Water runoff management as an ecosystem service in the Project area (the YegdegkychRiver) compared to other river systems in the region

In spite of high value of specific runoff in relation to the larger catchments into which it flows the Yegdegkych catchment runoff is very small; its contribution is about 0.4% of Bolshoy Anyuy runoff and 0.03% of Kolyma runoff<sup>97</sup>. As such the ESS is of importance only to the Yegdegkych catchment.

## Soil erosion prevention

Soil, which is a critically important component of all terrestrial ecosystems, is prevented from being eroded by water and wind by the ecosystems themselves and the vegetation in particular. The ecosystems also serve to accumulate the runoff and recharge groundwater with that runoff. Accordingly, this ESS could be estimated by comparing the size of the area that has been transformed by anthropogenic activities to the untransformed land in the area. For the Yegdegkych catchment (which includes the Project area) that is some 383 ha of transformed area compared to the 17,216 ha that is untransformed (97.8% of the area). The ESS is deemed important and valuable for the Project in issues such as preventing landslides that would otherwise present a safety risk. The ESS is limited though to that function specifically for the project but has much wider value to the ecosystems and their intrinsic value. The relative loss of the ESS as a result of the transformation brought about by the Project is considered negligible given the relatively small area that would be transformed.

# 6.13.4. Social and Cultural Services of Local Ecosystems

Social and cultural services of ecosystems in the area are largely limited to local people (i.e. the Burgakhchan Community). Although the area has the potential to develop adventure tourism due to its rich hunting resources and highly picturesque landscape<sup>98</sup> such potential is seriously counteracted by the extreme remoteness and difficult access to the Project area.

### 6.13.5. Supporting Services

The importance of supporting systems provided by ecosystems in the study area lies in the pristine nature of these ecosystems. The ecosystems play an essential role in the global cycling of elements and serve as a geochemical barrier to pollution with their slow and seasonally inactive natural destruction processes<sup>99</sup>. In addition, the undisturbed condition

 <sup>&</sup>lt;sup>98</sup>Based on interviews with local experts and data on availability of special packages for adventure tourists.
<sup>99</sup> P.Kh. Zaydfudim, S.N.. Goluvchikov. Introduction to the Russian North Studies. – Moscow, Art-Paper Print, 2003.



<sup>&</sup>lt;sup>97</sup> Census of Small Water Bodies of Russia. Available at <u>https://water-rf.ru/</u>.

and remoteness of these ecosystems make them a reliable place of refuge for many wild species of plants and animals.

### Supporting biodiversity and genetic resources

The importance of the biodiversity in the area is that it is key to ecosystem sustainability and the continuation of the ESS provided by that biodiversity. In addition, the biodiversity also sustains natural genetic resources especially those of typically rarer plants and animals and more specifically 'evolutionary significant units'.

Landscapes (Arctic-mountain desert and tundra on flat tops, larch forest tundra (on slopes of the valleys) and river valley bottom areas) form ecosystem bases for sustaining biodiversity in the larger Project area. There are some 251 plant species, 40 bird species, and 12 species of mammals. Compared to the entire Chukotka Autonomous District (64 mammal and 220 bird species) the Project area contains 18% of the biodiversity although it occupies only 0,0124% of the district area. Freshwater fauna includes 10 zoobenthic species and groups in the area watercourses including *Ephemeroptera*, *Plecoptera*, and *Trichoptera* species as well as *Oligochaeta* and *Chironomidae*. Three species of fish were identified constituting 5% of Chukotka fish diversity.

Rare and protected animals, which occur in the Project area,<sup>100</sup> include one mammal and seven bird of prey species. Also, according the Chukotka Red Data Book the Bolshoy Anyuy and its tributaries provide habitat for one rare fish species (*Cottus poecilopus*). No rare or protected plant and animal species listed in the RF and Chukotka Red Data Book have been recorded in the area during field surveys. The associated ESS are nevertheless important regionally in sustaining biodiversity.

### 6.13.6.Beneficiaries of Ecosystem Services in the Project Area

Based on the stakeholder analysis, the following beneficiaries of ecosystem services have been identified in the Project area:

- **The Burgakhchan Community:** the community use the ESS of extensive reindeer pastures, which has very high significance for the continuation of the traditional lifestyles, maintained by this community. There is no such demand for the ESS in the Project area.
- **Bilibinsky Municipal District residents:** the district residents benefit from the ESS of fish, fresh water, wild plant harvesting, hunting resources and so forth. These ESS contribute to the wellbeing of local communities (including the Burgakhchan) community and has a high significance for such communities. While communities living far from the area show little demand for these services, the situation may change in the future when the availability of good-quality roads makes them more accessible. There is no such demand for the ESS in the Project area other than from personnel on the mine, which should be very carefully managed to prevent poaching.
- Local authorities: Local authorities are probably better thought of as custodians of the ESS rather than users necessarily and bear the responsibility for ensuring that

<sup>&</sup>lt;sup>100</sup> Letter of Animal Life Conservation and Management Division of the Chukotka Autonomous Okrug Department of the Industrial and Agricultural Policy of 09.07.2018 No. 12-10/896.



the ESS are sustained due to the importance of these services for their constituents. At the same time, hunting tourism, while being a source of revenue for the local budget, is weakly developed and therefore has a minor significance for the local economy;

- **Proposed Project/Project sponsor:** As the Project will be an active user/consumer of ecosystem services (water, soil, vegetation and possibly local food products), the significance of these services is considered to be high for these users.
- **RF citizens:** The ESS in the Project area are very rarely used by the residents of other regions of the country implying that the significance of such services is therefore little to none for this stakeholder group;
- World population: The regulating and supporting services of local ecosystems including carbon fluxes, global nutrient cycling and maintenance of genetic diversity play a massive significant role in maintaining the stability of the global biosphere. That importance notwithstanding the significance of these services within the area affected by the Project is considered negligible for these users.

A summary of ecosystem services for the Project area is provided ANNEX 2.

## 6.14. Climate Change

## 6.14.1. Introduction

An assessment of environmental and social impacts cannot be considered complete without reviewing implications of a development for climate change and highlighting how climate change may impact, over time, on the proposed development itself. The best possible introduction to the topic of climate change within this ESIA is to present the key findings of the Intergovernmental Panel on Climate Change's (IPCC) (the United Nations body for assessing the science related to climate change) Fifth Assessment Report (AR5) which was published in 2014. AR5 contains the following key findings in respect of the current status of climate change and what is causing such change viz. (Observed changes and their causes (Topic 1)). These findings are<sup>101</sup>:

- Human influence on the climate system is clear, and recent anthropogenic emissions of green-house gases are the highest in history. Recent climate changes have had widespread impacts on human and natural systems.
- Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, and sea level has risen.
- Anthropogenic greenhouse gas emissions have increased since the pre-industrial era, driven largely by economic and population growth, and are now higher than ever. This has led to atmospheric concentrations of carbon dioxide, methane and nitrous oxide that are unprecedented in at least the last 800,000 years. Their effects, together with those of other anthropogenic drivers, have been detected

<sup>&</sup>lt;sup>101</sup> IPCC. 2014. Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, 151 pp.



throughout the climate system and are extremely likely to have been the dominant cause of the observed warming since the mid-20th century.

- In recent decades, changes in climate have caused impacts on natural and human systems on all continents and across the oceans. Impacts are due to observed climate change, irrespective of its cause, indicating the sensitivity of natural and human systems to changing climate.
- Changes in many extreme weather and climate events have been observed since about 1950. Some of these changes have been linked to human influences, including a decrease in cold temperature extremes, an increase in warm temperature extremes, an increase in extreme high sea levels and an increase in the number of heavy precipitation events in a number of regions.

It is against this backdrop that the baseline status of climate change is presented for the study area together with forecasts of how these changes would continue into the future.

# 6.14.2. Climate Dynamics and Regional Trends in the Study Area

Roshydromet (the Russian Federal Service for Hydrometeorology and Environmental Monitoring) has determined trends in temperature and precipitation throughout Russia over the past 40 years. From that data it can be seen that in the Bering Strait area, the average annual temperature from 1976-2018 increased by 2.5-3.0°C, while the average winter and autumn temperatures increased by about 4.0°C, spring by less than 3.0°C, and summer by less than 2.0°C. There have been no statistically significant changes in precipitation during the same period for all seasons.

The Roshydromet Climate Center forecasts that temperatures will continue to rise. In the period 2011-2030 the average winter and autumn temperatures in Chukotka AO are predicted to be 1-3°C higher than in 1981-2000 and the average summer and spring temperatures are predicted to be 0.7-2.5°C higher. By the middle of the century (2041-2060), the average winter and autumn temperatures are forecast to be 5°C higher than the last 20 years of the 20th century, and some 3°C higher in summer and spring. Much stronger warming is projected for the end of the 21 century. According to the maximum global greenhouse gas emissions scenario (RCP 8.5), winter and autumn average temperatures are forecast to be some 7-15°C higher than the end of the 20<sup>th</sup> century. Under the Minimum Emissions Scenario (RCP 4.5), the temperature rise in the second half of the century is obviously forecast to be far less severe.

Precipitation is also forecast to increase over time. Under the scenario of minimum global greenhouse gas emissions (RCP 4.5), total (solid and liquid) precipitation is projected to increase by 0.5 mm per day in the autumn. Under the maximum emissions scenario, by the end of the century that increase may be as high as 0.9 mm per day. Atmospheric water vapour is also predicted to increase. In general, climate change forecasts indicate that Chukotka would become progressively warmer and wetter into the 21<sup>st</sup> Century.

The consequences of climate change for Russia as a whole were considered in the Second Assessment Report of Roshydromet. A number of such consequences will be characteristic of what is forecast for the Arctic, including of course the Chukotka AO. Among these consequences are increased atmospheric water content resulting in increased river flows, especially in winter, thawing of permafrost, resulting in slight increase in methane emissions, accelerated vegetation growth, including afforestation of the tundra and



increased soil respiration, leading to increased carbon emissions and reductions of carbon reserves in soils.

Importantly, as the climate changes, carbon dioxide emissions of forest ecosystems are expected to increase by about 15%. This increase is due to the fact that as increases in temperature and humidity would result in accelerated mineralization of organic substances in soil. At the same time, however, those same conditions would stimulate the growth of vegetation, increasing carbon sequestration. As such it is expected that as the Chukotka tundra is gradually overgrown with forest, the balance will shift towards a small carbon sink.

A more informative forecast of the effects of climate change is determining the frequency and strength of temperature and precipitation anomalies, in particular, how many times in a given decade, winter or autumn will be by 5°C or even 10°C warmer than at the end of the 20th century. Such a forecast is currently being developed and would ultimately provide a more specific expression of the risks and possible damage from climate change.

## 7. SOCIO-ECONOMIC BASELINE

## 7.1. Chukotka Autonomous Okrug

## 7.1.1. General Information

The Chukotka AO (Chukotka) is a constituent member of the Russian Federation. Geographically, it occupies the most northeastern part of Eurasia including the Chukotka Peninsula (washed by the East Siberian Sea, Chukchi Sea, and Bering Sea), part of the mainland and the islands of Wrangel, Herald, Kruzenshtern, Ratmanov, Aion and others (Figure 2).

The entire area of the Chukotka AO is part of the Far North whose residents are entitled to special privileges to compensate for the hardship of living in extreme climatic conditions. The administrative centre of the Chukotka AO is based in Anadyr located at the mouth of the Anadyr River where it forms an estuary (Anadyrsky Liman) connected to the Bering Sea. Anadyr has a population of 15,639 people<sup>102</sup>. Chukotka is administratively divided into the following six administrative units (in descending order in terms of area): Anadyrsky, Bilibinsky, Chukotsky Municipal Districts, and Pevek, Providensky, and Egvekinot Urban Districts.

In the beginning of 20<sup>th</sup> century on the Chukotka Autonomous Okrug territory gold deposits were found and since then extensive mining activities began in the area with many placer and lode gold deposits explored and developed. The Russian-American Company (RAC) was established in the early 19<sup>th</sup> century to colonize the area with activities continuing till 1867 when Alaska was sold to the USA. GULAG prisoners were also used to exploit the mineral wealth during the Soviet era.

http://habstat.gks.ru/wps/wcm/connect/rosstat\_ts/habstat/ru/municipal\_statistics/chukot\_stat/main\_indica\_tors/



<sup>&</sup>lt;sup>102</sup> Federal Service on State Statistics, Department for the Khabarovsk Kray, Magadan Oblast, Yevreyskaya Autonomous Oblast, and Chukotka Autonomous Okrug. 2019. Preliminary Population figures for Chukotka Autonomous Okrug and its Municipalities as of 01/01/2019. Available at:

# 7.1.2. Infrastructure and Human Settlements

There are five urban settlements and a number of rural settlements in Chukotka. Municipal services including water, sewerage and heating are widespread but obsolete and derelict. The majority of people live in apartment blocks. Drinking water quality is poor despite abundant water resources in the region.

# 7.1.3. Energy Sector

Chukotka AO's energy system in its present form is a technically isolated territorial system which has no connection with other regional energy systems of the Russian Federation. It comprises three energy hubs, which operate independently of each other – Chaun-Bilibinsky, Anadyrsky and Egvekinotsky energy hubs (Figure 45).



Figure 45. Chukotka 's power system<sup>103</sup> with planned facilities

The total energy output of major power generating facilities in Chukotka is about 256.65 MW. Part of the energy produced in Chukotka is currently supplied to Yakutia. However, a plan to phase out the existing power generation units at the Bilibinskaya Nuclear Power Plant (NPP) in 2019-2025, along with the construction of large mine and processing plants including those within the Baimka License Area, Kekura and so forth.), is expected to create an electricity supply deficit. The existing Energy Bridge Project will address this issue by connecting two isolated energy systems of the Magadan Region and Chukotka AO (Figure 46). In addition, it is planned to develop the Bilibinsky Energy Centre comprising the Bilibinskaya Thermal Power Plant (TPP) (whose design capacity is 24 MW of electricity and 83.2 MW of heat).

<sup>&</sup>lt;sup>103</sup> Chukotka is Open to the Pacific Region and the Rest of the World. Information Brochure. – Anadyr, 2015.



The Energy Bridge and Bilibinsky Energy Centre Projects will provide capacity required to replace the retiring power generation units at the Bilibinskaya Nuclear Power Plant (NPP) and meet energy demands of the Peschanka Copper Project and other mining operations.



Figure 46. The schematic plan of the energy bridge connecting the Magadan Region and Chukotka<sup>104</sup>

# 7.1.4. Transport and Communication Infrastructure

Chukotka's transport system comprises air, maritime, and road transport. Its important distinction is the absence of railroads. Chukotka has 8 airports that are part of the Aeroporty Chukotki Federal Treasury Enterprise (Beringovsky, Zaliv Kresta, Keperveyem, Lavrentiya, Markovo, Pevek, and Provideniya). The airport in Pevek has a paved runway and operates regular flights to Moscow, Khabarovsk, Magadan, district centres and ethnic rural communities in Chukotka. Two airports (Anadyr and Provideniya) operate international flights. In addition, there are seven runways of local significance.

<sup>&</sup>lt;sup>104</sup> Chukotka is Open to the Pacific Region and the Rest of the World. Information Brochure. – Anadyr, 2015.



There are 5 seaports in Chukotka (Anadyr, Beringovsky, Pevek, Provideniya, and Egvekinot). Cargo ships transport goods both eastward and westward; eastward is the dominant direction. There is no reliable road transport system with paved road network in Chukotka. The paved road density is 2.5 km per 1,000 km<sup>2</sup>, which is 13 times less than the country average. The total length of regional motor roads is 2,813.5 km with only 544.6 km being all-season roads with basic paving.

The ongoing road construction and renovation project covering the Kolyma-Omsukchan-Omolon-Anadyr sections is funded by the federal government. The Omolon-Anadyr component of this project lies within Chukotka and includes the construction of access roads to Bilibino, Komsomolsky and Egvekinot. The implementation of this project will provide a reliable road transport connection linking the Baimka License Area with human settlements and logistic centres.

### 7.1.5. Demography

#### Historical changes in population growth

During the Soviet era, the Chukotka population showed rapid growth, followed by a dramatic population decline in the first post-Soviet years due to large-scale migration to other regions of Russia. The rural population has also decreased dramatically (Table 29).

Year	Population	Percentage Change			Percentage of the Total Population				
			Urban	Rural	Urban	Rural			
1897	12,900	-	-	12,900	-	100			
1926	13,500	104.6	-	13,500	-	100			
1939	21,456	158.9	3,256	18,200	15.2	84.8			
1959	47,231	219.7	26,960	20,271	57.1	42.9			
1970	103,235	218.7	70,933	32,302	68.7	31.3			
1979	139,944	135.6	96,356	43,588	68.9	31.1			
1989	163,934	117.2	118,986	44,948	72.6	27.4			
2002	53,824	32.8	35,869	17,955	66.6	33.4			
2010	50,526	93.9	32,734	17,792	64.8	35.2			

Table 29. Population statistics based on the historical census data<sup>105</sup>

# Current population structure (urban/rural, gender and age)

As of 2019, the population of the Chukotka AO was 49,663 people with the Chukotsky municipal district being made up only of rural dwellers including nomadic reindeer herders (Table 30). Unlike the rest of Russia, men outnumber women in Chukotka (Table 31).

http://habstat.gks.ru/wps/wcm/connect/rosstat\_ts/habstat/ru/statistics/chukot\_stat/population/.



<sup>&</sup>lt;sup>105</sup> Federal Service on State Statistics, Department for the Khabarovsk Kray, Magadan Oblast, Yevreyskaya Autonomous Oblast, and Chukotka Autonomous Okrug. 2019. Population // Official Statistics for Chukotka Autonomous Okrug. Available at

Estimated Permanent Population Number as	Total Number	Including:			
of 1 January 2015	(People)	Urban	Rural		
Chukotka AO	49,663	35,193	14,470		
Urban District – Anadyr Town	16,338	15,849	489		
Anadyrsky Municipal District	8,161	4,531	3,630		
Bilibinsky Municipal District	7,379	5,319	2,060		
Egvekinot Urban District (Iultinsky Municipal District before 2016)	5,038	3,276	1,762		
Providensky Urban District (Providensky Municipal District before 2016t)	3,678	2,165	1,513		
Pevek Urban District (Chaunsky Municipal District before 2016)	5,038	4,053	985		
Chukotsky Municipal District	4,031	-	4,031		

	Table 30.	Estimated	number o	f urban	and rural	population	as of	f <b>1/01/2019</b> <sup>106</sup>
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Table 31.	Gender an	d Aae	Structure o	f Po	pulation	(2014	)107
TUDIC JI.	ochaci an	u nge	Structure of	,,,,	pulation		/

Year	Total Popu	lation	Urban		Rural			
	Male Female			Female	Male Female			
Total population	25,737	24,818	17,443	16,667	8,294	8,151		
Number of Population in the Following Age Categories:								
Below the working age	5,761	5,495	3,331	3,192	2,430	2,303		
Working age <sup>1)</sup>	18,206	15,073	12,873	10,477	5,333	4,596		
Above the working age	1,770	4,250	1,239	2,998	531	1,252		

<sup>1)</sup> 16-59 years for men and 16-54 years for women

### Ethnic composition

Russians (49.6%) and Chukchi (25.3%) dominate the Chukotka population, followed by Ukrainians (5.7%). According to the latest census data, the following indigenous minorities of the North are present in the region: Eskimo (3%), Even (2.8%), Chuvan (1.8%), Yukaghir (0.4%), and Koryak (0.1%) (Table 32).

http://habstat.gks.ru/wps/wcm/connect/rosstat\_ts/habstat/ru/statistics/chukot\_stat/population/.



<sup>&</sup>lt;sup>106</sup> Federal Service on State Statistics, Department for the Khabarovsk Kray, Magadan Oblast, Yevreyskaya Autonomous Oblast, and Chukotka Autonomous Okrug. 2019. Preliminary Population figures for Chukotka Autonomous Okrug and its Municipalities as of 01/01/2019. Available at:

http://habstat.gks.ru/wps/wcm/connect/rosstat\_ts/habstat/ru/municipal\_statistics/chukot\_stat/main\_indica\_tors/.

<sup>&</sup>lt;sup>107</sup> Federal Service on State Statistics, Department for the Khabarovsk Kray, Magadan Oblast, Yevreyskaya Autonomous Oblast, and Chukotka Autonomous Okrug. 2019. Population // Official Statistics for Chukotka Autonomous Okrug. Available at

Table 32.	. Ethnic	Composition	of Chukotka	Population	(Only	Groups	Accounting	for	Over	1%	of
Total Population) Based on the 2010 Census <sup>108</sup>											

Ethnic Group	Number of People	As a Percentage of Total Population. %	As a Percentage of Those Who Indicated the Ethnicity. %	
Total	50,526	100.00		
People who indicated their ethnicity	47,756	94.52	100.00	
Russians	sians 25,068 49.61		52.49	
Chukchi	hukchi 12,772		26.74	
Ukrainians	2,869	5.68	6.01	
Eskimos	1,529	3.03	3.20	
Evens (Lamuts)	1,392	2.76	2.91	
Chuvans	897	1.78	1.88	
Other	608	1.20	1.27	

### Population growth/decline due to natural causes and migration

Following the large outmigration during the first post-Soviet decade (ca. 76%), Chukotka has since sustained population growth, which is also atypical for Russia.

### 7.1.6. Population Health and Disease Incidence

Disease incidence rates are generally very high in Chukotka. Communicable disease incidence rates for the Chukotka AO are compared to the country's average rates inTable 33. Tuberculosis rates are very high while HIV and syphilis rates appear to the relatively low thought to be as a result of strict control of migrant workers.

Table 33. Socially significant disease incidence rates	109

Socially Significant Disease Incidence Rates per	Chuko	otka AO	RF	
100.000 People	2014	2015	2014	2015
Newly detected active tuberculosis cases	136.5	156.3	59.4	57.8
Total number of registered individuals with active tuberculosis	324.5	332.4	137.3	129.3
Newly detected HIV-positive individuals	33.6	37.6	63.3	68.5

<sup>&</sup>lt;sup>108</sup> ChAO Demography // Wikipedia. Available at

<sup>&</sup>lt;sup>109</sup> Socially Induced Diseases among Russia's Population in 2015 (Statistic Data): RF Ministry of Health and FGBU Central Scientific Research Institute for Healthcare System Management and Information Support. Moscow 2016.



https://ru.wikipedia.org/wiki/%D0%9D%D0%B0%D1%81%D0%B5%D0%BB%D0%B5%D0%B5%D0%BD%D0%B8%D0%B5 %D0%A7%D1%83%D0%BA%D0%BE%D1%82%D1%81%D0%BA%D0%BE%D0%B3%D0%BE %D0%BD%D0%BE%D0%BD%D0%BE%D0%BC%D0%BD%D0%BE%D0%B3%D0%BE D1%83%D0%B3%D0%B0.

Socially Significant Disease Incidence Rates per	Chuko	otka AO	RF	
100.000 People	2014	2015	2014	2015
Including children of age 0-17	-	-	4.5	4.7
Syphilis	7.9	15.8	25.0	23.5
Malignant tumours	330.4	271.1	387.6	402.9

# 7.1.7. Employment and Unemployment

Employment rates in Chukotka AO have been consistently high and indeed, higher than Russia's average rate (64.8% in 2013) (Table 34). Female employment rates are somewhat lower than those among men Apart from low population density, weak migration within the region and so forth, one of key issues faced by the regional labour market is a shortage of qualified staff<sup>110</sup>. State budget-funded enterprises and mining industries are key employers in the region (

Table 35).

Table 34. Labour force participation rate, employment and unemployment rates in the 15–72 agegroup as of January 2015<sup>111</sup>

	nically Population	Including		nically Population	Force Dation Rate	Employment Rate, %	Unemploymen t Rate, %	
	Econon Active I	Employed	Unemplo yed	Econon Active I	Labour Particip			
Total	32,734	31,766	968	6,697	83.0	80.6	3.0	
Male	17,237	16,511	726	2,883	85.7	82.1	4.2	
Female	15,497	15,255	242	3,814	80.3	79.0	1.6	

Table 35. Number of employees by sector in May 2015 (people)<sup>112</sup>

Total	27,226
Agriculture, hunting and forestry	1,302
Fisheries and fish farming	50
Mining	5,266
Processing industries	272

<sup>&</sup>lt;sup>110</sup> Kulik I.N. 2012. Issues Affecting the Development of the Regional Labour Market in Chukotka Autonomous Okrug // Issues of Economics and Law. 2012. No. 5. P. 47–50. Available at: <u>http://law-journal.ru/files/pdf/201205/201205\_47.pdf</u>.

<sup>&</sup>lt;sup>111</sup> Federal Service on State Statistics, Department for the Khabarovsk Kray, Magadan Oblast, Yevreyskaya Autonomous Oblast, and Chukotka Autonomous Okrug. 2019. Official Statistics for Chukotka Autonomous Okrug. Available at https://habstat.gks.ru



Total	27,226
Electricity, gas and water generation and distribution	3,422
Construction	466
Wholesale and retail trade; repair of vehicles, motorcycles, home appliances and personal appliances	1,673
Hotels and restaurants	311
Transport and communications	2,652
Financial sector	408
Real estate operations and services	1,104
State governance, military security; social insurance	4,350
Education	2,899
Healthcare and social services	2,296
Other communal, social and individual services	755

## 7.1.8. Economy

# Gross regional product and key sectors of regional economy

Mining is a core sector of the regional economy while indigenous people are engaged in traditional crafts and activities. The Chukotka AO has amongst the highest gross regional product (GRP) per capita after the oil-producing Tyumen and Sakhalin regions, with gold mining being especially prominent (the Chukotka AO has about 10% of Russia's gold reserves). The largest industrial enterprises in the Chukotka AO<sup>113</sup> are depicted in Figure 47. Enterprises engaged in reindeer husbandry and marine mammal hunting receive subsidies as do other food producers.

<sup>&</sup>lt;sup>113</sup> RF Ministry of Industry and Trade 2015. Chukotka Autonomous Okrug Passport. Available at. <u>http://minpromtorg.gov.ru/common/upload/files/docs/pasregions/5\_12\_CHukotka.pdf</u>





Figure 47. GRP (mln rubles), 2006 - 2012 for the Chukotka AO<sup>114</sup>

# Living standards

### Wages and salaries

Apart from the financial sector, the highest wages are paid to state employees where even in the mining sector, wage levels are often lower than in the public sector. Other sectors where higher than average wages are paid include transport and communications, power and water supply, fisheries and fish farming. Despite state subsidies, agricultural workers are among the lowest paid employees in the region.

### Household incomes and expenditures

Incomes and expenditure have grown relatively steadily, notwithstanding a small decline in 2014 over the last several years. The average disposable income (mainly received in the form of cash income) grew across all households from 18,400 Roubles in 2009 to 26,700 Roubles in 2014 with urban residents enjoying generally more disposable income than those in rural areas.

<sup>&</sup>lt;sup>114</sup> Federal Service on State Statistics, Department for the Khabarovsk Kray, Magadan Oblast, Yevreyskaya Autonomous Oblast, and Chukotka Autonomous Okrug. 2019. Official Statistics for Chukotka Autonomous Okrug. Available at https://habstat.gks.ru



# 7.1.9. Cultural Heritage

In Chukotka AO, archaeological sites constitute the overwhelming majority of historical and cultural heritage sites that are protected by the state. Overall, 249 historical and cultural monuments (including 144 archaeological heritage sites) have been registered in the Chukotka AO, with 87 having state protection status (data as of 2001).

## 7.2. Bilibinsky Municipal District

### 7.2.1. General Information

The Bilibinsky Municipal District, established in 1930 is the second largest district in Chukotka, occupying 174,652 km<sup>2</sup> or 23.7% of the region's total area (Figure 48); it has a population density of 0.043 people per km<sup>2</sup>. The administrative centre of the Bilibinsky Municipal District is Bilibino Town located in the Bolshoy Keperveyem River valley. Bilibino and Keperveyem rural settlement were merged into the Bilibino Urban District with the administrative centre in Bilibino.



Figure 48. Bilibinsky Municipal District

The Bilibinsky Municipal District is rich in mineral resources including lode and placer gold, silver, and platinum group metals. A number of promising deposits of tin, zinc, copper, antimony, tungsten, mercury, lead, and coal have been discovered. Key industrial sectors are mining (gold mining) and electricity generation (Bilibino NPP), while the agricultural sector is made up of reindeer hunting, fisheries, and greenhouse farming. The Bilibino NPP became operational in 1976 and is the first and the only nuclear power plant built within the Polar circle in the permafrost zone. The NPP is in the centre of the isolated Chaun-Bilibinsky energy system, accounting for 75% of its electricity generation. The Bilibinsky Municipal District has 10 human settlements (Table 36).



Table 36.	Urban and rur	al settlements	in the Bi	ilibinsky i	Municipal	District as	of the	beginning	of
<b>2018</b> <sup>115</sup>									

No.	Urban and Rural Settlements	Administrative Centre	Number of Settlements	Population
1	Bilibino Urban Settlement	Bilibino Town	2	5560
2	Anyuysk Rural Settlement	Anyuysk Village	1	396
3	Ilirney Rural Settlement	Ilirney Village	1	252
4	Omolon Rural Settlement	Omolon Village	1	785
5	Ostrovnoye Rural Settlement	Ostrovnoye Village	1	376
6	Area lying between the settlements		4	

#### 7.2.2. Demography

As of 1 January 2018, the permanent population in the Bilibinsky Municipal District was 7,369 with 5,292 residing in urban areas, and 2,077 people in rural areas (Table 37). The District's population showed positive natural growth in 2014 when the number of births exceeded the number of deaths by 9. The average age is 33.3 years (32.8 years for men and 33.9 years for women).

Table 37. Bilibinsky Municipal District population dynamics in 2002 – 2018<sup>116</sup>

	Year									
	2002	2010	2012	2013	2014	2015	2016	2017	2018	
Population, people	8,820	7,866 ₪	7,801 لا	7,738⊻	∕77,855	7,825 ⊾	7,609 ⊾	7,464 ⊿	7,369 ⊾	

### 7.2.3. Ethnic Composition

The Bilibinsky Municipal District is home to 43 ethnic groups with Russians being the largest group accounting for 60% of the total population and indigenous Chukotka people (Chukchi, Evens, Yukaghirs and so forth) accounting for 20%. The remaining 20% include Ukrainians, Belarusians, Tatars and other ethnic groups. The Bilibinsky Municipal District is included in the list of areas where indigenous minorities live and maintain their traditional lifestyles in the Russian Federation<sup>117</sup>. Indigenous minorities account for 24.6% of the total population of the District. Traditional nature resource use practices include nomadic reindeer herding, fishing and hunting but overgrazing by unsustainable reindeer numbers has denuded large parts of reindeer pastures in the District.

<sup>&</sup>lt;sup>117</sup> RF Government Resolution of 08/05/2009 No. 631-r. On Approval of the List of Areas Traditional Residence and Economic Activities of Small-Numbered Indigenous Peoples of the Russian Federation and the List of Their Traditional Economic Activities.



<sup>&</sup>lt;sup>115</sup>Federal Service on State Statistics, Department for the Khabarovsk Kray, Magadan Oblast, Yevreyskaya Autonomous Oblast, and Chukotka Autonomous Okrug. 2019. Municipal Statistics for Chukotka Autonomous Okrug. https://habstat.gks.ru/folder/23556.

<sup>&</sup>lt;sup>116</sup> Bilibinskiy Municipal District. Available at <u>https://ru.wikipedia.org/wiki/Билибинский район</u>.

## 7.2.4. Population Employment

As of 1 January 2017, the number of economically active people in the District was 4,423 people, or 59.3% of the total population. Some 4,291 people are employed and of the 132 unemployed persons 107 (2.4% of the economically active population) are officially registered with the employment service.

The peculiarity of the district is the difficult transportation links between the settlements and limited access to communication services (Internet, mobile communication). In this regard, the mechanism of employment through the public employment centre (PEC) is the only one really operating in the district. According to the Head of the Bilibinsky Department of Inter-District Employment Center, there is a problem of hidden unemployment and hidden employment in the district. As of October 27, 2019, 115 job seekers were registered in the district, of which 87 are qualified as unemployed. Of these, 18 people are under the age of 30 and 10 people are of pre-retirement age.

According to the last place of employment, among the unemployed, 14 people are workers in agriculture, forestry, hunting, fishing and fish farming, 4 mining workers, 6 energy workers, 18 transport workers, 7 construction workers, 9 trade workers.

In the Bilibinsky district, 66 vacancies were submitted to the PEC, including 12 medical workers, 9 engineers, 3 district inspectors, 2 machine operators, 5 locksmiths, 2 turners, 12 electricians, 1 carpenter and 2 workers.

The PEC provides vocational training and retraining services to the applicants on the basis of the college operating in the district, as well as remotely via the Internet. As of October 27, 2019, a recruitment for professional training in the specialties of a computer operator, procurement agent, document controller, salesperson, social worker, as well as additional education in the specialties of HR records management, accountant, 1C, procurement management, was opened in the Bilibinsky Department of PEC. The PEC inspectors work in all settlements of the district, who are in constant contact with the unemployed and job seekers, provide them with information on available vacancies and vocational training opportunities.

According to the Head of Bilibinsky Department of Inter-District Employment Center, the problem of the district is the gradual loss of existing professional skills by the unemployed in the absence of work experience. The PEC management sees opportunities for attracting the local population to work in the projects implemented in the Bilibinsky district in advance informing the PEC of future vacancies, so that the PEC has the opportunity to train personnel: provide professional training, advanced training and retraining.

### 7.2.5. Industry and Agriculture<sup>118</sup>

The Bilibinsky Municipal District is among the most economically developed districts in Chukotka AO with key economic activities including upgrading energy and transport infrastructure to support mining. Key industrial sectors in the District are mining, electrical power, food processing; and agriculture (reindeer husbandry and crop farming). Russia's largest copper deposit is located on the boundary of the Bilibinsky and Anadyrsky Municipal Districts. All economic activities have exhibited growth in recent years.

<sup>&</sup>lt;sup>118</sup> Bilibinsky Municipal District Administration. 2019. District Economy: General Description // Bilibinsky Municipal District Administration official website. Available at <u>http://www.bilchao.ru/index.php?newsid=120</u>.



## 7.2.6. Budget<sup>119</sup>

The main budget expenditure is education (44.8%), followed by public utilities (22.0%) and national economy (15.1%). The socio-economic development indicators estimated for the Bilibinsky Municipal District over the past several years show that the economic situation has remained stable.

### 7.2.7. Public Health<sup>120</sup>

Medical care for the population of the Bilibinsky municipal district is carried out by the Interdistrict Medical Center (IMC) in Bilibino, which includes a district hospital with 105 beds, the outpatient clinics in Anyuysk and Omolon with 5 beds, 3 rural first aid stations in Ostrovnoye, Ilirney, Keperveyem. The district hospital is well-equipped, has modern equipment, the level of equipment is estimated by the Chief Medical Officer at 85-90%. The hospital has all the equipment necessary for diagnosis. CT, nuclear magnetic tomography, coronary angiography, angiography are absent in the hospital due to the inexpediency of creating departments for this equipment. However, in the district there is a need for specific medical equipment - mobile diagnostic unit.

The hospital is staffed by the medical personnel. Due to the poor transport accessibility of the district and the small number of population, medical specialists have several qualifications. Thus, of the narrow specialists, only an oncologist is missing in the district.

In the district there is an emergency department. It includes medical paramedic and paramedical teams. The department is fully staffed with personnel and equipped with vehicles. The rural population is served by cross-country vehicles, in case of acute illness or injury, air ambulance is available.

In Bilibino the ambulance reaches the patient in 7 minutes, in Keperveyem - 25 - 40 minutes. The air ambulance reaches Omolon in 3 hours and 1 hour is set to stabilize the patient's condition. Anyuysk, Ilirney and Ostrovnoye can be reached in 25-40 minutes. There is a communication by land transport only with Keperveyem and Anyuysk. Residents of the given villages are reimbursed for transportation costs if they reached the hospital on their own.

1-2 times a year, visiting teams of medical specialists arrive in the villages to conduct medical examinations and treatment. They see the patients in a local outpatient clinic or a rural first aid station, while the severe patients are seen at home. Children, as well as the maternity group (teachers, doctors, cooks, medical workers, cultural workers, administration) are subject to mandatory medical examination. The rest undergo medical examination at will. The dentist also visits the villages separately from the general team. He/she spends 1 to 2 weeks in each village for dental treatment.

### 7.2.8. Sickness rate

The sickness rate of the population tends to decrease. Thus, in 2016, the primary incidence was 10240 cases, and in 2018 – 8480 cases. The total incidence in 2016 was 14,356 cases, and in 2018 – 13,310 cases. The first place are diseases of the respiratory system, the

 <sup>&</sup>lt;sup>119</sup> Bilibinsky Municipal District Administration. 2019a. District Economy: General Description // Bilibinsky Municipal District Administration official website. Available at <u>h http://www.bilchao.ru/index.php?newsid=27</u>
<sup>120</sup> Bilibinsky Municipal District Administration. 2019b. Public Health and Healthcare // Bilibinsky Municipal District Administration official website. Available at <u>h http://www.bilchao.ru/index.php?newsid=23</u>.



second - injuries and poisoning, the third and fourth place are diseases of the genitourinary system and digestive organs. Among the causes of death, the first place is occupied by diseases of the cardiovascular system, the second – injuries and poisoning, the third place – neoplasms. Cases of treatment in the late stages of the disease (oncological) were recorded, as a result of which death occurred within a few months after treatment.

The situation with socially-caused diseases is estimated by the Chief Medical Officer of the district to be stable. The incidence of tuberculosis and hepatitis is at the level of the national average. Syphilis has not been registered in the area for the last 8 years. As of October 27, 2019, 8 people with HIV infection are registered in the district, in 2014 there were only 2 HIV-infected people in the district.

Quite a serious problem in the district is alcoholism. According to the characteristics of the Chief Medical Officer, the population of the district does not perceive alcoholism as a disease and, therefore, does not seek medical help. The narcologist is present as part of the visiting team of doctors, but in order to maintain the maximum available anonymity, he/she sees the patients in another room.

A feature of the region is a large number of shift workers. Due to the fact that shift workers arrive in the region from other climatic zones, in the North they have aggravated chronic diseases. This is especially relevant for workers whose specialty is related to physical labor and outdoor work.

# 7.2.9. Housing Assets

Housing assets in the Bilibinsky Municipal District had a total floor area of 286.2 thousand m<sup>2</sup>, including 242.2 thousand m<sup>2</sup> of housing located in Bilibino town (2012 figures) (Table 38). In the city of Bilibino housing assets are represented mainly by five- and nine-story houses, in villages it is one-time two-storied houses for one, two or four families. The housing today is generally in a state of disrepair.

Settlement	Total Floor	Floor Area	by Ownershi	р Туре	Total	Total	
	Area, m <sup>2</sup>	Municipal	State	Private	Occupied Housing Floor Area	Unoccupied Housing Floor Area	
Bilibino Urban S	Settlement						
m²	242,223.5	117,168.6	1,658.8	107,285	190,428.4	7,667.3	
%	100	48.4	0.1	44	х	3.2	
Rural Settleme	nts						
m²	44,011.2	35,684	-	4,979.3	40,663.3	3,374.7	
%	100	81		11	х	0.1	
Including:							
Ilirney	5,564.2	4,805.9	-	269.1	5,075	237.5	

Table 38. Bilibinsky Municipal District housing assets in 2012<sup>121</sup>

<sup>121</sup> Bilibinsky Municipal District Administration. 2012. Feasibility Study for the Proposed Bilibinsky Municipal District Spatial Planning Scheme. Volume 1. 2012. // Available at <a href="http://www.bilchao.ru/index.php?newsid=120">http://www.bilchao.ru/index.php?newsid=120</a>.



Settlement	Total Floor	Floor Area l	by Ownershi	р Туре	Total	Total		
	Area, m <sup>2</sup>	Municipal	State	Private	Occupied Housing Floor Area	Unoccupied Housing Floor Area		
Ostrovnoye	6,455.3	5,447.2	-	536.1	5,983.3	414.3		
Omolon	10,410	8,265.2	-	1,333	9,598.2	1,156.3		
Keperveyem	11,372.1	8,646.4	-	1,831.5	10,477.9	1,104.5		
Anyuysk	10,209.6	8,519.3	-	1,009.6	9,528.9	462.1		
Total in the District								
m <sup>2</sup>	286,234.7	117,168.6	1658.8	112,264.3	231,091.7	11,042		
%	100	40.9	0.6	39.2	x	3.9		

### 7.2.10. Education and Culture

There are 11 municipal budget-funded educational institutions in the Bilibinsky Municipal District, as well as the Central Library, Local History Museum, Hobby, Arts and Crafts Centre, and the BI-TV Television and a radio studio. As of 1 June 2016, the District had 47 identified archaeological sites of federal significance including ancient encampments and burial sites<sup>122</sup>.

#### 7.2.11. Traditional nature use

#### **Reindeer breeding**

The reindeer sector as a whole is in crisis and requires special attention from the government. Reindeer breeding in the Bilibinsky Municipal District is characterized by isolation from the sea, intercontinental location within the forest tundra landscapes and well-developed river systems (the Omolon, Bolshoy Anyuy, and Malyi Anyuy). The district is characterized by fine configuration of the pasture area limits and lack of large pasture areas (winter and summer pastures). Traditionally the areas of the district were used for reindeer breeding to a very limited extent and only at location where there were enough winter and summer pastures. For that reason, many reindeer collective farms were split into small farms during 1990s and later collapsed<sup>123</sup>. Currently the Bilibinsky Municipal District has four municipal reindeer farms producing reindeer meat. These are medium-sized business enterprises that base their activities on the traditional knowledge of the indigenous peoples of the region. All these farms receive support from the district administration and the regional government. Due to these measures the reindeer sector in the district is currently stable.

 <sup>&</sup>lt;sup>122</sup> Government of the Chukotka AO Resolution of 23/05/2013 On Approval of the Aggregated List of Cultural Heritage Sites of Federal, Regional, and Local Important within the Chukotka Autonomous Okrug (as amended on 01/06/2016). Available at <a href="http://docs.cntd.ru/document/424073084">http://docs.cntd.ru/document/424073084</a> (currently not in force).
<sup>123</sup> <a href="https://economics.studio/ekonomika-regionov/1631-faktoryi-slabosti-silyi-olenevodcheskih-44125.html">http://clabesti-silyi-olenevodcheskih-44125.html</a>.



## Fishing and hunting

The Bilibinsky Municipal District is the first district of the Chukotka AO where the areas of the traditional nature use may officially be registered as zones of special protection<sup>124</sup>. The first area of traditional nature use is planned to be created in the valley of the Alaya River near the Omolon Settlement (in about 200 km southwest of the Baimka License Area). The residents of the Omolon Settlement are traditional fishers and hunters, and it is planned to support fishing and hunting within the planned area of the traditional nature use.

### 7.2.12. Settlements nearby the Baimka License Area

The closest settlements located near the license area are Anyuysk, llirney, and Omolon villages.

#### Anyuysk Village

Anyuysk Village was founded in the lower reaches of the Small Anyuy River in the 1930s. Nomadic reindeer herders and hunters gradually switched to a settled way of life, forming two collective farms: the May Day and the New Life. In the early March of 1960, the Anyuysky state farm was formed on the basis of these two collective farms, with a central estate in the village of Anyuysk and a production site in the village of Pyatistenny, which is mentioned in the early 18th century. With the organization of a state farm in Anyuysk, the development of the rural settlement began. Comfortable houses and streets, a school, a kindergarten, and a boarding school were built.

Anyuysk is the administrative centre and the only settlement of the Anyuysk rural settlement<sup>125</sup>. The area of the rural settlement is about 2.83 sq. km. Its population is gradually declining and at present it is slightly less than 400 inhabitants. The data on population dynamics are presented inTable 39.

Year	1959	2002	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Population	858	542	499	483	480	475	472	468	459	457	434	412	396

Table 39. Anyuysk population dynamics<sup>126</sup>

Source: Wikipedia, 2019

The ethnic composition of the Anyuysk population is as follows<sup>127</sup>:

- The ethnic majority are Evens 55%,
- The Chukchi account for about 3% of the total,
- The Russians and other nationalities make up the remaining 42%.

 <sup>&</sup>lt;sup>126</sup> Wikipedia. 2019. Anyuysk Village // Wikipedia. Available at: <u>https://ru.wikipedia.org/wiki/Анюйск</u>.
<sup>127</sup> Bilibinsky Municipal District Administration. 2019. Urban and Rural Settlements // Bilibinsky Municipal District. Available at: <u>http://www.bilchao.ru/index.php?newsid=33.</u>



<sup>&</sup>lt;sup>124</sup> The Decree of the Chukotka AO Government of 30/05/2018 No. 195 On the Approval of the Provision on the Areas of Traditional Nature Use of Indigenous Peoples of the North, Siberia and the Far East of the Russian Federation living in the Chukotka Autonomous Okrug.

<sup>&</sup>lt;sup>125</sup> The boundaries of the rural settlement are determined by the Law of the Chukotka Autonomous Okrug of 29/11/2004 No. 43-OZ On the Status, Borders and Administrative Centers of Municipalities in the Bilibinsky Municipal District of the Chukotka Autonomous Okrug.

In the 1980s, a dairy farm for cattle was built at the state farm, providing dairy products for boarding school and village residents. At the state farm there were 7 reindeer herding teams. In 1986 the deer stock amounted at 18,890 animals.

Currently, the main occupations of local residents are reindeer husbandry and fishing, hunting and fur trade. The Ozernoye Municipal Agricultural Enterprise employing on the average 50 workers is based there. In 2012, the number of deer livestock at the enterprise amounted 8,200 capita. At present, such public facilities as an educational centre, a district hospital, a post office, a shop, a communications centre, a culture centre, a library, and a hotel with maximum capacity for 10 guests are operating at the settlement. The headquarters of the East Tundra Trade Office are established at Anyuysk, which is designed to provide all types of goods for surrounding national settlements.

The bird's-eye view of Anyuysk Village is presented in Figure 49below.



Figure 49. Aerial view of Anyuysk Village<sup>128</sup>

The educational center includes a secondary school for grades 1 - 9, 2 kindergartens for children under 4 years old and from 4 to 7 years old, and a boarding school.

As of October 26, 2019, 60 children were studying at the secondary school of Anyuysk. The school is 100% provided with textbooks, each student has a double set of textbooks – for work at home and in the classroom. Staffing is 100%. The school has a computer class, where 7 computers have Internet access. Wi-Fi is not available at the school due to student safety concerns.

<sup>&</sup>lt;sup>128</sup> Wikimapia. 2019. Rural settlement of Anyuysk // Wikimapia. Available hat: <u>http://wikimapia.org/10938553/ru/</u> Анюйск





Figure 50. Secondary school of Anyuysk



Figure 51. Classrooms of secondary school of Anyuysk

The school has 4 extended daycare groups for grades 2 - 4, as well as extracurricular activities. The first grade studies five days a week, and other grades - six days a week. School students receive hot meals for breakfast and lunch. Meals are free.



The school holds physical education classes. The shells are missing a beam, a buck, and Pbars. Physical education classes include games of volleyball, football, and basketball. Crosscountry skiing classes are held in the spring.



Figure 52. Gym of the secondary school of Anyuysk

After grade 9, children can continue their education in grades 10 and 11 in the schools of Bilibino and Keperveyem. The most talented go to a lyceum or college in Anadyr, where they can prepare for admission to the university. Graduates of such lyceums and colleges receive higher education in St. Petersburg, Khabarovsk, and Vladivostok. Graduates of the 9th grade capable of needlework and creativity enter Magadan College of Design or Food Technology The rest enter the technical school of Bilibino. Most young men serve in the army.

The kindergarten is attended by 36 children, 16 of them – up to 4 years old and 20 from 4 to 7 years old. The boarding school was originally created for children of reindeer herders, but is currently used as a place of temporary boarding of children of parents who find themselves in a difficult life situation, including with alcohol addiction.







Figure 53. Kindergarten of Anyuysk

According to the district police inspector, the criminal situation in Anyuysk and other villages of the Bilibinsky district is calm. Of the crimes recorded there are only domestic or committed in an intoxicated state crimes. As of October 26, 2019, one family was in follow-up by the police. There is no juvenile delinquents' room in the village, the level of children hooliganism is lower than in the district center.

The outpatient clinic in Anyuysk has one general practitioner, one paramedic and one nurse. Of the causes of morbidity, medical workers identified seasonal respiratory diseases. During seasonal epidemics, there are up to 10 calls per day.

Among the health problems, medical workers named interruptions in the provision of medicines, as well as the inaccessibility of the local population: nomads may not leave the tundra and not receive medical care for years.

The store in Anyuysk is open 5 days a week. The goods are delivered from Bilibino, where they are delivered by plane, some food products (cabbage, potatoes, onions) can be delivered by river transport (barge) in the summer.

In addition to food, the store supplies clothing, furniture, and construction materials. It is possible to pre-order the necessary goods.



The assortment of goods in the store is quite wide. But it is necessary to note the high level of prices for all goods, in connection with which they are often unpurchaseable to the local population, especially pensioners. To solve this problem, a group of socially significant products was allocated, the prices of which are fixed, and the difference between the price in the store and the market value is compensated by the Administration.



Figure 54. Storefront in the village of Anyuysk. Red price tags indicate socially significant goods, the prices of which are regulated by the administration

Delivery of letters, parcels and press to the post office is carried out once a month. In addition to the letters, clothing, shoes, food, and household appliances are often sent by mail. Of the press in Anyuysk, the children's magazines and household magazines are mostly received.

A branch of Sberbank operates in Anyuysk. There is no ATM in the village. According to the bank employee, salaries, benefits and pensions to the local residents are received regularly, but there may be failures associated with unstable Internet connection.





Figure 55. Post Office and Sberbank branch in the village of Anyuysk

In Anyuysk there are a rural house of culture and a library.

The main readers of the library are children. The library receives new editions of children's books and magazines, there are also old editions. The library has a computer with Internet access, and if there is no printed edition of any work in the collections of the library, it can be found on the Internet. The pensioners are also often readers.

The library holds various events for schoolchildren and preschoolers, as well as celebrates significant dates (anniversaries of writers, works of art).

### llirney Village

In 1945, a hydrometeorological station was established on the shores of Nizhny Ilirneyskoye Lake; a reindeer herding farm named after Malenkov and a village (currently – the village of Ilirney) were soon founded. However, due to the flooding of the settlement in 1954, it was moved 7 km upstream of the Anyuy River. The village of Ilirney is located on the left bank of Maliy Anyuy, below the Nutesyn River. In the upper reaches of the Maliy Anyuy River the Lake Ilirney is located. 'Ilirney' is translated from Chukchi as the 'island-mountain, so named for the rocky islets on the lake. Mass construction began in the village in the late 1950s, the collective farm was transformed into the 40 Years of October State Farm. The impetus for development was the emergence of the gold mining industry in the region, so the demand for farm products has also increased significantly. In 1982, a new building of a rural school was built in the settlement.

At present, there is the Ilirney Rural Settlement (a municipality) with an administrative centre in Ilirney Village<sup>129</sup>. At present Ilirney Village occupies the area of 2.15 sq. km. Since 2009 its population is gradually declining and at present it is slightly less than 252 inhabitants. The data on population dynamics are presented in Table 40.

<sup>&</sup>lt;sup>129</sup> The boundaries of the rural settlement are determined by the Law of the Chukotka Autonomous Okrug of 29/11/2004 No. 43-OZ On the Status, Borders and Administrative Centers of Municipalities in the Bilibinsky Municipal District of the Chukotka Autonomous Okrug.



Year	2002	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Population	295	299	304	287	286	281	277	274	273	263	257	252

#### Table 40. Ilirney Population Dynamics<sup>130</sup>

Source: Wikipedia, 2019

The ethnic composition of the Ilirney population can be estimated as follows<sup>131</sup>:

- the ethnic majority are the Chukchi 76%,
- the Evens and Koryaks account for about 2% each,
- the Russians and other nationalities make up the rest 20% of the rural settlement population

The main occupation of local residents is reindeer herding and fishing. The central estate of the Topolevoe agricultural enterprise employing on the average 20 workers (2012 data) is based at the settlement. In 2012, the number of deer livestock at the enterprise amounted at 3600 animals. At present, such public facilities as an elementary school-kindergarten, a medical outpatient clinic, a post office, a communications center, a hotel with maximum capacity for 20 guests, a culture center, a library, and a bakery shop are operating at the settlement. Since 1963, a 2nd category hydrometeorological station has also been operating at llirney.

In the area of Ilirney in the 1970s the sites of an ancient man (the Stone Age), that arose ten thousand years ago, were discovered by Magadan archaeologists Dikov N.N. and his wife M. Dikova-Kiryak. Currently, near the Ilirney lakes, archaeological excavations are carried out annually.



The bird's-eye view of Ilirney rural settlement is presented in Figure 56 below.

Figure 56. Aerial view of Ilirney Village<sup>132</sup>

 <sup>&</sup>lt;sup>130</sup> Wikipedia, 2019. Ilirney Village // Wikipedia. Available at: <u>https://ru.wikipedia.org/wiki/Илирней (село)</u>.
<sup>131</sup> Bilibinsky Municipal District Administration. 2019. Urban and Rural Settlements // Bilibinsky Municipal District. Available at: <u>http://www.bilchao.ru/index.php?newsid=33.</u>


# Omolon Village

Omolon is a rural settlement located on the Omolon River, the right tributary of the Kolyma River. 'Omolon' is translated from the Yukagir language as the 'good river'. Omolon, founded in 1944 for servicing the back-up airfield of the Alsib airway, is currently the largest rural settlement in Chukotka.

At present, there is the Omolon Rural Settlement (a municipality) with an administrative center in Omolon Village<sup>133</sup>. At present Omolon Village occupies the area of 2.7 sq. km. Since 2010 its population is gradually declining and at present it is around 785 inhabitants. The data on population dynamics are presented in Table 41.

Table 41. Omolon Population Dynamics<sup>134</sup>

Year	2002	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Population	946	871	841	873	866	855	854	836	822	791	790	785

Source: Wikipedia, 2019

The ethnic composition of the Omolon population can be estimated as follows<sup>135</sup>:

- the ethnic majority are the Evens 58%,
- the Chukchi account for about 20% of the total,
- the Yukagirs and Koryaks together account for about 5% of the total,
- the Russians and other nationalities make up the rest 17%.

Currently, the main occupations of local residents are reindeer husbandry and fishing, hunting and fur trade. The Oloy municipal agricultural enterprise Oloy employing on the average 78 workers (2012 data) is based at the settlement. In 2012, the number of deer livestock at the enterprise amounted at 10100 animals. At present, such public facilities as a secondary school, a local hospital, a post office, a communications center, a culture center, a hotel with maximum capacity for 21 guests and a bakery shop are operating at the settlement.

In the vicinity of Omolon Village there is a two-kilometer Mammoth cliff, which is an exposure of loam layers pierced by huge ice lenses, from where the remains of mammoths, woolly rhinos and other prehistoric animals are thawed annually.

In 1982, in the area of the village, local residents discovered a rare-type iron-stone meteorite weighing 250 kg. It was given the name "Omolon"; it is currently on display at the Museum of Natural History of the North-Eastern Research Institute of the Far Eastern Branch of the Russian Academy of Sciences in Magadan.

 <sup>&</sup>lt;sup>134</sup> Wikipedia, 2019. Omolon Village // Wikipedia. Available at: <u>https://ru.wikipedia.org/wiki/Омолон (село)</u>.
 <sup>135</sup> Bilibinsky Municipal District Administration. 2019. Urban and Rural Settlements // Bilibinsky Municipal District. Available at: <u>http://www.bilchao.ru/index.php?newsid=33.</u>



<sup>&</sup>lt;sup>132</sup> Zoriananata. 2019. Ilirney - cities and towns of Chukotka //Zorinata.ru. Available at:

http://zorinanata.ru/goroda-i-poselki-chukotki/ilirnej-goroda-i-poselki-chukotki.

<sup>&</sup>lt;sup>133</sup> The boundaries of the rural settlement are determined by the Law of the Chukotka Autonomous Okrug of 29/11/2004 No. 43-OZ On the Status, Borders and Administrative Centers of Municipalities in the Bilibinsky Municipal District of the Chukotka Autonomous Okrug.



A view of the Omolon airport building is presented in Figure 57 below.

Figure 57. Omolon Airport Building<sup>136</sup>

## 7.3. <u>Pevek Urban District</u>

### 7.3.1. General Information

The Pevek Urban District (known as the Chaunsky Municipal District before 2016) established in 1933 occupies 67,091 km<sup>2</sup> and has a population density of 0.075 person per km<sup>2</sup>. The Pevek Urban District comprises the following settlements: Pevek town, Baranikha, Valkumei, Bystry, Komsomolsky, Krasnoarmeisky, and Yuzhny townships that are undergoing dissolution; and Ayon, Apapelgino, Billiings, Rytkuchi, and Yanranay (Figure 58).

The Pevek Urban District is the most industrialised district in the region and one of the major transport hubs in Chukotka. The Pevek Airport is the second largest airport in Chukotka connected with Moscow and Anadyr by regular flights. Pevek is one of Russia's monotowns (a town whose economy is dominantly a single industrial activity).

The Pevek Commercial Port is the largest seaport in Chukotka, and one of the few ports on the Northern Sea Route receiving all types of vessels. Pevek's development as a seaport is part of the country' maritime transport strategy aiming to revive trade and other activity by the Northern Sea Route. Other large-scale economic activities in the Pevek Urban District include the ongoing development of the Kupol, Dvoynoye and Mayskoye deposits; it has resulted in a steady increase of freight turnover since 2012. The development of Peschanka deposits will play an important role in the regional economy and port operations. The exploration of oil and gas deposits in the coastal shelf area will also set the scene for the development of oil and gas sector with an oil/gas terminal in the Pevek Sea Port. Urban population living in Pevek accounts for 81.27% of total population of the Pevek Urban District (Table 42).

<sup>&</sup>lt;sup>136</sup> Zoriananata. 2019. Ilirney - cities and towns of Chukotka //Zorinata.ru. Available at: <u>http://zorinanata.ru/goroda-i-poselki-chukotki/ilirnej-goroda-i-poselki-chukotki</u>.



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Figure 58. Pevek Urban District

Table 42.	. Urban and rura	l settlements in the	Pevek Urban	District as on	the beginning of 20	018
	••••••					

Urban and Rural Settlements	Total Population	Urban Population, persons	Rural Population, persons
Pevek Urban District	5,327	4,329	998
Pevek Town	4,329	4,329	

Source: Pevek Urban District Investment Passport

## 7.3.2. Demography

As of 1 January 2018, the permanent population in the Pevek Urban District was 5,327 people, with 4,329 residing in urban areas, and 998 people in rural areas (Table 42). The Urban District's population showed positive growth in 2012 and 2013.



	Year								
	2002	2010	2012	2013	2014	2015	2016	2017	2018
Population, people	6,962	5,359⊻	⊅5,927	⊅6,081	5,800 ₪	∖15,774	5,747⊻	5,551 ⊻	5,327⊻

Table 43. Pevek Urban District population dynamics in 2002 – 2018<sup>137</sup>

# 7.3.3. Ethnic Composition

The Pevek Urban District is home to 44 ethnic groups with Russians being the largest group accounting for 61.9% of total population. The Pevek Urban District is one of the areas inhabited by indigenous minorities maintaining a traditional lifestyle in the Russian Federation with indigenous minorities accounting for 18.3% of the total population. Indigenous people (the Chukchi, Eskimos, Chuvans, Evens, Koryaks, and Yukagirs) account for 18.3%. The remaining 19.8% comprises Ukrainians, Tatars, Belarusians, Moldovans, and Kalmyks.

## 7.3.4. Population Employment

As of 1 January 2018, the number of economically active people in the Pevek Urban District was 3,993 people, or 75% of the total population. Some 3,943 people are employed and of the 50 unemployed persons 47 (0.88% of the economically active population) are officially registered with the employment service.

## 7.3.5. Industry and Agriculture

The Pevek Urban District (the former Chaunsky Municipal District) is the most industrialised district in Chukotka. Precious and rare metals mining is the most significant economic activity, and the mining industry contributes over 70% to the total industrial output. As the placer gold deposits have become depleted, gold continues to be extracted from its source, i.e. from primary gold and silver bearing deposits. Large-scale precious and rare metals mining operations are now underway at a number of sites including Dvoynoye and Mayskoye deposits.

The Pyrkakay Stockworks is the most promising project for the local economy with Pyrkakay being Russia's largest and world's fourth largest tin deposit whose reserves are estimated at 5 billion USD. The deposit contains about 350 thousand tonnes of tin and 21 thousand tonnes of tungsten. The concentration of tin in ore is 0.29%. Other valuable components reflected in the State Records of Mineral Resources include copper, silver and gold. The deposit comprises four large stockwork bodies and has a total mining area of 8.2 km2.

The large-scale modernisation of the Chaun-Bilibinsky Power Hub is underway to ensure sustainable long-term economic development. As part of this modernisation, the Pevek Urban District will host the world's first floating nuclear power plant starting from 2019, and the construction of new power lines is expected to start soon to meet growing power demands of mining sector.

<sup>&</sup>lt;sup>137</sup> Chaunskiy District// Wikipedia. Available at <u>https://ru.wikipedia.org/wiki/Чаунский район#cite note-</u> 2015DS-23.



The port of Pevek is a major sea commercial port along the Northern Sea Route, located in the Chaunskaya Bay which is part of the East Siberian Sea. The strategic significance of the Pevek sea port for the Chukotka AO and the entire Northern Sea Route stems from the fact that it provides the deepest berths and is the most mechanised port in Chukotka and along the Northern Sea Route, being the centre of Chukotka's gold mining operations. Pursuant to the Federal Law of 3 July 2016 No. 252-FZ "On Amending the Federal Law on the Proactive Socio-Economic Development Areas in the Russian Federation and Federal Law on the Free Port of Vladivostok", the Pevek Urban District and its water area are part of the free port of Vladivostok.

Governmental policy supports the development of the agricultural sector in the region which offers various incentives to reindeer breeders, hunters, fishermen and other people engaged in agricultural activities.

## 7.3.6. Budget

The main expenditure items in the local budget are education (34%), public utilities (23.75%) and national economy (15.38%)138. Socio-economic development indicators estimated for Pevek Urban District show that economic situation has remained stable over the past several years.

### 7.3.7. Public Health

Public healthcare services are provided by the Chukotka Okrug Hospital and its branch – Chaun District Hospital based in Pevek, which is in good condition, properly equipped and staffed.

#### 7.3.8. Housing Assets

The total floorage available in the residential buildings in the Pevek Urban District is 144,600 m2, none being in poor condition or requiring urgent repair. The major proportion of housing assets is privately owned (Table 44).

#### Table 44. Ownership of housing assets in Pevek Urban District<sup>139</sup>

Municipality ownership, no. of housing assets	1200
Private ownership, no. of housing assets	1606

The current list of households, which need improvement of their housing conditions includes 82 families.

#### 7.3.9. Education and Culture

Education infrastructure in the Pevek Urban District comprises 8 educational institutions including 2 comprehensive secondary schools, 2 comprehensive pre-school and primary school establishments, 2 pre-school establishments, and 2 extended education

<sup>&</sup>lt;sup>139</sup> Pevek Urban District Investment Passport. Available at: <u>https://go-pevek.ru/o-городском-округе-</u> <u>певек/инвестиционная-деятельность</u>.



<sup>&</sup>lt;sup>138</sup> DECISION (LIII Session, V Convocation) on the Pevek Urban District Budget Performance in 2017. Available at: <u>https://go-pevek.ru/меню/открытый-бюджет/решения-о-бюджете</u>.

establishments. As of 1 June 2016, there was 1 archaeological site of federal significance in Pevek Urban District (Chaunsky District)<sup>140</sup>.

## 7.3.10. Traditional Nature Use

## Reindeer breeding

Reindeer breeding has existed in the Pevek Urban District (former the Chaunsky Municipal District) since ancient times and is a traditional nature use for local population. The pastures are situated close to the coast and this defines wide areas and different types of pastures for all seasons (first of all summer pastures). So reindeer breeding is one of the main activities in Pevek Urban District. The Chaunskoye Municipal Agricultural Enterprise is located in the Rytkuchi Settlement, which is in about 350 km northeast from the Baimka License Area and in about 80km from the proposed marshalling yard at Pevek. The enterprise comprises five reindeer brigades and is considered the best reindeer enterprises in Chukotka AO. The enterprise employs 130 people and produces 52 tonnes of meat annually. The problem of the reindeer sector here is lack of qualified employees as most of the youth are not aimed at working in traditional nature use sector.

## Fishing and hunting

The Chaunskaya Bay and the Kolyma River Basin are included into the East Siberian sea fishing area - one of four fishing areas in Chukotka AO. Indigenous peoples are not required to obtain a fishing license to conduct fishing in order to support their traditional lifestyle. A hunting reserve Tyjukul is created in the low Ichuveyem River basin in the Pevek Urban District.

## 7.4. Baimka license area and closest subjects of traditional nature use

The Baimka license area is located on the inter-settlement territory, far from the existing settlements. The existing settlements closest to the license area - the villages of Anyuysk, Ilirney, Stadukhino, Omolon – are quite distant from it (Figure 2).

In the immediate vicinity of the licensed area, there are two villages in which there are no permanent residents: Vesenny settlement (under liquidation) and Angarka settlement (liquidated). Both villages are used as a base by the Luch Mining Cooperative.

Government of the Chukotka AO Resolution of 23/05/2013 On Approval of the Aggregated List of Cultural Heritage Sites of Federal, Regional, and Local Important within the Chukotka Autonomous Okrug (as amended on 01/06/2016). Available at <u>http://docs.cntd.ru/document/424073084</u> (currently not in force).





Figure 59. Vesenny Settlement

Luch Mining Cooperative LLC (Luch LLC) conducts placer gold mining in an area bordering the license area. Luch LLC registered in 1992 and employs about 80 people including 4 Evens<sup>141</sup>. The Luch LLC production site including all repair and maintenance works, vehicles and mobile plant, and employee accommodation is located in the Vesenny Settlement (Figure 59). Luch LLC has acquired the infrastructure remaining in the settlement and ownership of the land on which this infrastructure is located. There are 1-2 permanent residents in the settlement including a site attendant and a site manager. On the border of the licensed area, there is a settlement of the territorial neighboring community (TNC) "Burgakhchan" (Figure 61, Figure 62).

In addition, in the area of the licensed area there is a hunting plot of Dyachkov M.K. (ANNEX 3) and the patrimony of the Hecket community (Figure 61).

<sup>&</sup>lt;sup>141</sup> Information obtained during the interview with R.M. Skorik, General Director of Luch LLC





Figure 60. Map of territories used for traditional activities

# 7.4.1. Burgakhchan Community

A small Even community has a regular place of residence (station) in the Burgakhchan area near the Baimka License Area. In the past, a settlement of Burgakhchan existed with local residents engaged in reindeer husbandry and more than 10,000 reindeer grazed in the area. Over time, the number of inhabitants decreased, and in the 1990s the settlement was officially closed.

Currently a small community based in the settlement are engaged in reindeer husbandry, fishing and hunting. Some 16 adult members of the community (excluding children) are living and traversing the area to pasture the reindeer. There is an equal number of men and women in this community with half of the community being younger than 30. The community is led by a woman who has higher education. The small number of people in the community increases the vulnerability of the community.

The settlement itself consists of residential houses, backyard structures, a garage, stationary reindeer corral and cemetery (Figure 62).





Figure 61. Baimka License Area in Relation to the Land Used by the Burgakhchan Community

In 2010, the community has been legally registered as Burgakhchan Territorial Neighborhood Community. This status allowed the community to operate as a non-profit



organization, for example, to receive grants, implement projects, and so forth. Economically, the community consists of Brigades No. 7 and 8 of Ozernoye Municipal Agricultural Enterprise with all reindeer being owned by the enterprise. Attempts by the Burgakhchan Community to acquire ownership for part of the reindeer herd were not successful. The traditional use of pastures is also not legally registered by the Burgakhchan Community.

The community maintains a traditional lifestyle and from 2010 to 2015 sold agricultural products for a total value of 16,144 Russian Roubles (RUR) (Table 45). Other traditional activities practiced by the Burgakhchan Community members include plant and berry harvesting, hunting, and fishing<sup>142</sup>.



Figure 62. Burgakhchan Settlement

Year	2010	2011	2012	2013	2014	2015 (End-of- Year Estimate)
Product output, thousand RUR	1,028.0	4,904.0	2,835.0	1,761.0	4,262.0	7,778.7

Migration routes for deer grazing include 4 seasonal routes:

• Winter route: deer migration and grazing mainly takes place in the basin of the Burgakhchan river (in its middle course) and all its tributaries (the Omchak river, Pyne, Provalny, Rusty streams: quarters 379 - 400);

<sup>&</sup>lt;sup>142</sup> The issue whether there are other traditional activities maintained by the community members requires further clarification during focused consultations.



- The spring route covers mainly the territory where deer calving takes place: quarters 353, 382, 401. It is located in the basin of the Burgakhchan river with streams and tributaries: Nechaku stream, from Vstrechny stream to Pryamoi stream and further;
- The summer route includes quarters 412, 413, 424, 425, 426, 427 and 432, located in the upper reaches of the Burgakhchan river at the confluence of the Aluchin river and the Tyuleneut stream;
- The autumn route runs in the middle flow of the Burgakhchan river with its tributaries and further downstream until it flows into the Bolshoi Anyuy River.

The status of lands used by the Burgakhchan Community is not officially registered. In 2017 a Traditional Nature Use (TNU) Design for was developed by the Ozernoye Municipal Agricultural Enterprise but was not approved. The information about the TNU lands presented in this report has been kindly provided by the Ozernoye Municipal Agricultural Enterprise (Figure 63).

It is clear from the map that the license area partly overlaps the TNU lands used by the Burgakhchan IP community but the mining and ore processing infrastructure is at some distance from the license area boundary.

## 7.4.2. Hacket clam community

The Hacket family-tribal community (Severnoye Siyaniye was registered in 2013 and includes three people (N.S, Shcherbakova, F.E. Sherbakova. and U.F. Shcherbakova). The community is engaged in hunting and breeding of wild animals (the main activity) and fishing and gathering wild plants (additional activities). Also, members of the community produce traditional clothing, supporting national traditions.

Members of the clan community emphasize that they are fishing in the area excurrent to Bolshoi Anyuy.

## 7.4.3. Hunting grounds

To the west of the license area there is a hunting site, registered on M.K. Dyachkov. (Even). According to M.K.Dyachkov, 26 people use the site.





Figure 63. Location of the Baimka License Area and facilities, pastures and base housing of the Burgakhchan Community



### 8. ASSESSMENT OF BIOPHYSICAL IMPACTS

### 8.1. Impact on Air Quality

#### 8.1.1. Introduction

A key environmental concern for the proposed Peschanka Copper Project is the effect the mine and associated activities would have on prevailing air quality. In order to assess this potential impact, ambient air pollution concentrations were modeled using a Gaussian air pollution dispersion model known as AERMOD, which is an internationally recognized US EPA Regulatory Model. The model requires two broad inputs namely atmospheric emissions (sources) and the atmospheric dispersion characteristics of the area (wind velocity, mixing height and turbulence) and then as a function of the two inputs computes ground level (ambient) concentrations of the emitted pollutants. The predicted ambient concentrations are then compared to defined regulatory limits for different averaging periods to assess the potential impacts on the environment with a particular focus on human health risk. These various components of the study are presented in the sections that follow assess the impacts on air quality of the proposed Project and the consequences of such changes in air quality.

#### 8.1.2. Emissions Data

The mine will have multiple sources of atmospheric emissions including emissions from all fuel burning appliances, plant and machinery, vehicles, mechanically generated dust, emissions from blasting, aeolian (wind-generated) dust especially in respect of the tailing storage facility (TSF) and other emissions. Emissions from the proposed Project were determined by characterizing the nature of the facilities and activities and then using emission factors derived from the Australian National Pollutant Inventory, Emission Estimation Technique Manual for Mining (Version 3.1, Commonwealth of Australia, January 2012) as summarised inTable 46.

The concentrator does not have the characteristics of a typical industrial operation, and is largely both a physical and mechanical process and a wet process with limited emissions other than dust from crushing and grinding. Given that the ground will be snow covered and frozen for much of the year limiting the amount of dust that could be generated by the movement of vehicles it was decided to focus on the largest emissions mass that could be generated in a day and so emissions as a result of blasting and wind blown dust from the TSF were modelled to assess implications of such emissions for ambient air quality.

Blasting emissions were calculated from the total mass of explosive, using several different methodologies and reconciling the results. The open pit type was selected as the best model of blast geometry, with blasts produced at 20 m above the bottom of the pit and covering the area equal to the area of the pit at half of the depth of the pit. Blast sizes were calculated from yearly data on blasted rock volume. The size distribution of particulate matter is important for dispersion and this was sourced from information available on open pit mining distinguishing between  $PM_{2.5}$  (<  $2.5\mu$ m),  $PM_{10}$  ( $2.5 - 10\mu$ m) and  $PM_{30}$  ( $10-30\mu$ m) each of which have different reference concentrations for determining human health risk. There is also a reference concentration for total dust (total suspended particulates or TSP).

Emissions from the TSF were refined to deal with the fact that the emissions are at their maximum during high wind speeds, but it is also under those same conditions that dispersion is at its greatest. Similarly, under low wind speed conditions the emissions are at



their least but the dispersion is at its poorest. For tailings, the standard approach to fugitive emission of dust is to take the emission in grams per sec (g/s) at its highest value corresponding to the highest probable wind speed. Where source parameters were not directly available for the Peschanka Copper Project, proxy information was sourced from Malomyr and Olympiadinsky. The sources were combined for years 2024, 2030, 2036, 2042, 2048, 2054 and 2059.

	ł		Atmosphe	eric emissions	(tpa)	
	Source	РМ	NOX	SO <sub>2</sub>	CO2	СО
	Haul vehicles	300	6 300	800	389 900	1 900
ON- SITE	Waste oil burner	0,1	2,0	6,4	2 000	0,5
0.1.1	SUB-TOTAL	300	6 302	806	391 900	1 901
	Material to Pevek	10	200	30	14 200	70
	Material to mine	0	0	0	1 400	10
OFF- SITE	Fuel to mine	1	2	6	2 000	0
0	Shipping	NC	NC	NC	1 000	NC
	SUB-TOTAL	11	202	36	18 600	80
	TOTAL	311	6 504	843	410 500	1 981

Table 46. List of Atmospheric Emissions Sources Associated with the Proposed Peschanka Copper Project

NC = Not calculated as quantities unlikely to result in material local impact

The dispersion model calculates ambient concentrations for each of multiple grid cells that are defined across the mining and processing and surrounding (impact) area. Some 500 receptor cells were defined for this assessment at 1 km by 1 km resolution with a higher cell resolution of 300 m by 300 m defined for the core area. Each cell is defined in terms of x and y coordinates together with elevation (z). The potentially affected area was further divided into impact zones as shown in Figure 64. Meteorological data for 2018 were obtained from free sources for monitoring points in close proximity to the Project area with 3-hour surface observations from Bilibino (WMO 25147), and 12-hour observations and upper air (radiosonde) data from Chersky (WMO 25123). Various other input data required for the dispersion model such as surface roughness, Bowen value and albedo were computed using good practice principles. Meteorological data is pre-processed (as input to the dispersion model) using the AERMET package. Pre-processed data is shown in Figure 65.





Figure 64. Topography of the area covered by the dispersion modelling together with the receptor (impact) areas (purple boundaries) and the sanitary protection (exclusion) zone with a green boundary





Figure 65. Wind velocity characteristics (wind speed top, wind direction bottom) derived from the AERMET processor and that have been used as input into the dispersion model

## 8.1.3. Emissions Used in the Modelling

The source parameters used for the dispersion modelling are presented in Table 47 together with the emissions determined for the TSF. Various methods for determining the emissions from blasting were tested to ascertain the most appropriate for this application and the emissions ultimately used shown together with the parameters upon which they are based shown inTable 48. Finally, but importantly, it is necessary to determine the dust fraction sizes due to the different rates of settling out and also for the different reference concentrations for the different size fractions. No such information is available in the literature for specific rock types with information only for coal, limestone and general construction materials. This latter information has been used as the best approximation for this application (Table 49).



	YEARS						
Source parameter	2024	2030	2036	2042	2048	2054	2059
TSF area (km <sup>2</sup> )	3.4	19.0	27	33	38	42	45
TSF pond area (km²)	5.9	7.7	8.8	9.8	10.9	11.7	12.5
TSF fugitive area (km²)	3.4	11.2	18.3	23.3	27.2	30.6	32.8
Emission factor for TSF at 4 m/s wind (g/s/m <sup>2</sup> )	5.8E-5						
Full emission from TSF at 4 m/s wind (g/s)	201	656	1,067	1,363	1,586	1,788	1,915
Standard blast: explosives mass (tonnes)	260	260	260	260	0	0	0
Standard blasts per year	76	220	235	21	0	0	0
Maximal blast: explosives mass (tonnes)	415	415	415	415	0	0	0
Maximal blasts per year	1	1	1	1	0	0	0
Blasts: depth of pit 1 (m)	36	254	472	654	0	0	0
Blasts: depth of pit 2 (m)	0	0	12	42	0	0	0
Blasts: depth of pit 3 (m)	0	0	10	49	0	0	0
Blast height above pit base (m)	10	10	10	10	0	0	0
Blasts: area of cloud for pit 1 (km²)	0.09	0.63	1.17	1.62	0	0	0
Blasts: area of cloud for pit 2, (km <sup>2</sup> )	0	0	0.08	0.27	0	0	0
Blasts: area of cloud for pit 3, (km <sup>2</sup> )	0	0	0.04	0.25	0	0	0

# Table 47. Source parameters used in the dispersion modelling for the Peschanka Copper Project



Parameter	Standard blast	Maximal blast
Blasts per year	235	1
Duration of blast, sec	1200	1200
Mass of explosive for a blast, kg	260000	415000
Full mass of explosives per year, t	61100	
Volume of rock exploded by a blast, m <sup>3</sup>	260000	415000
Full volume of rock per year, t	61100000	415000
Rock strength	6	6
Humidity-related factor for dust	0,1	0,1
Explosives used per 1 m3 of rock	1	1
Emission of NO <sub>x</sub> , kg, per 1 kg of explosive	0,0087	0,0087
Emission of CO, kg, per 1 kg of explosive	0,007	0,007
Emission of dust, kg, per m <sup>3</sup> of rock (no humidity)	0,04	0,04
Emission of dust, kg, per m <sup>3</sup> of rock *	0,004	0,004
Shaft depth, m	15	15
Blast area, m <sup>2</sup>	17333	27667
Emission of NO <sub>x</sub> , grams/sec	1885	3008,75
Emission of dust, grams/sec**	418,37	843,68

Table 48. Emission parameters for blasts used to determine emissions of dust and NOx in g/s (shown in bold in the table)

\* Methods 1999 and Collection

\*\*US EPA AP-42

#### Table 49. Mass Spectrum of Dust from Blasts

Average size, mkm	>50	>30	20	15	10	5	2.5
Fraction	0,19	0,28	0,23		0,16	0,1	0,04

For emissions from the TSF there is considerable complexity that must be managed in that while higher and more turbulent wind speeds mobilise more dust (and for wind speeds higher than 5.4 m/s dust loading increases sharply and nonlinearly with wind speed) (see emission coefficient multiplier inTable 50), such conditions also result in in the greatest dispersion of such dust and thus smaller ambient concentrations. To manage this complexity emission coefficient multipliers were derived from averaging two different published methods resulting in the values used inTable 50.



Wind speed category	1	2	3	4	5	6
Range of w for category	0-1.5	1.5-3.1	3.1-5.1	5.1-8.2	8.2-10.8	>10.8
Assumed mid-range w	1	2	4	6	9	12
Total emission from TSF, E, g/s	0	0	1 073	7 324	22 578	44 886
Emission coefficient multiplier	0.01	0.07	1	5	15.7	32.8

 Table 50. Multipliers for Emissions Under Different Wind Speed Categories

## 8.1.4. Ambient Air Quality Limits

Once the ambient air quality has been predicted by the dispersion model it is then necessary to compare the predicted values with defined air quality limits or reference concentrations. Limit values are concentrations that serve to define (as a function of typically human health based responses) tolerable ambient concentrations. For the purposes of this assessment the ambient air quality limits of the World Health Organization (WHO) have been used as reference concentrations. The WHO limits form the basis of many defined air quality standards around the world and indeed, are used by the International Finance Corporation (IFC) of the World Bank in the WBG EHS Guidelines. The WHO ambient air quality guidelines do not however include limits for all referencing periods and so additional limits have been included in the assessment to ensure that there is a reference concentration for all the averaging periods for all the pollutants included in this assessment. These reference values are shown in Table 51.

Table 51. Ambient quality limits (reference concentrations) for the pollutants modelled in this assessment, from different authorities (in  $\mu g/m^3$ )

		IFC, 2007a	= WHO, 200	Duccio 2010 d	U.S. EPA,	
Authority, year		Interi	im targets	Russia, 2010 d	2012 f	
	1	2 3 4				
TSP 1hr					500	
TSP 24hr					150	150 h
TSP year						60 g
PM <sub>10</sub> 1hr					300	
PM <sub>10</sub> 24hr	150	100	75	50	60 e	150 i
$PM_{10}$ year	70	50	30	20	40	50 k
PM <sub>2.5</sub> 1hr					160	
PM <sub>2.5</sub> 24hr	75	50	37.5	25	35 e	35 j
PM <sub>2.5</sub> year	35	25	15	10	25	15 k
SO <sub>2</sub> 10-20 min				500	500	660
SO <sub>2</sub> 24hr	125	50		20		
$SO_2$ year					50	50



	I	FC, 2007a	= WHO, 200	Duccio 2010 d	U.S. EPA,	
Authority, year		Interi	im targets	Russia, 2010 d	2012 f	
	1	2	3	4		
NO2 1hr				200	85	200
NO <sub>2</sub> year				40	40	40
NO 1hr					400	720
NO year					60	60
Ozone 8hr	1601			100 I		
Ozone 1hr					160	180
Ozone year					30	30
CO 1hr					5,000	23,000
CO year					3,000	3,000

a) IFC Environmental, Health, and Safety Guidelines, 2007

b) WHO Air Quality Guidelines, Global Update 2005

c) Not to be exceeded more than 3 days per year

- d) [RF]
- e) 99% quantile
- f) EPA and Human health
- g) Annual geometric mean
- *h*) Not to be exceeded more than once per year
- *i)* Not to be exceeded more than once per year on average over a 3-year period
- *j)* 98th percentile, averaged over 3 years
- k) Annual arithmetic mean, averaged over 3 years
- I) 8hr daily maximum

## 8.1.5. Reference Concentrations for Blasting Dust

Because the size fractionation of the dust from blasting differs from that of other dust sources it is necessary to derive reference concentrations that would apply to the dust from blasting. Such reference conditions are shown in Table 52.

Table 52. Ambient quality limits (reference concentrations) for dust size fractions produced from blasting (in  $\mu g/m^3$ )

Averaging period	Hourly	Daily	Annual		
PM <sub>10</sub>	0.34	0.07	0.043		
PM <sub>30</sub>	1.4	0.185	0.12		



## 8.1.6. Configuring the Dispersion Model

Dispersion models can be configured in many different ways and it is beyond the remit of this assessment to present in detail how the model was configured for this study other than to highlight several important parameter options, namely:

- Hours with wind speed less than 1 m/s were excluded, as recommended by the US EPA;
- Topography was included but not for blasting emissions where the elevation is already incorporated;
- Dust settling was included;
- As a non-regulatory option, which is not yet included in the standard AERMOD / AERMET software package, wind speed corrections were applied where required;
- Wet scavenging was not taken into account because it was deemed insignificant in this region;
- Ozone-limited transformations of NOx were applied; and,
- The puff effect was accounted for. By this is meant that most emissions, even those of short duration, can be treated as plumes. Blasting emissions though cannot be viewed as plumes as they manifest as puffs.

In the latest version of AERMOD there is an option to apply a correction factor for low wind speeds. Although this is still an experimental option the decision was made to run the model both with and without the low wind speed correction option and to present as a final output the geometric mean of the two. Dust settling, viz the rate at which dust 'falls out' of the atmosphere was also considered for the different particle size fractions with the larger particles obviously settle in closer proximity to the source than the smaller particles. Finally, it needs to be recognised that blasting emissions are a short duration, high intensity episode (typically with one occurring per day). Reference concentrations are for longer terms averaging periods, hourly, daily and annually. For the modelling the emission is assumed to apply for the whole hour and the whole day to simulate the ambient concentrations under a representative range of meteorological conditions, but those hourly and daily concentrations are then divided by 3 and 72 respectively to get the concentrations for the time period of a typical blast (1200 seconds).

## 8.1.7. Model Predictions

The predicted ambient concentrations are presented in two ways in the sections that follow. Firstly the predicted concentrations at each grid square have been averaged for the receptor (impact) areas that were defined earlier (see Figure 64). These receptor area averages are shown for annual, daily and hourly concentrations for the 2024, 2030, 2036, 2042, 2048, 2054 and 2059 mine life periods.

## Annual average dust concentrations

Predicted average annual ambient concentrations for the four dust size distribution categories are shown inFigure 66. It can be seen form the graph that TSP,  $PM_{10}$  and  $PM_{2.5}$  concentrations are all predicted to be less than 1% of the respective limit values.  $PM_{30}$  concentrations on the other hand are predicted to be up to 8% of the limit value, relatively much higher than the other dust size fractions but still only a small percentage of the limit



value. It can also be seen from the graph that over the life of the Project  $PM_{30}$  will only evident during mining activities and more specifically associated with blasting. At well less than 10% of the limit values, annual average concentrations of dust are unlikely to pose a material risk of environmental damage and even were populations to be exposed to such concentrations, which they are not given the remoteness of the Project site, human health effects would be deemed highly unlikely.



Figure 66. Predicted Annual Average Concentrations for the Four Dust Fractions in Each of the Receptor (Impact) Areas (as Percentage of the Relevant Limit Value)

# Daily average dust concentrations

Predicted daily annual ambient concentrations for the four dust size distribution categories are shown inFigure 67. Here the pattern is noticeably different to that of the annual averages, with non-compliance with the limit values evident for TSP (albeit marginally), PM<sub>10</sub> and PM<sub>2.5</sub>. What is especially noteworthy is that non-compliances with limit values are predicted both for the mining and ore processing facilities but also off-site in the hills and in the southwest. These elevated concentrations would imply the risk of human health effects in such off site areas but there are no inhabitants in these areas who might be exposed. It is also instructive to note that for the two offsite areas that it is blasting that is the source of the emissions. Note the rapid increase in concentrations from 2024 to 2036 and then the dramatic reduction in 2042 as the mining is scaled down and blasting ceases. The pattern associated with the tailings reflects dust loading from the TSF and it can be see that the predicted concentrations simply increase throughout the life of the Project and only flatten out right at the end of the Project life, which will be the time when dust loading from the TSF would be at its zenith.





Figure 67. predicted daily average concentrations for the four dust fractions in each of the receptor (impact) areas (as percentage of the relevant limit value)

## Hourly average dust concentrations

Finally predicted hourly average dust concentrations are shown in Figure 67. It can be seen from the graph that non-compliance with the limit value is only evident in the area of the mine pit and only for the early years of the mine life as a function of blasting and for TSP and PM<sub>10</sub>. It should be noted though that, again in the vicinity of the TSF, concentrations of TSP and PM<sub>10</sub> are predicted to come very close to the limit values. The consequences of these hourly predicted concentrations are not considered significant as they are restricted to the source areas where such elevated concentrations would be expected and do not extend off-site.



Figure 68. Predicted hourly average concentrations for the four dust fractions in each of the receptor (impact) areas (as percentage of the relevant limit value)



## Annual average nitrogen oxide concentrations

Predicted annual average NO<sub>2</sub> and NO concentrations are shown inFigure 69. It can be seen from the graph that the predicted concentrations are negligible at no more than 0,03 % of the limit values with the relatively largest predicted concentrations in the vicinity of the mine pit, which is the source. Such concentrations would not result in any risk of human health effects or indeed environmental damage.

## Hourly average nitrogen oxide concentrations

No daily reference concentrations are available for nitrogen oxides and so the analysis is only for annual average (presented above) and hourly average concentrations. Predicted hourly average NO<sub>2</sub> and NO concentrations are shown in Figure 70. Compared to the annual predicted concentrations, the hourly predicted concentrations are seen to be dramatic with both NO and NO2 seen to be some nine or ten times the limit value in the mine pit area, which is the source of the nitrogen oxides (from blasting). That source is also evident in the overall pattern of the nitrogen oxide concentrations, which are seen to be largest in the early days of the mine (2024-2030) and reducing progressively until 2042 when mining would have tailed off. What is also evident from the graph is that are significant off-site exceedances of the limits especially for 2030 where more than five times the limit value for NO is predicted. Although there are no communities exposed to such concentrations, these are large concentrations potentially creating negative environmental effects off-site. The difference between the predicted annual concentrations and the predicted hourly concentrations, however, implies that the elevated nitrogen oxide concentrations are intense but short duration events. Such a conclusion is also consistent with the blasting pattern which is once or twice a day and for a very short duration only.



Figure 69. Predicted annual average concentrations for nitrogen oxides in each of the receptor (impact) areas (as percentage of the relevant limit value)





Figure 70. Predicted hourly average concentrations for nitrogen oxides in each of the receptor (impact) areas (as percentage of the relevant limit value)

The second way in which the modelling results have been presented is to show the individual concentrations at each of the grid points in the model domain. This form of presentation is shown on maps in Figure 71 to Figure 75. It should be noted that this form of presentation must be interpreted carefully as the maximum grid point concentrations do not necessarily occur at the same time of the year for the daily and hourly averaging processes. In other words, the maximum concentrations shown at each point are the highest concentrations for that point at any time of the year. The receptor points are colour coded to show the predicted concentrations as a percentage of the relevant limit values.

## Spatially resolved annual average PM<sub>2.5</sub> concentrations

For indicative purposes the spatial distribution of predicted annual average  $PM_{2.5}$  concentrations in 2059 is shown in Figure 71. That is when the TSF will be at its fullest thus presenting the highest potential dust loading. It can be seen from the figure that there are no predicted exceedances of the limit value and that the distribution of average concentrations is spread from the TSF in a south-easterly direction.





Figure 71. Annual average concentrations of  $PM_{2.5}$  from all sources for 2059. Red rectangles  $\geq$  limit value all other colours < limit value

# Spatially resolved daily average PM<sub>2.5</sub> concentrations

The spatial distribution of predicted maximum daily average concentrations of  $PM_{2.5}$  are shown for 2059 in Figure 72. The spatial distribution of concentrations is seen to emulate the annual average pattern extending south-west to north-east, with a large area in which predicted concentrations exceed the limit value extending in a south-westerly direction from the position of the TSF. As previously described there are no human receptors in the area that would be affected by the exceedances of the limit values.



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Figure 72. Maximum daily average concentrations of  $PM_{2.5}$  from all sources for 2059. Red rectangles  $\geq$  limit value all other colours < limit value

# Spatially resolved hourly average PM<sub>2.5</sub> concentrations

The spatial distribution of predicted maximum average concentrations of  $PM_{2.5}$  are shown in Figure 73. Again, and not unexpectedly, the spatial distribution of concentrations is seen to emulate the annual and daily average pattern but extending to the south-west of the TSF only. Although there is an area where the limit values are exceeded, the area is smaller than for the daily average concentrations and enclosed by concentrations that comply with the limits.



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Figure 73. Maximum hourly average concentrations of  $PM_{2.5}$  from all sources for 2059. Red rectangles  $\geq$  limit value all other colours < limit value

# Spatially resolved annual average NO<sub>2</sub> concentrations

The spatial distribution of predicted annual average concentrations of  $NO_2$  are shown for 2030 in Figure 74. That is when the maximum nitrogen oxide loading is predicted. It can be seen from the figure that the effect of that loading when averaged over the year is negligible and very much limited to the main pit with almost no effect beyond the exclusion



zone of the pit. The consequences of such concentration in terms of human health effects would be similarly negligible.



Figure 74. Annual average concentrations of NO<sub>2</sub> from all sources for 2030. Red rectangles  $\geq$  limit value all other colours < limit value

# Spatially resolved hourly average NO<sub>2</sub> concentrations

The spatial distribution of predicted maximum hourly average concentrations of  $NO_2$  are shown for 2030 in Figure 75. It can be seen from the figure that there are widespread exceedances of the relevant limit value on all sides of the pit but again it must be recognised that such a pattern is a function of the ambient air quality that prevails across



the entire year with each block representing the highest hourly average concentration predicted for that year regardless of the date and time when it occurred.

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Figure 75. Maximum hourly average concentrations of NO<sub>2</sub> from all sources for 2030. Red rectangles  $\geq$  limit value all other colours < limit value

Given the difference between predicted annual average concentrations and the predicted hourly average concentrations it is argued here that the elevated NO<sub>2</sub> concentrations are short, episodic events that mirror the blasting pattern. Adverse human health effects as a result of these predicted concentrations are improbable especially given the fact that there



are no human settlements close to the mine that might be affected by this predicted air quality.

### 8.1.8. Impact Assessment

Atmospheric emissions as a result of mine activities were modelled to determine the impact on ambient air quality, with a view to understanding the human health and environmental risks posed by such emissions as illustrated in Figure 76.



Figure 76. Systems depiction of the components of the receiving environment that would be affected by atmospheric emissions from the proposed Peschanka Copper Project

Impact significance is presented in Table 53 and Table 54. The inherent risk of human health effects is high but the likelihood of these manifesting as a result of atmospheric emissions from the mine and associated activities is highly unlikely implying an impact significance of being low. Similarly, the inherent risk of vegetation damage and habitat loss as a result of atmospheric emissions from the mine and associated activities is moderate high but the risk of that consequence manifesting is considered highly unlikely, resulting in an impact significance of low.

Table 53. Impact significance for possible adve	erse human health risks as a result of atmosph	eric
emissions from the Project		

Potential Environmental Cost	Adverse human health effects						
Inherent risk	High						
Causes of risk	Likelihood of causes						
Emissions of NO <sub>x</sub> result in ambient concentrations that exceed defined health based limits	Definite both on and off-site for short term averaging periods but very limited area within mine pit for longer term averaging periods. Highly unlikely for Pevek given the nature of the activities there and the distance of the proposed marshalling yard to the town.						
Emissions of PM (TSP, $PM_{30}$ , $PM_{10}$ , $PM_{2.5}$ ) result in ambient concentrations that exceed defined health based limits	Definite both on and off-site for short term averaging periods but limited to TSF and mine pit for longer term averaging periods. Also likely that the predicted concentrations in the Hills area are exaggerated by the modelling which treats hills and ridges as transparent. Highly unlikely for Pevek given the nature of the activities there						



Potential Environmental Cost	Adverse human health effects					
	and the distance of the proposed marshalling yard to the town.					
Communities are exposed to ambient concentrations that	Highly unlikely given that there are no communities within a 10 km radius of the mine and as such there would be no exposure to ambient concentrations that exceed health based limits.					
exceed health based limits	Highly unlikely for Pevek given the nature of the activities there and the distance of the proposed marshalling yard to the town.					
Residual risk	Low					

Table 54. Impact significance for possible damage to vegetation and reduced habitat risks as a result of atmospheric emissions from the Project

Potential Environmental Cost	Damage to vegetation and reduced habitat						
Inherent risk	Moderate – high						
Causes of risk	Likelihood of causes						
Emissions of NO <sub>x</sub> result in ambient concentrations that exceed defined environmental damage based limits	Unlikely as vegetation damage would typically only occur with longer term exposure to elevated pollution concentrations which is not predicted by the dispersion model. Highly unlikely for Pevek given the nature of the activities there.						
Emissions of PM (TSP, PM <sub>30</sub> , PM <sub>10</sub> , PM <sub>2.5</sub> ) result in ambient concentrations that exceed defined environmental damage based limits	Unlikely as vegetation damage would typically only occur with longer term exposure to elevated pollution concentrations which is not predicted by the dispersion model. Highly unlikely for Pevek given the nature of the activities there.						
Habitat exposed to ambient concentrations that exceed damage based limits	Highly unlikely given the generally small, longer term averaging period ambient concentrations even over the immediate mine area. Highly unlikely for Pevek given the nature of the activities there.						
Residual risk	Low						

# 8.2. <u>Waste Generation</u>

## 8.2.1. Introduction

For the establishment and operation of the mine and processing plant a number of wastes will be generated and during mine operations very large quantities of waste. A distinction must be made immediately though between hazardous and non-hazardous wastes too because the risk posed by the different waste types present potentially different risks. *Hazardous waste has the properties of a hazardous material (e.g. ignitability, corrosivity,* 



reactivity, or toxicity), or other physical, chemical, or biological characteristics that may pose a potential risk to human health or the environment if improperly managed<sup>143</sup>. Wastes may also be categorised as hazardous simply by authority decree. Unless carefully managed both hazardous and non-hazardous wastes have the potential to result in environmental impacts and so the chosen waste management strategy is an important consideration in the ESIA process for the Peschanka Copper Project. Potential impacts on water resources and soils is a key concern but worker health and safety considerations must also be considered in evaluating the risks associated with exposure to, especially hazardous waste

It is also important to differentiate between construction and operations of the facilities which would produce quite different types of waste and which would require separate, bespoke disposal strategies. For the purposes of this assessment the anticipated types and quantities of wastes will be described highlighting the different hazard properties of each waste type. Thereafter the proposed disposal strategies will be described for the different waste types to ascertain whether the proposed disposal strategies are consistent with good industry practice, lender requirements and of course the Russian environmental regulations.

## 8.2.2. Russian Regulatory Requirements for Waste Management

At the outset the Russian regulatory requirements must be defined because it is these specifically that will ultimately be used to review and decide on the fate of the wastes generated at the Peschanka Copper Project. In addition, the regulatory requirements for waste management have similar requirements to the IFC. In accordance with the Russian requirements and in general terms, companies must reduce the amount of waste generated, implement waste segregation and strive to maximize waste processing or recycling. Importantly, the Russian requirements stipulate that for waste containing any of a defined set of materials that recycling such waste is mandatory and direct disposal of the waste is prohibited. As an example, from early 2018 disposal of metal waste and metal products including hazardous mercury waste has been prohibited.

All such waste must be sent to licensed companies for recycling. From early 2019, paper cardboard waste, packaging materials and containers made of paper, plastic and glass, car tires, and others can no longer be disposed. From the beginning of 2021, it would not be allowed to dispose of waste products (instruments, tools, etc.), including electronic and metal components. Extractive industry enterprises in the Russian Far North are located remotely from waste disposal centres and it is accordingly not possible to easily comply with this recycling requirement. Also, large enterprises based in remote areas already use incinerators to eradicate the problem of attracting predators to landfill sites. Importantly, as part of the development of the design documentation, the applicant would be required to submit a detailed waste inventory for the construction and operations phases of the mine together with the hazard class, expected waste volumes and proposed methods of handling each individual waste type. The approval of that design documentation is required before the waste generation can commence.

<sup>&</sup>lt;sup>143</sup> IFC/WBG EHS Guidelines: Environmental Waste Management, 2007



The final disposal that would be approved by the Russian authorities would be a function of the waste classification system. In accordance with the Russian classification system144, waste is divided into 5 hazard classes:

- 1st class extremely hazardous waste;
- 2nd class highly hazardous waste;
- 3rd class moderately hazardous waste;
- 4th class low hazard waste; and,
- 5th class practically non-hazardous waste.

## 8.2.3. Construction Wastes

Anticipated quantities of waste that are likely to be generated during the construction of the mine and processing plant are summarised in Table 55. As indicated, this characterisation of waste would be more accurately determined and better formalised as part of the development of the design documentation, including the approval of the intended means of disposal.

Construction waste by Type	Values for Peschanka*	Units
Logging residue	615,722	kg
Scrap steel	186,844	kg
Plastic	140,746	kg
General solid waste (unsorted)	1,324,075	kg
Solvents and fuel	623	liters
Grease	314	kg
Aerosols	206	kg
Used batteries	183	kg
Oil	4 571	liters
Contaminated lint and tongue stick	47	kg
Needles	5 033	units
Syringes	4 789	units

Table 55. List of the main types and approximate quantities of waste that is likely to be generatedduring the construction phase

\*Extrapolated from historical data sourced from a project analogous to the Peschanka Copper Project

<sup>&</sup>lt;sup>144</sup> Federal Law of 24.06.1998 r. № 89-FZ On Production and Consumption Waste (as amended on 12.25.2018. Federal Classification Catalogue of Waste (FKKO) approved by the Federal Service for Nature Use Supervision of 22.05.2017 r. № 242.



## 8.2.4. Operational Wastes

Anticipated quantities of waste that are likely to be generated during operations of the mine and processing plant are summarised in Table 56. Tailings is the largest volume of waste followed by waste rock with the remaining waste types being significantly lesser quantities. The tailings would be disposed as a slurry in a dedicated tailings storage facility (TSF) that is described in detail in the Project description (Chapter 3.7.6). The waste rock will be disposed as an open stockpile with wastewater runoff from that facility being pumped to the TSF. The remaining waste types would all be incinerated with the bottom ash from the incinerator being disposed in the TSF as well.

Operations waste by type	Values for Peschanka	Units	Means of disposal			
Waste rock	1 164	million tonnes (LOM)	Open stockpiles			
Tailings	68 000 000	tonnes/annum (dry solids)	Dedicated tailings storage facility (TSF)			
Waste oil	813 000	litres/annum	Incinerated, with			
Domestic waste	2 555	tpa	bottom ash disposed in			
Sewage sludge	2 400	tpa	TSF			
Production waste	215	tpa	Managed in line with the Russian legislation			
Hazardous waste	100	tpa	requirements			

Table 56. List of the main types and approximate quantities of waste that is likely to be generated during the operations together with the planned means of disposal

The expected performance of the incinerator is shown in Table 57, with the emissions volume shown in Table 58 and the emission concentrations of selected key pollutants shown in Table 59.

Table 57. Expected Throughput of the Waste Incinerator for the Different Waste Types that Woul	d
be Incinerated	

Feed Type	Waste m3/day	Waste tonne/d
Feed Type 1: domestic waste (5,000 people, 2kg/person/day)	29.10	10.0
Feed Type 2: sewage sludge	9.15	6.60
Feed Type 3: industrial waste (pallets, packaging, cleaning, used PPE, etc)	2.59	0.60
Feed Type 4: hazardous waste (waste oils, hydraulic fluid, lubricants, etc)	0.30	0.30
Total	32.40	14.46



Table	58.	Expected	emissions	from	the	incinerator	in	volume	as	а	function	of	the	waste
throug	hpu	t and oper	<b>ating burn</b> t	time										

Stack Data	Units	
Unit capacity	1.25	t/h
Waste input	14.50	t/d
Stack outlet	5,100	m³/h
Operating burn time	11.60	h
Stack flow per burn	59,000	m³ per burn

#### Table 59. Expected Emission Concentrations from the Incinerator for Selected Key Pollutants

Emission type	Emission (mg/Nm3)				
Particulate matter	30				
со	50				
SO2	10				
NOx	30				
нсі	5				
Organic compounds	50				
Fluorides	4				

## Waste rock stockpiles

Dumps of overburden rocks (external car dumps) are to be established in the vicinity of the mine pits on unoccupied land suitable for the formation of stable dumps. According to the results of the analytical studies and calculations on potential of formation of acid mine drainage (ARD) host rocks do not contain acid-generating materials. It is nonetheless prudent to discharge runoff from the waste rock dumps to the TSF.

#### 8.2.5. Impact Assessment

The potential impacts of poor waste management derive from the potential transfer of hazardous compounds within the waste into:

- Surface and/or groundwater;
- Soil; and,
- Atmosphere.

These impact/risks are assessed inTable 60.


Potential Environmental Cost	Risk of material reductions in environmental quality		
Inherent risk	Moderate		
Risk source	Likelihood of causes		
Transfer of contaminants from waste into surface and/or groundwater	The possible contamination of ground and surface water outside the boundaries of the mine and processing plant as a result of poor waste management is considered unlikely but possible. It is the integrity of the TSF that is key to ensuring that there is no infiltration of supernatant into the underlying suprapermafrost and from there into the surface water environment downstream of the TSF. The integrity of the TSF in preventing discharge of supernatant has been assessed in other parts of this report.		
	Due to the nature of activities at Pevek, waste generation will be minimal and largely limited to municipal solid waste (MSW). There is also an existing MSW landfill at Pevek that can be used for such waste.		
Transfer of contaminants from waste into soil	The transfer of contaminants from waste to soil is considered to be definite for the waste rock stockpile and for the TSF as there will be no impervious lining for either facility preventing contact of possible contaminants with the underlying soil. The relative small scale of this effect, compared to the broader wilderness area as well as the fact that the soil would be underlain by permafrost preventing further movement of the contaminants into water resources. Due to the nature of activities at Pevek, waste generation will be minimal and largely limited to municipal solid waste (MSW). There is also an		
	existing MSW landfill at Pevek that can be used for such waste.		
Transfer of contaminants from waste into atmosphere	The likelihood of transfer of contaminants into the atmosphere as a result of emissions from the incinerator would be definite but the materiality of this effect is considered insignificant due to the fact that emissions concentrations from the incinerator all comply with defined emissions performance criteria for incinerators (IFC EHS Guidelines). This possible risk does not apply to Pevek as no incinerators would be used there.		
Residual risk	Moderate		

Table 60. Impact sign	ficance for Project-rel	ated waste manageme	nt impacts
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## 8.2.6. Proposed Mitigation

#### Waste rock dumps

Proposed mitigation for management of waste rock dumps include the following:

- Dumps should be planned with appropriate terrace and lift height specifications based on the nature of the material and local geotechnical considerations to minimize erosion and reduce safety risks; and,
- Design of waste rock dumps to provide for potential deterioration of geotechnical properties with higher factors of safety. Stability / safety assessments of existing facilities should take these potential changes into account.



## Tailings

Proposed tailings management strategies include:

- Design of tailings storage facilities should take into account the specific risks / hazards associated with geotechnical stability or hydraulic failure and associated downstream risks. Environmental management planning should thus also consider emergency preparedness and response planning and containment / mitigation measures in case of catastrophic release of tailings or supernatant waters;
- Seepage management and related stability analysis must be key in the design and operation of tailings storage facilities. This would require a specific piezometer based monitoring system for seepage water levels within the structure wall and downstream of it, which should be maintained throughout its life cycle;
- Design specifications should include the probable maximum flood event and the required freeboard to safely contain it (depending on site specific risks) across the planned life of the tailings dam, including its decommissioned phase; and,
- Where potential liquefaction risks exist, including risks associated with seismic behaviour, the design specification should take into consideration the maximum design earthquake.

## Hazardous Waste

Recommended practices for the management of hazardous waste include the following:

- Hazardous wastes should always be segregated from non-hazardous wastes. Hazardous waste management should ensure prevention of harm to human health, safety, and the environment, as follows:
  - Understanding potential impacts and risks associated with the management of any generated hazardous waste during its complete life cycle;
  - Compliance with applicable national and international regulations;
  - Hazardous waste should be stored so as to prevent or control accidental releases to air, soil, and water resources in a location where:
    - Commingling or contact between incompatible wastes is prevented and allows for inspection between containers to monitor leaks or spills;
    - It is stored in closed containers;
    - Secondary containment systems should be constructed with materials appropriate for the wastes being contained (e.g. anticorrosion properties) and adequate to prevent loss to the environment;
    - Secondary containment (bunding) must be included wherever liquid wastes are stored in volumes greater than 220 liters. Secondary containment should be at least 110% of the largest storage container; and,
    - Adequate ventilation must be provided where volatile wastes are stored.



- Hazardous waste storage management must be conducted by employees who have received specific training in handling and storage of hazardous wastes:
  - Information on chemical compatibility must be readily available to employees, including labelling containers;
  - Preventing access to hazardous waste storage areas to employees who have not received proper training;
  - Clearly identifying (label) and demarcating the area, including documentation of its location on a facility map or site plan; and,
  - Conducting periodic (as required) inspections of waste storage areas and developing corrective actions on non-compliance.
- Preparing and implementing spill response and emergency plans to address accidental release; and,
- Avoiding underground storage tanks and underground piping of hazardous waste.

## **Incinerator Operations**

- Conduct waste segregation and/or pre-sorting to avoid incineration of wastes that contain metals and metalloids that may volatilize during combustion and be difficult to control through air emission technology (e.g., mercury and arsenic);
- Follow applicable national requirements and internationally recognized standards for incinerator design and operating conditions, including:
  - Rapid quenching of flue gas after leaving combustion chambers and before entering dry particulate matter air pollution control device but also apply combustion temperature, residence time, and turbulence so as to minimize dioxin and furan formation;
  - Introduce wastes into the incinerator only after the optimum temperature is reached;
  - Prevent the addition of waste if the operating temperature is below the required limits;
  - o Minimize uncontrolled ingress of air into the combustion chamber; and,
  - Optimize and control combustion conditions by controlling air (oxygen) supply, distribution and temperature, including gas and oxidant mixing.
- Implement maintenance and other procedures to minimize planned and unplanned shutdowns;
- Avoid operating conditions in excess of those that are required for efficient destruction of the waste;
- Use auxiliary burner(s) for start-up and shutdown and maintaining required operational combustion temperatures (according to the waste concerned) at all times when unburned waste is in the combustion chamber;
- Use flue gas treatment system for control of acid gases, particulate matter and other air pollutants; and



 Minimize formation of dioxins and furans by preventing particulate control systems from operating in the 200 to 400oC temperature range; identifying and controlling incoming waste composition; using primary (combustion-related) controls; using designs and operation conditions that limit the formation of dioxins, furans, and their precursors; and using flue gas controls.

## Used Tyres

• A key waste management challenge for an open pit operation like Peschanka is disposal of used tyres. Tyres will be collected and stored on site until they are transported to a suitable recycling facility.

## 8.3. Impact on Surface Water and Groundwater

## 8.3.1. Introduction

For any mine, potential surface water and groundwater impacts are a key issue and in the case of the Peschanka Copper Project, made more complex still by the extreme weather and the resultant cryogenic processes, and by the multiple systems in the Project area that are potentially vulnerable to contamination. There are several ways that the development and operation of the mine could impact on groundwater and these are:

- Pumping of water (groundwater, snowmelt and rain) from the mine pits to maintain a safe working environment, pit dewatering may result in creation of the depression cone which could influence regime of local aquifers;
- Infiltration of supernatant from the tailings storage facility into the underlying groundwater and associated contamination risk; and,
- Spillage of hazardous materials on site, most notably fuels and/or oils that could potentially impact on groundwater if such materials percolate into the groundwater.

# 8.3.2. Acid mine drainage (AMD) and metals leaching (ML) risk

Before presenting the assessment it is also necessary to deal with the risk of Acid Mine Drainage (AMD) and possible metals leaching (ML) from the waste rock stockpiles, which would also potentially infiltrate groundwater and impact on surface water. The results of static and kinetic tests have been presented in detail in Section 6.1.3 and indicate that the majority of samples are not acid generating. However, some samples have acid generating properties, which must be taken into account in the design of mine facilities in order to minimise environmental risks and potential for metal leaching and acid rock drainage.

## 8.3.3. Hydrogeological Conditions

# Geological substrate

The geological substrate in the Project area consists of a thick layer of Lower Cretaceous plutonic rocks (quartz diorite porphyry) containing multiple mafic and intermediate rock intrusions in the form of dikes and stocks. Dikes also date back to the Lower Cretaceous period. The ore grade mineralisation is concentrated in the intrusive formations and dike



contact zones containing copper, gold and other metals in disperse form. The upper part of the geological profile comprises relatively thin alluvial deposits associated with small local rivers and streams (gravel, sand and loam) and diluvial deposits (debris and sandy loam) forming a thin blanket on the river valley slopes in the Peschanka River basin.

# Tectonic structure

The tectonic structure of the Project area is one of an ancient island system similar to the present-day Kuril Islands, which includes large near north-south Baimka and Yegdegkych faults. These faults are described as 'extension zones', which facilitate the upward movement of ore-bearing fluids and solutions. Such extension zones typically include exposed fractures and are highly permeable as such, with the only exception being 'healed fractures' (i.e. those filled with quartz, calcite and other minerals). The main faults are associated with fracture zones that have a near north-south extension and almost vertical inclination. The lack of information about the nature and origin of these zones makes it difficult to provide their hydrogeological characterisation but the configuration of river valleys in the Project area with their axes matching the directions of main faults, suggesting the renewal of north-south joints due to neotectonic activity. These are the weakest zones in the Earth's crust where the river valleys and, possibly, linear fracture systems have developed in their current shape and form.

# Geocryological stratification

The hydrogeological stratification must be considered together with the permafrost (geocryological) stratification of the profile because there can obviously only be transport of pollutants through water, and indeed movement of the water itself, when it is in liquid form. Here it is necessary to differentiate between suprapermafrost, interpermafrost and subpermafrost groundwater (in liquid form) that occurs above, between and below the permafrost respectively.

# <u>Suprapermafrost water</u>

Suprapermafrost water occurs as a seasonally thawed layer having a thickness of 0.5 to 3.5 m. The groundwater saturates the diluvial sediments covering the slopes, thus affecting their physical, mechanical and structural properties and significantly limiting their suitability to serve as a basement for engineering structures. Alluvial sediments covering the valleys of the Peschanka River and its tributaries also thaw during the (relatively) warm season reaching maximum thickness where they are present in sand and gravel of different varieties and are not covered by a loamy clay or peat blanket. Peat covering the floodplain and lower terrace acts as insulation that limits the thawing of the underlying permafrost layer to no more than 0.5 m. Narrow, shallow talik zones lie underneath the river and stream channels. In the Peschanka River valley, these zones occur only where there is flow from the river tributaries. These small talik zones have no significance as a water supply source.

# Interpermafrost groundwater

Interpermafrost groundwater or water of non-frozen continuous thaw zones under rivers and streams ('through taliks') is concentrated under the river channels and lower terraces of larger rivers (i.e. the Bolshoy Anyuy and Malyi Anyuy and Yegdegkych rivers).



# Subpermafrost groundwater

Subpermafrost groundwater occurs at depths exceeding 150 m in slightly fractured or even completely impermeable plutonic rocks. There is no information about whether and how this groundwater source can be used to produce water of potable quality in the required quantity because none of the exploration wells has been confirmed to reach an intensively fractured tectonic zone. The following two considerations should be borne in mind when conducting hydrogeological exploration of the Project area. First, it is difficult to abstract low-temperature water from a production well drilled in the permafrost while the use of a well heating technology is very costly. Second, water quality may deteriorate significantly as the depression cone develops and reaches ore-bearing rocks due to the following two factors that may be at play there: the migration of heavy metals toward the well due to an increased velocity of groundwater flow and inflow of contaminated mine water. Note that no groundwater would be used for either industrial or potable purposes.

## Fracturing

Judging by core samples taken from exploratory wells, Mesozoic plutonic rocks have a massive monolithic structure with rare metamorphic and tectonic fractures encountered per each metre drilled; there are only few occasions when the number of these fractures is more than 10 per metre. This rock profile comprises three more intensively fractured zones. The upper one includes weathering zone and seasonally thawed layer. It includes talik zones lying underneath the river channels and frost-cleft rock formations in exposed areas. The middle zone includes the contact zones of dikes and other intrusions. The lower zone has a thickness of up to 100 m and encompasses the bottom section of permafrost layer. It has developed as a result of cryogenic disintegration of the Lower Cretaceous rocks - a process which has involved the multiple freezing and thawing during the downward advancement and temporary degradation of permafrost. Water freezes in the cracks of rocks and expands, breaking the rocks apart and making them more permeable. This process occurs in parallel with the development of an excessive cryogenic pressure under the permafrost bottom. This means that the subpermafrost groundwater head combines two components, i.e. the hydrostatic pressure which is traditionally described by Bernoulli's equation and cryogenic pressure. With groundwater filtration rates being extremely low, the dynamic head as a component of the total head can be neglected.

## Permafrost depth

It should be borne in mind that the permafrost thickness estimates in the Peschanka River valley are very approximate. A profile composed of high-resistivity permafrost rocks and subpermafrost aquifers containing sweet water is always difficult to describe with the electrical logging methods. Blurred boundaries between the frozen and thawed sections of the profile also impede accurate interpretation. It is likely that there is a certain 'transitional' zone between the frozen and thawed sections which includes permafrost interlayers and lenses surrounded by thawed zones, i.e. so-called permafrost patches developed as a result of temperature fluctuations occurring during the freezing cycle.

## Estimates of pit inflow volumes

The use of the term 'fracture vein water' with respect to the lower subpermafrost section of the ore-rich layer may require revising the method used to predict water inflows to the mine pit. Under low water yield and permeability of rocks, the major proportion of water



inflow is likely to be generated as a result of localised groundwater discharges from fractured tectonic zones and cryogenic disintegration zones exposed by the pit mining. Before reaching these levels it will be necessary to identify the intensively fractured zones and refine the estimation of water inflows to the pit based on the actual characteristics of each horizontally and vertically exposed component. This further refinement of the inflow calculations would require implementing and maintaining continuous hydrogeological monitoring at the Project site.

## 8.3.4. Water Quality

The hydrochemistry (quality) of groundwater and surface water is sourced from the data provided in the 2016 HYDEC reports<sup>145</sup>.

## Surface water quality

Water mineralisation in rivers and streams in the license area is very low. These watercourses contain fresh and sweet water, being fed by melt water. The Peschanka River and its tributaries are seasonal and freeze up in winter, and begin to thaw in spring with small streams of water flowing across the ice sheets. Total mineralisation ranges from tens to a hundred milligrams per litre with total hardness being up to 1 mg-eq/l. Water is slightly acidic to neutral with pH ranging from 5.6 to 6. Based on K. Pityeva's classification, the water is categorised as sulphate-hydrocarbonate and calcium-magnesium.

Surface waters cannot be used as a source of water supply without serious treatment because they contain iron and manganese at elevated concentrations (which exceed the respective MPC limits by more than 3 times) and show high permanganate oxidability values suggesting the presence of phenols and other organic compounds. In addition, the water in rivers and streams has a pale yellow to brown colour, which is probably an indication of humic, and fulvic acids entering the river water with flow from thawing bogs. Overall, previous test work on the river water indicates surface water quality in the Project area does not meet the fisheries and drinking water quality guidelines, especially during flood flow periods.

Water samples were collected in the spring and summer and it would be necessary to maintain a surface water quality-monitoring regime into the future to detect and quantify potential changes in water chemistry and composition as the mine is established and operated.

## Groundwater quality

## Suprapermafrost water

Suprapermafrost water is very similar to surface water in composition. The water is fresh and sweet with mineralisation ranging from 0.03 to 0.3 g/l; it has a sulphate-hydrocarbonate or sulphate and calcium-magnesium or calcium composition. The pH levels range from 5.8 to 7.3. The permanganate oxidability value exceeds the respective MPC limit

HYDEC. 2016b. Hydrogeological Substantiation of the Development of the Peschanka Deposit, the Baimka License Area (Chukotka AO). HYDEC Hydrogeological and Geo-ecological Company (HYDEC) CJSC, Moscow, 2016.



<sup>&</sup>lt;sup>145</sup> HYDEC. 2016a. Investigation of the Hydrogeological Conditions of the Peschanka Deposit, the Baimka License Area in 2015 (Chukotka Autonomous Okrug). Report on Findings of the Study. HYDEC Hydrogeological and Geo-ecological Company (HYDEC) CJSC, Moscow, 2016.

by fivefold. Iron and manganese are present at elevated concentrations (from being equal to the MPC limit to 18 times the MPC limit), causing an unpleasant taste and rusty colour. Aluminium, lead and tungsten are also present at concentrations exceeding their MPC limits. The concentrations of copper, zinc and molybdenum exceed regional background levels.

Of special note is water flowing in exploratory and drainage ditches, on the surface which is a bright blue colour, indicating the presence of copper sulphate at high concentrations reaching 1 g/l. For many years of geological time this polymetallic ore deposit dating back to the Cretaceous period had existed without permafrost and was affected by natural weathering processes, both physical and chemical. Due to these processes, copper, iron and other metal sulphides were exposed to water and oxygen. Sulphide minerals (pyrite, copper pyrite, peacock ore, and so forth.) were oxidized to form soluble sulphate compounds known as copperas. When ore mining and processing occur in anaerobic conditions but in the presence of organic matter, a 'reverse' biogeochemical reaction – sulphate reduction – may develop to transform sulphates into hydrogen sulphide and reduce hexavalent sulphur to bivalent sulphur.

## Subpermafrost water

Subpermafrost groundwater occurs in the form of cryopegs, i.e. lenses of brines formed as a result of downward frost penetration when fresh water with little or no mineralisation freezes within the pores, causing groundwater to move further downward where its mineralisation increases as it receives dissolved compounds. Due to high mineralisation, liquid groundwater permanently remains at subzero temperature, being chilled but not frozen by the surrounding permafrost. Multiple changes in permafrost depths in the Project area have caused the dilution of briny water in cryopegs.

Subpermafrost water is categorised as sulphate-chloride calcium and has a mineralisation of up to 1.8 g/l, and as such being classified as brackish water. Mineralisation increases with depth and, according to the GIDEK report, may reach 5 g/l. This water is not suitable for domestic and potable uses due to the elevated concentrations of iron and manganese which exceed the MPC limit for iron by 150 times and that for manganese by more than tenfold. In addition, this water contains boron, beryllium, lithium, strontium and tungsten at unacceptably high concentrations. It can be concluded that this water cannot be discharged to surface water bodies without pre-treatment. Subpermafrost water samples taken from deep wells sometimes also indicate the presence of technogenic contaminants (drilling solution components that have not been completely washed, de-icing fluids, surfactants, ammonium ions (2 times the MPC limit) and so forth.

## 8.3.5. Geohydrology Impact Assessment

A systems depiction of the way in which geohydrological impacts may be manifest is shown in Figure 77.

# Pit dewatering

The open pits are arranged as two isometric sections of about 900 m in lateral dimensions and one oval-shaped section of  $2\times3$  km. The elevations of the pit walls range from +395 m to 349 m. The pit bottom elevations in the separate pit sections are expected to range from +210 m to minus 145 m at the end of the mine life. As the pit reaches depth of 180-200 m, mining will expose thawed deposits comprising sandstone, aleurolite, argillite, and



conglomerate, which contain unconfined and weakly confined fracture and vein water. Assuming an average filtration rate of 0.00005  $m^3$ /day and less, the total water inflow to the deepest section of the pit is expected to be some 650  $m^3$ /day at the end of the mine life.



Figure 77. Systems depiction of the components of the geohydrological regime that would be affected by activities associated with the proposed Peschanka Copper Project

During the pit mining and dewatering, the sub-permafrost aquifer will be fed through talik zones which are presumably located in the upper reaches of the Baimka River. Water pumped from the pits and runoff from ore stockpiles will be discharged into the tailing storage facility. Toward the end of the mine life, the cone of depression is expected to extend for 6-8 km in the upward direction and is not likely to reach the groundwater flow collection zone; the extent of groundwater level disturbance in the downward direction will be about 15-18 km, which means that it will not affect the groundwater flow discharge zone located within the talik area in the Bolshoy Anyuy River valley. In other words, the Project-related impact on groundwater resources is expected to be limited to a local scale and, considering a relatively small pit dewatering requirement during mining operations, it is considered to be of minor significance for groundwater itself.

The most permeable linear fractured tectonic zones have not yet been identified and described although they will be the main pathways for water inflow to the pit as mining proceeds downwards and reaches the permafrost base. Water inflow estimates provided in the GIDEK report can be used as indicative values but water inflows are more likely to take place through several channels similar to springs and craters rather than be evenly distributed over the pit walls. The total output of these springs may be close to estimates presented above. The pit water will contain iron, manganese, copper and other heavy metals at elevated concentrations and their discharge downslope or to surface water bodies is not allowed without prior treatment. The likelihood of pit water to contain copper and other heavy metal compounds is seen as almost 100% given the groundwater origin. Provided there is adequate capacity in the TSF for the volume of water to be pumped from the pits, which is implied by the current water balance, disposal to TSF is seen as an



acceptable option for ensuring that there is no discharge to surface water from the pumped groundwater. Associated impact significance is presented accordingly in Table 61.

Potential Environmental Cost	Deterioration of surface water quality		
Inherent risk	Moderate		
Causes of risk	Likelihood of causes		
Water pumped from the pits towards the end of the mine life will derive principally from interpermafrost and subpermafrost water, which will contain elevated concentrations of iron, manganese, copper and other heavy metals.	Unlikely (but possible) that this water will enter the surface water environment given that it is planned to discharge the pumped water into the TSF, which is being designed as a zero discharge facility. This risk does not exist at the Pevek site.		
Discharge of supernatant from the TSF into the downstream environment either directly or via infiltration into the groundwater. The supernatant will contain significant quantities of iron, manganese, copper and other heavy metals.	Unlikely (but possible) as the TSF will have an impermeable base (as a result of a permafrost base) and there will be a retention dam downstream of the main dam wall for any seepage underneath the main wall to be captured and pumped back into the TSF. This risk does not exist at the Pevek site.		
Residual risk	Moderate		

Table 61. Summary rationale for impact significance in respect of risk of deterioration of surface
water quality as a result of Project activities

# 8.3.6. Tailings Storage Facility

The proposed TSF design features two rockfill tailings storage dams. Dams are located between the slopes of Peschanka river valley. The upstream slope of the dam will be covered with an impermeable bentonite geomembrane, layers of sand and protected by a surface layer of rock. A seepage collection system will be arranged downstream of the TSF dam to collect and recycle seepage back to the TSF basin. The materials underlying the TSF are:

- Biogenic deposits (peat, silt)
- Diluvial deposits (gravel, sandy loam, silty clay)
- Alluvial/diluvial deposits (sand, gravel, sandy loam)
- Alluvial deposits, and,
- Bedrock materials (andesite-basalt, sandstone, diorite etc.).

A network of 247 exploration boreholes covers the Project site. Temperature observations conducted using these boreholes indicate that the permafrost bottom occurs at depths ranging from 320 to 340 m. The permafrost temperature is -2 to -4°C. The permafrost layer acts as a regional confining bed in the study area. Ice layers and lenses of up to 6 m thick occur in the alluvial and alluvial/diluvial deposits. The top layer of bedrock is heavily fractured and often overlain with a low-permeable 0.3 - 1 m layer of materials formed by erosion processes (heavy sandy loam and silty clay containing pebble and gravel fragments).



Thermal conductivity estimates show that permafrost thawing and appearance of a completely thawed zone under the TSF site is not expected. Additionally, a drainage system will be installed to collect and recycle seepage water to the TSF.

The design includes a suite of measures for minimising seepage and providing seepage collection and recycling back to the tailing storage facility in order to prevent surface water and groundwater pollution downslope of TSF. Potential efficient seepage control options include:

- Proper preparation of dam foundation including the removal of loose diluvium/alluvium materials and ice to reach low-permeable deposits formed by erosion processes or bedrock layer;
- Application of seepage control measures for the dam foundation and slopes; and,
- Installation of seepage collection system on the downstream face of the dam to collect and recycle seepage water back to the TSF.

## Contamination of groundwater

Contamination of groundwater is an important risk for any mining operation given the immediate interface between mining activities and groundwater. In the harsh climatic conditions, the use of permafrost to create the impermeable layer at the base of the TSF is deemed to be a most optimal solution for the Peschanka Copper Project.

At the same time various hazardous materials that are required on the mine site means that there is a continued risk of spillage of such materials and depending on the ground conditions when such a spillage occurs, the materials may soak through the ground and contaminate the suprapermafrost water. The risk of such impact is mitigated by a two pronged approach namely an effective hazards materials management regime that ensures that there are effective controls for the transport, storage, use and disposal of such materials to prevent spillages from occurring. The second part of the mitigation is ensuring that are effective spill recovery and countermeasures that can be deployed in the event of a spill, so as to ameliorate the spills before the materials can soak through to the groundwater. Impact significance is presented accordingly in Table 62.

lable	62.	Summary	rationale	for	impact	significance	ın	respect	of	risk	of	deterioration	of
groun	dwa	ter quality	related to	the F	Project								

Potential Environmental Cost	Deterioration of groundwater quality			
Inherent risk	Moderate			
Causes of risk	Likelihood of causes			
Infiltration of supernatant through the base of the TSF to superpermafrost water	Unlikely (but possible) given the extremely severe climate in the Project area, the use of permafrost as an impermeable barrier is considered feasible. This is obviously not applicable to Pevek as there would not be a TSF at Pevek.			
Spillage of hazardous materials including flotation chemicals, fuels, lubricants, solvents and others may	Unlikely (but possible) as provision will be made to transport, store, use and dispose of hazardous materials in a manner that prevents them from being spilled onto a soil			



Potential Environmental Cost	Deterioration of groundwater quality
permeate through the soil and into the superpermafrost water	surface. In the event of a spillage there would also be spill recovery and countermeasures across the mine to ameliorate such a spill were it to happen. Such contingencies would also apply to the Pevek site.
Residual risk	Moderate

## 8.3.7. Proposed Mitigation

- Develop a detailed water balance for the mine, processing plant and all other water uses/sources;
- When tectonically weak zones are encountered in the frozen or thawed pit walls, advance drainage wells should be drilled in order to reduce groundwater pressure;
- An environmental monitoring system must be established including a network of hydrogeological observation wells. The design of an environmental monitoring system should be developed to include the rationale for groundwater monitoring locations, timing and organisational arrangements. A rationale for the timing of groundwater monitoring activities means the justification of well/water source testing dates; a rationale for groundwater monitoring locations is the justification of drilling locations and filtering intervals (i.e. the horizontal and vertical spacing of test intervals); and a rationale for organisational arrangements relates to ensuring that an adequate and sufficient suite of physical and chemical tests is included in the monitoring programme;
- As tailings will accumulate in the tailings storage facility, tailings layer will increase thickness of isolating layer thus providing a better protection of permafrost.
- Engineering and geological geocryological investigations were conducted at the TSF site which will inform the TSF design development.

## 8.4. Impact on Biodiversity

#### 8.4.1. Introduction

As described in the Environmental Baseline (see Section 6.7.1) the Chukotka wilderness is one of hilly topography, with strong altitudinal zoning of physiographic conditions and rock weathering processes and complex vegetation cover characterized by low species and taxonomic diversity. The plant species composition and distribution, as well as the structure of vegetation cover, are considered to be typical of the mountainous Anyuy-Chukotka geobotanical district of the Arctic Tundra Region. Three altitudinal landscape belts can be distinguished in the Project area namely:

- 500-750 m: Arctic-mountain desert and tundra belt lying on cryostructured rubble/stone ridge-top primary deposits with little or no vegetation;
- 400-500 m: Larch forest tundra belt extending over primary slopes, fluvioglacial trails, upland terraces, and loose Quaternary deposits of various origin; and,
- 200-400 m: River valley bottom belt composed of pebble/stone and sand/pebble alluvial deposits.



Sparse larch woods dominate the area with dwarf cedar woods playing a secondary role. The least commonly occurring plant communities are associated with the bottom sections of river valleys. Areas with no vegetation or those covered by ruderal vegetation (vegetation that is first to colonize disturbed lands, where such disturbance is natural or anthropogenic) is concentrated in the disturbed sections of river valleys and accounts for less than 1.5% of the area.

Chukotka's fauna comprises 64 mammal species and some 220 bird species with important game species including elk, wild reindeer, brown bear, sable, wolf, glutton, ermine, fox, Arctic fox, American mink, squirrel, Arctic hare, water rat, bean goose, white-fronted goose, rock capercaillie, white grouse and ptarmigan, and over 10 duck species. Specific species of conservation value inhabiting Chukotka snow sheep, osprey, white-tailed eagle, blue hawk, gyrfalcon, peregrine falcon, eagle owl and boreal owl. Seasonal (spring/autumn) migration routes used by larger birds (goose and duck) are some 20 km away from the mine site and the aerodrome in particular, and follow the floodplain valleys of the Bolshoy Anyuy, Angarka and Baimka rivers.

Species recorded during the field surveys in 2015 and 2019 predominantly represent predators and small rodents. No rare and protected species were recorded in the Project area or the larger surrounding survey area. The bird and terrestrial fauna in the Project area are typical of the much larger geographic distribution of such fauna with habitats concentrated in the floodplains of rivers and streams flowing in the area. This representation of a much larger area is extremely important to the assessment that follows. The tundra is extremely vulnerable to impact as evidenced by the legacy effects of exploration and mining activities, especially placer mining, which has have resulted in significant environmental degradation. Such degradation is, however, largely limited to the areas directly affected by the mining. The mechanisms whereby the activities associated with the Peschanka Copper Project could result in impacts on biodiversity are:

- Habitat destruction as a result of physical changes to the landscape including the areas used for waste rock and overburden, ore stockpiles, the mine pits, the processing plant and other mine facilities and the TSF;
- Changes in habitat quality as a result of atmospheric emissions, wastewater discharge and disposal of waste;
- Noise and light pollution from the mine facility; and,
- Poaching by mine personnel.

# 8.4.2. Impact on Aquatic Ecosystems

Any mine activities that interfere with the hydrology, hydraulics, water quality and ultimately aquatic habitat of the surface water systems in the vicinity of the mine invoke the risks of impacts on fish populations and other aquatic organisms in those systems. Ichthyological surveys conducted in 2015, revealed no fish species of significant conservation and commercial value in the watercourses in the Baimka and Yegdegkych river basins. That notwithstanding the construction and operation of the mine would cause impacts of varying intensity on the aquatic habitat of the Peschanka and Yegdegkych river basins with possible reductions in fish populations, with the extent of these impacts reaching as far as where the Baimka River flows into the Bolshoy Anyuy River. A systems depiction of how impacts might manifest is shown in Figure 78 with impact significance



presented accordingly in Table 63. Before presenting that assessment, it is necessary to first consider in some detail the effect of establishing the TSF.

## Impacts associated with the TSF

The TSF construction will change the hydrological regime of the middle and lower reaches of the Pravaya Peschanka River, a right tributary of the Peschanka River, converting it into a reservoir with associated changes in water quality, loss of river zoobenthos and fish populations affected by the TSF. The TSF will also result in loss of terrestrial habitats of flooded areas. Similar impacts will occur in the middle and lower courses of several small streams being tributaries of the Peschanka-Yegdegkych River.

At the same time, the surface water habitat that will be lost to the TSF extends over a vast area well beyond the area of the TSF and it is highly unlikely that this larger area will be so affected even in the relative close downstream proximity to the TSF. That likelihood will also reduce with increasing distance from the TSF. As such although fish populations would be lost from the rivers directly affected by the TSF, the lost population would not constitute a significant loss of species and would not imply in any way the potential loss of a species.



Figure 78. Systems depiction of the components of how biodiversity might be affected by activities associated with the proposed Peschanka Copper Project

Table 63. Summary rationale for impact significance in respect of aquatic ecosystems as a resultof Project activities

Potential Environmental Cost	Risk of reduced fish populations			
Inherent risk	Moderate-high			
Causes of risk	Likelihood of causes			
Increased suspended and stream bed sediment transport, accompanied with a turbidity plume developing downstream of a polluting activity	Definite in the upper reaches of the Yegdegkych River which will be affected by the TSF and highly likely downstream of the TSF during construction of the dam wall. During mine operations, sedimentation			
Suspended solids deposition and silt build-up in the spawning area and	downstream of the TSF is unlikely (although possible) due to the controls that would be exercised on the TSF to ensure that it is a zero discharge facility. The			



Potential Environmental Cost	Risk of reduced fish populations
bottom benthic community habitats in the area where construction activities take place	construction of the water raw dam is unlikely to affect downstream of the Yegdegkych river, because of the TSF location downstream of the wall. It should be noted that these effects are likely to be limited to the near vicinity of the construction activities and controls will be implemented during the construction of the two dam walls to minimise downstream sedimentation effects. These risks do not apply to the Pevek site.
Reduced water quality due to wastewater discharges	Highly likely during the construction phase but again restricted to the immediate vicinity of the mine site. Unlikely, but possible, due to discharge of all wastewater into the TSF and the controls that will be used on the TSF to prevent downstream releases of water from the TSF. Previous test work on the Peschanka and Yegdegkych rivers water indicates that it does not comply with fisheries and drinking water quality guidelines. These risks do not apply to the Pevek site.
Impeded migration of migratory fish populations due to the alteration of hydraulic parameters of watercourses including channel gradients, water levels, physical obstacles etc.	Definite in the upper reaches of the Yegdegkych River, which will be affected by the TSF. Highly unlikely elsewhere in the surface water environment as no activities are planned that would have a direct hydraulic impact on other river systems. These risks do not apply to the Pevek site.
Changes in water level patterns of watercourses affecting reproduction conditions for aquatic biota	Definite downstream of the TSF but with a limited extent as a result of stopping the flow in the Yegdegkych River. Investigations are currently underway to see whether some level of flow can be maintained in the Yegdegkych downstream of the TSF to ensure that this potential impact is effectively mitigated.
Disturbed topsoil and vegetation cover on the river banks and in the floodplain areas as a result of various construction activities that would lead to the degradation of riparian habitats and spawning areas	Highly unlikely outside the realm of the TSF as no construction activities are envisaged that would so affect riparian habitats. This risk does not apply at Pevek.
Impacts associated with physical fields (acoustic, ultra and infrasonic, vibration, hydraulic shock, heat, and electromagnetic radiation) that may scare away, affect or cause injury to aquatic organisms	Highly unlikely, again outside of the realm of the TSF, as no activities are envisaged that would bring about such effects. It is unlikely that the noise and/or vibration from blasting would have a material effect on the surface water beyond the extent of the TSF. This risk does not apply at Pevek.
Illegal fishing activities of construction and operation staff affecting fish stocks	Highly likely unless strict controls are implemented to prevent this activity. Ironically, illegal fishing could ultimately have a bigger negative impact on fish stocks than the impacts described above. This risk does not



Potential Environmental Cost	Risk of reduced fish populations			
	apply at Pevek.			
Residual risk	Moderate			

## 8.4.3. Impact on Terrestrial Ecosystems

Impacts on terrestrial ecosystems are primarily a function of the direct physical transformation of land as a result of exploration and mining activities and the impacts of that transformation on habitat. In addition, noise, especially from blasting but also from vehicle movement and operations of the processing plant, and light from the mining activities would also serve to reduce habitat suitability beyond the areas directly affected by the physical transformation of land. Atmospheric emissions, especially dust would also potentially reduce habitat quality through impacts on vegetation beyond the direct physical transformation of land but limited to no more than a radius of 10 km around the mine site. The main concern regarding the consequences of such changes would be potential reductions in terrestrial fauna populations and as such that is how the impact assessment is framed. A systems depiction of how impacts might manifest is shown in Figure 78 with impact significance presented accordingly in Table 64.

Potential Environmental Cost	Risk of reduced terrestrial fauna populations				
Inherent risk	Moderate-high				
Causes of risk	Likelihood of causes				
Complete degradation of vegetation cover over the mine site	Such loss of vegetation cover is definite over the entire mine site and includes the access roads to the aerodrome and to the main road that will be constructed by the authorities to Pevek as well as the marshalling facilities at Pevek. Within the context of the surrounding expanse of wilderness area the loss of vegetation is a very small area and cannot be viewed as a significant loss. It is important to note though that the informal winter road and other tracks that have been created in order to access the mine are likely to have a more significant impact on the tundra given the distances covered by these tracks.				
Dust deposition and inhibition of plant growth in and around the areas where excavations take place	Dust deposition has been seen from the air quality assessment to extend for several kms from the mine site and the inhibition of plant growth is considered likely. That notwithstanding the extent of the impact on vegetation cover is still considered to be relatively small compared to the overall extent of the vegetation that exists beyond the mine site. This risk may apply at Pevek during construction but would be of negligible impact due to the small scale.				
Distortion of natural succession processes in plant communities and associations	As above, such distortion is limited to the immediately affected area of the mine works, which is deemed to be a small area relative to the expanse of the vegetation beyond the mine site. The same applies to Pevek.				

Table 64. Summary rationale for impact significance in respect of terrestrial ecosystems as a resultof activities at the Peschanka Copper Project



Potential Environmental Cost	Risk of reduced terrestrial fauna populations	
Increased risk of anthropogenic fires at construction and mining sites and in the surrounding areas	Such an impact is considered likely and also to potentially affect much larger areas of vegetation than would be affected by the direct impact of the mine. Although fires are known to occur naturally in the area, additional anthropogenic fires would have a negative impact on the vegetation. It will be extremely important for the mine to maintain an effective fire control and management regime so that the mine itself is not a source of runaway fires in the summer. The same would apply to the facilities at Pevek.	
Creation of barriers (linear structures) impeding natural migration patterns	The creation of such barriers is considered highly unlikely given the migration patterns that are understood to prevail and the relatively small scale of the overall footprint of the mine. Where this issue may be more important is in terms of the construction of the power lines and the new road which is being done by others. This risk does not apply to Pevek.	
Fragmentation of natural ecosystems	Fragmentation of natural ecosystems is considered highly unlikely again due to the relative size of the natural areas outside of the mine	
Creation of traps (gullies, holes, pits etc.) on the animal migration routes	area and the mine area itself. Certainly the establishment of the TSF will result in fragmentation of the tributaries running into the Yegdegkych upstream of the TSF and it seems most likely that the effect on these individual tributaries will be severe. Again however, it the relatively small scale of the effect that mitigates against this being seen as a significant impact. Care will also need to be taken with the linear structures, especially the new road that is to be built by the authorities to ensure that there is provision for addressing ecological fragmentation risk. This risk does not apply to the Pevek facilities due to the very limited spatial extent of the facility.	
Disturbance caused by night construction and production activities (noise and vibration generated by machinery, mobile plant and vehicles; odour, and light)	This effect while definite will be largely limited to the mine area and a radius of up to some 10 kms from the mine footprint. Fauna density is generally low with bears only being some 1-2 individuals per 1000 ha. As such it seems unlikely that there would be material reductions in faunal ranges and importantly some of this effect would already have manifest as a result of the exploration activities that have already occurred. The noise from blasting will definitely extend the range of this effect but it is unlikely that even that effect would limit the extent of faunal ranges to the extent that there was heightened conflict between fauna in respect of ranges. An argument could be made for this risk to apply at Pevek, but is seems unlikely given the proximity to the town.	
Unregulated wild plant harvesting and poaching activities in the adjacent areas	This effect is considered likely unless there are very strict controls implemented to prevent especially poaching activities. As with illegal fishing it must be recognised that poaching would exact a much larger toll on faunal populations than as a result of environmental aspects associate with the mine's activities.	
The development and operation of tailings storage facility and waste rock dumps would result in	This effect is definite but is again limited to the areas so affected which constitute a small fraction of a much larger area of similar habitat. This risk would not apply at Pevek.	



Potential Environmental Cost	Risk of reduced terrestrial fauna populations
the irreversible loss of directly affected habitats	
Birds and large predators could be attracted to MSW disposal areas where they may encounter lethal risks (poisoning, injury, killing by shooting)	This effect is highly unlikely given that an incinerator will be used for waste destruction. It will be important though to maintain a disciplined routine to the waste destruction to ensure that waste is not allowed to accumulate in areas where it may be accessed by animals. This risk does not apply directly at Pevek but would be likely to apply to the landfill at Pevek.
Residual risk	Moderate

#### 8.4.4. Proposed Mitigation

#### Surface water

- Establish and maintain a special protection regime for water protection zones and riparian strips as required by the Russian environmental legislation;
- Ensure wastewater is not discharged to the natural water object without treatment.
- Use treated wastewater as much as possible in the closed-loop water supply systems at the processing plant and for other purposes (fire water tanks, wetting road surfaces in dry warm weather and so forth);
- Schedule the construction of all water management facilities in water bodies and river channels in a manner that helps minimize adverse impacts, i.e. complete construction works during the cold or low-flow months, before and after floods, and take into account the aquatic ecosystem requirements (wintering periods and habitats, spawning areas, feeding habitats and key migration routes);
- Implement erosion control and bank strengthening measures to protect soil against erosion; and,
- Establish a surface water quality monitoring regime that will provide assurance that there are no surface water impacts downstream of the TSF.

#### Habitat

- All earthworks and excavations should be carried out in strict compliance with the design provisions and within the delineated construction site boundaries; and,
- Prevent unauthorized temporary roads at the mine site and at Pevek and adjacent areas during the construction, commissioning and operation of Project facilities.

#### Biodiversity

- Ensure strict compliance with design provisions and standards pertaining to emissions and discharges, and limit surface disturbance to within the Project site boundaries;
- Prevent access by vehicles to adjacent areas of barren tundra at both the mine site and the Pevek facilities;



- Maintain and enforce a strict anti-poaching regime at the mine with strict punitive measures for non-compliance; and,
- Maintain a fire prevention regime across the mine site and at Pevek together with a fire crew that is able to quickly extinguish a tundra fire that may have been started inadvertently by mine personnel or activities.

Soil

- Relevant Russian standards require that the fertile topsoil layer during the site preparation be stripped and stored for later use in reclamation activities;
- Soil samplings within environmental surveys on site confirmed that soil on site does not meet criteria of fertility;
- Stripped soil is to be used as soon as possible, for example, in reclamation of construction infrastructure that is decommissioned;
- Soil is to be remained where thermotechnical calculation shows that topsoil removal intensifies permafrost erosion.

## 8.5. Ecosystem Services Assessment

## 8.5.1. Introduction

In the presentation of the environmental baseline the importance of ecosystem services (services that are important and sometime essential to the continued welfare of humankind) that derive from the natural environment in the Project area was highlighted. It was also presented that there are different kinds of ESS namely:

- **Provisioning**, i.e. resources required to produce goods and services including food, water, and raw materials;
- **Regulating**, i.e. services the ecosystems provide by acting as regulators (assimilation of pollutants, regulation of climate and water regime, ozone layer and so forth.);
- **Cultural**, i.e. recreation, aesthetic appreciation, spiritual, ethical, moral and historical values; and,
- **Supporting** services include soil formation, photosynthesis, chemicals and water cycling. By contrast to other categories of ecosystem services that offer direct benefits, supporting services have indirect impacts on human lives (while supporting services provide the basis for all ecosystems and their services, they can be recognised as a separate category).

In the baseline the ESS provided by the terrestrial and freshwater ecosystems in the Project area were described together with the potential users of such services. In this section the degree to which the mine and associated facilities would potentially reduce or impair such services is assessed. It must be remembered that all ESS have an inherent value in their own right, but the real value of the service lies in the use of that service by humankind and how dependent those users are on that service as detailed inTable 65. The level of impact on the ecosystem services is essentially determined by the Project activities, receptor sensitivity and importance of each specific ESS to its beneficiaries.



High significance	An ecosystem service is of critical importance for users
Moderate significance	Not being critically important, an ecosystem service forms an essential component of livelihood
Low significance	An ecosystem service is of no importance for users
Zero significance	An ecosystem service is not provided/not used by beneficiaries

Tuble 05. Trainework for assessing the relative significance of ecosystem services (asea)	Table	65.	Framework	for assessing	the relativ	ve significance	e of ecosy	ystem services	(used)
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## 8.5.2. Potential Impacts on Ecosystem Services (ESS)

The way in which the mine and associated facilities and activities may result in impaired ecosystem services lies in the destruction or damage of specific components of the environmental system that play a role in the provision of such services. In many respects these impacts (changes in the receiving environment brought about by the environmental and social aspects of the mine's activities) have already been described and categorised in terms of significance. The assessment presented here on ESS is an extension of those previous assessments to examine how the environmental and social impacts from the mine may have a negative bearing on the levels of welfare of users through potentially impairing such ESS. A systems depiction of how impacts might manifest is shown in Figure 79 with impact significance presented accordingly in Table 66.



Figure 79. Systems depiction of the components of how ecosystem services (ESS) might be impaired by activities associated with the proposed Peschanka Copper Project



Table 66. Summary rationale for impact significance in respect of ecosystem services (ESS)	as a
result of activities at the Peschanka Copper Project	

Potential Environmental Cost	Risk of impaired ecosystem services			
Inherent risk	High			
Causes of risk	Likelihood of causes			
Natural pastures	In principle it could be argued that the Project area of 9,000 ha (completely transformed area excluded) could potentially provide pastures for 112 reindeer annually (assuming 80 ha per reindeer annually) but the area is not used in any way for pastures. The Burgakhchan Community (Crew No. 8) have a herd of some 2,700 reindeer and could potentially increase that to 9,000. The pastures used by the Burgakhchan are located on the agricultural land to the south of the Baimka License Area and on the forest land to the east where pastures lie in the river catchments of the Burgakhchan River (winter and autumn pastures), Aluchin River (summer pastures) and Nichekvaam River (spring pastures), occupying a total area of 728,339 ha. The closest pasture is some 12 km beyond the watershed in which the mine would operate. As such there will be no loss of ESS as provided by natural pastures because of the Peschanka Copper Project. The same principle applies to the Pevek marshalling yard.			
Forest fare	Again, it could be argued that the Project area excluding the sanitary protection zone could provide 4.1 tonnes of mushrooms and 3.3 tonnes of berries but the broader availability of forest fare is not harvested due to the remoteness and difficult accessibility of the area. As above the Project would then not result in the loss ESS of forest fare. Although access to the Pevek site is far easier, the area of that site is too limited for the ESS to be of any material consequence.			
Game	Here too though the ESS is not used due also to the inaccessibility of the areas where the games are to be found. For game ESS, the Peschanka Copper Project would accordingly also not result in the loss of game ESS. It is extremely important though to recognise the risk of poaching here by mine personnel and to ensure that poaching is outlawed and that the outlawing is enforced. Poaching has the potential to bring about a significant impact on terrestrial fauna way beyond any of the other risks posed by the mine and processing plant's activities. This risk is not considered material to the Pevek site.			
Fish	Once again though this ESS is simply not used due to the remoteness of the area and the inaccessibility. It is therefore also argued that the Peschanka Copper Project would not result in the reduction of the ESS of fish. Here too though it is extremely important to ensure that poaching is outlawed and that the outlawing is enforced. Poaching has the potential to bring about a significant impact on aquatic fauna way beyond any of the other risks posed by the mine's activities. This risk does not apply to the Pevek marshalling yard.			
Firewood	Given that there is some demand for this timber, a case could be made for a small ESS value but that ESS value would not be lost as a result of the Project. Indeed not even the extensive fires in the area that decimate the stands bring about a loss of the ESS value. The Pevek site is spatially too limited to have any material effect.			



Potential Environmental Cost	Risk of impaired ecosystem services
Greenhouse gases flux regulation	Current estimates show that flux for tundra is about zero. Whether tundra ecosystems absorb or emit carbon dioxide depends on vegetation, season, and temperature fluctuations, level of soluble organic matter (labile soil carbon) in soil and others that collectively balance one another. As significant part of the Project area (ca.75% of the total license area of 9,000 ha) would be transformed the Project would have certain impact on GHG flux regulation: the transformed sites would not absorb CO2 due to photosynthesis but continue emitting it. The mine in itself will be a source of greenhouse gas emissions (both directly and indirectly), but this is addressed elsewhere in the assessment. The impact of the marshalling yard on the GHG flux regulation is of low significance as its footprint (77 ha) is relatively small.
Carbon sequestration	Importantly the Peschanka Copper Project will not significantly reduce this benefit for two reasons. The first reason is that the sequestration potential across the Project area will not be reduced other than for the direct footprint of the mine and associated facilities and the second is the relatively small contribution of the area anyway relative to the entire tundra area. This assessment also applies to Pevek.
Water runoff management	As such the ESS is of importance only to the Yegdegkych catchment. Even so the yield from the catchment is important to the Project and as such the ESS has at least the value of what it would cost to source that water via a commercial utility. The Project will also result in the reduction in the availability of the ESS but other parties do not use the ESS and, as has been presented above, is a relatively negligible component of the overall surface water availability. This effect is not deemed material for the Pevek site.
Soil erosion prevention	The ESS is deemed important and valuable for the Project in issues such as preventing landslides that would otherwise present a safety risk. The ESS is limited though to that function specifically for the project, but has much wider value to the ecosystems and their intrinsic value. The relative loss of the ESS as a result of the transformation brought about by the Project is considered negligible given the relatively small area that would be transformed. That assessment would also apply to Pevek.
Social and cultural services of local ecosystems	Both tourism opportunities will be damaged at the mine and in the immediate vicinity of the mine but the significance of that loss is negligible given the vast area still available and principally unused that will not be affected by the mine. Because the Pevek Marshalling Yard would be established close to an existing town which has sprawling (albeit derelict) infrastructure, this effect is deemed highly unlikely for Pevek
Supporting services	Again, the relative small area of the ecosystems that would be lost as a result of the mine prevents this ESS loss from being anything more than negligible.
Supporting biodiversity and genetic resources	No rare or protected plant and animal species listed in the RF and Chukotka Red Data Book have been recorded in the area during the field surveys. The associated ESS are nevertheless important regionally in sustaining biodiversity.
Residual risk	Low



## 8.5.3. Proposed Mitigation

- Develop and implement an ecosystem services management programme, with the overarching purpose of ensure that the mine and associated activities do not result in further ESS impairment than that described here;
- The programme will require an effective monitoring regime that provides a direct indication of the impacts of the mine and the marshalling yard at Pevek on ESS; and,
- Poaching of any form (terrestrial fauna, forest fare or aquatic fauna) is to be strictly outlawed and this requirement is to be enforced by the mine management with strict punitive action for transgressors.

#### 8.6. <u>Climate Change Assessment</u>

#### 8.6.1. Introduction

Following on from the baseline assessment an assessment is presented of how the Project may further contribute to climate change and to highlight some of the risks posed to the Project as a result of further climate change in this section. As with the presentation of the baseline it is considered apposite to present the key findings of the 5<sup>th</sup> IPCC Assessment Report regarding expected future climate changes and the associated risks and impacts to provide the context in which the climate change assessment of and for the Peschanka Copper Project has been conducted (Future climate changes, risks and impacts (Topic 2)). These findings are<sup>146</sup>:

- Continued emission of greenhouse gases will cause further warming and longlasting changes in all components of the climate system, increasing the likelihood of severe, pervasive and irreversible impacts for people and ecosystems. Limiting climate change would require substantial and sustained reductions in greenhouse gas emissions which, together with adaptation, can limit climate change risks.
- Cumulative emissions of CO<sub>2</sub> largely determine global mean surface warming by the late 21<sup>st</sup> century and beyond. Projections of greenhouse gas emissions vary over a wide range, depending on both socio-economic development and climate policy.
- Surface temperature is Projected to rise over the 21<sup>st</sup> century under all assessed emission scenarios. It is very likely that heat waves will occur more often and last longer, and that extreme precipitation events will become more intense and frequent in many regions. The ocean will continue to warm and acidify, and global mean sea level to rise.
- Climate change will amplify existing risks and create new risks for natural and human systems. Risks are unevenly distributed and are generally greater for disadvantaged people and communities in countries at all levels of development.
- Many aspects of climate change and associated impacts will continue for centuries, even if anthropogenic emissions of greenhouse gases are stopped. The risks of abrupt or irreversible changes increase as the magnitude of the warming increases.

<sup>&</sup>lt;sup>146</sup> IPCC. 2014. Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, 151 pp.



## 8.6.2. Change in Microclimatic at the Project Site

Predicted climatic changes in the Arctic region (including hazardous hydrological events) and microclimate changes in the valleys of the Peschanka River and its tributaries as a result of the Project increase (especially with cumulative impacts of global changes in climate) the risks of disruption of safe operation of Project facilities and environmental pollution. Construction of the TSF with an area of 45 km<sup>2</sup> and a water reservoir would cause a change in microclimatic in the river valleys: during warm, calm weather, air humidity will increase due to limited air exchange, and temperature fluctuations will probably be smoothed due to the buffer capacity of a large volume of water mass. The periods of freezing and melting of the ice cover of the water reservoir and TSF would also likely change compared to the surrounding watercourses. A slight increase in humidity in the winter would be associated with the area of the TSF that will remain unfrozen where the tailings are discharged into the TSF. The size of that area would depend on the characteristics of the tailings and may vary during the operations phase.

At the Project site, the microclimatic changes will precede global climatic changes emerging in the Chukotka Autonomous Okrug (increase in surface air temperature, amount of precipitation, especially in winter, thawing of frozen soils and so forth). Given the unidirectional nature of changes, the overlap effect will be synergistic – during the Project implementation, the microclimate will shift to warmer and wetter, the water content of the area will increase but the microclimate changes will be limited to the valleys of the Peschanka, Left Peschanka, Right Peschanka, Yegdegkych rivers, and the lower reaches of the Baimka River. Increases in atmospheric humidity, precipitation and runoff create additional risks for the Project. These risks include dam failure due to unexpected inflow volumes as a result of increased snow accumulation and spring floods, increased water inflow into open pits, increased runoff of polluted water, infiltration from the reservoir and TSF, and sliding (solifluction) of soil along the thawed surface of permafrost. Given the nature of the facilities at Pevek these risks would be less severe.

## 8.6.3. Natural and Anthropogenic Potential of Greenhouse Gas Emissions in the Far North

Greenhouse gas (GHG) emissions in the Russian Far North derive from construction of facilities and disturbance of topsoil resting on permafrost. Tundra soils are extremely sensitive to any anthropogenic transformations. Changes result in changes in albedo (the reflective properties of a surface) partial or complete thawing of soils near large facilities, which in winter are a source of heat. Degradation of permafrost, and temperature increases in frozen soils could reduce the bearing capacity of structures and even result in damage to such structures due to subsidence, landslides, and voids. This does not the case for foundations and buildings on Rock (the concentrator plant and major infrastructure).

At the same time, permafrost and associated cryogenic soils are considered the most significant terrestrial carbon pools (reserves) on the planet<sup>147</sup>. The increase, observed in recent years, in average annual temperatures<sup>148</sup> leads to the thawing of frozen soils and to

<sup>&</sup>lt;sup>148</sup> Stochkute Yu.V., Vasilevskaya L.N. Long-term changes in air and soil temperatures in the far north-east of Russia. Geographical Bulletin. 2016. No. 2 (37). 84-96.



<sup>&</sup>lt;sup>147</sup> Quote from: Bobrik A.A. Patterns of greenhouse gas emissions by soils of northern taiga and forest-tundra ecosystems of Western Siberia. Abstract of the dissertation, Ph.D. in Biology, Moscow, 2016.

Mergelov N.S. Soil formation, topsoil and carbon reserves in the Kolyma tundras and sparse forests. Abstract of the dissertation, Moscow, 2007.

additional emission of carbon into the atmosphere in the form of CO<sub>2</sub> and CH<sub>4</sub>. Calculations show that additional GHG emissions due to permafrost degradation can equal annual anthropogenic GHG emissions. This may lead to the transition of northern ecosystems from the organic carbon sink they are currently to an emission source<sup>149</sup>. Methane formation is closely related to soil moisture in the tundra: the higher the soil moisture the more methane is formed. At the same time as areas dry out the carbon in the soil combines with oxygen to form CO<sub>2</sub>. Disturbance of vegetation can therefore trigger a feedback cycle of carbon with frozen soils, which will lead to thawing of permafrost and transition of ecosystems from net absorption to net production of GHG emissions<sup>150</sup>. This does not the case for foundations and buildings on rock (the concentrator plant and major infrastructure).

## 8.6.4. Assessment of Greenhouse Gas Emissions from the Peschanka Copper Project

GHG emissions would be brought about by the following activities associated with the development and operation of the mine and the marshalling yard at Pevek<sup>151</sup>:

- All earthworks with associated vegetation clearing and stripping of topsoil including construction of roads;
- Operation of vehicles, construction machinery and other fuel burning appliances;
- Operation of industrial, residential and office facilities that create a thermal envelope around the facilities and thaw permafrost in the heat-affected zone of the facilities;
- The use of electricity generated through burning of fossil fuels including on site generators and some coal-fired energy suppliers of the Chaun-Bilibinsky energy hub and Magadan energy system. Although power station emissions are considered as indirect GHG emissions they are still attributable to the Project as a function of the electricity used by the Project;
- Increased methane emissions areas flooded by the water reservoir and TSF; and,
- Increase carbon dioxide emissions from the soil drying effect of runaway fires the incidence of which may increase due to construction and operation of the proposed mine and processing plant.

Table	67.	Summary	rationale	for	impact	significance	in	respect	of	climate	change	and	its
consequences as a result of Project activities				;									

Potential Environmental Cost	Contribution to climate change and its consequences
Inherent risk	High
Causes of risk	Likelihood of causes

<sup>&</sup>lt;sup>149</sup> Greenhouse gas emissions and carbon sequestration in soils. Extended abstracts of the seminar reports with international participation, St Petersburg, October 14-15, 2015. – St Petersburg: Federal State Budgetary Scientific Institution, AFI, 2015. – 76 p.

<sup>&</sup>lt;sup>151</sup> For quantitative assessments, please see the 'Ecosystem Services' section.



<sup>&</sup>lt;sup>150</sup> Ake L. Nauta at all. Permafrost collapse after shrub removal shifts tundra ecosystem to a methane source. Nature Climate Change 5, 67–70 (2015)

Potential Environmental Cost	Contribution to climate change and its consequences			
All earthworks with associated vegetation clearing and stripping of topsoil including construction of roads	All of these risk sources are definite but the relative scale of the emissions from these sources are negligible relative to the incomparably larger scale effects of the global warming that is impacting on the tundra anyway. This is not to argue that they should			
Increased methane emissions areas flooded by the water reservoir and TSF				
Operation of industrial, residential and office facilities that create a thermal envelope around the facilities and thaw permafrost in the heat- affected zone of the facilities	<ul> <li>not be managed as risk sources, just that they are not significant for decision-making on the acceptability of the Project. These effects of the marshalling yard at Pevek is especially small relative to those other effects.</li> <li>These risks are definite and will result in a material addition to the GHG emissions budget of the region. Again, though in relative terms to emissions from the</li> </ul>			
Operation of vehicles, construction machinery and other fuel burning appliances				
The use of electricity generated through burning of fossil fuels including on site generators and the Chaun-Bilibino and Magadan energy suppliers that are based on coal use. Although power station emissions are considered as indirect GHG emissions they are still attributable to the Project as a function of the electricity used by the Project. This same assessment including the obligation to minimise energy use would also apply to the marshalling yard at Pevek.	country as whole (estimated at 2.7 billion tonnes CO2eq.) and the world, the risk sources as a contribution to climate change and its consequences is very small. In addition, it should be noted that the mine and processing plant are expected to have GHG emissions similar to all copper mines in the world. With that said it must be recognised that the challenge for the globe is one of reducing GHG emissions across all sources. While the emissions contribution from the Peschanka Copper Project will be relatively small, it must be viewed as an important consideration in the decision-making process, and every effort must be made to reduce GHG emissions across the entire mine and processing plant operation.			
Increase carbon dioxide emissions from the soil drying effect of runaway fires that could be started by mine activities.	This risk source is considered likely but again due to the comparative scale of the impacts of global warming on the tundra, negligible in consequences terms. What should be noted, however, is that it is a cause that is entirely preventable and as such should be prevented. Although the risk is seen to be far less for Pevek, the fire control requirements would be as important.			
<b>Residual risk</b>	Moderate			

## 8.6.5. Proposed Mitigation

Requirements of the International lenders<sup>152</sup> and the Russian environmental legislation<sup>153</sup>, <sup>154</sup> oblige businesses to assess the sources and volumes of GHG emissions and

RF Governmental Decree of 22.04.2015 No. 716-r "On Approval of Concept for Formation of a System for Monitoring, Reporting and Verifying the Volume of Greenhouse Gas Emissions in the Russian Federation"



<sup>&</sup>lt;sup>152</sup> IFC, 2012. Environmental and Social Sustainability Standards

<sup>&</sup>lt;sup>153</sup> GOST R 56267-2014 / ISO / TR 14069: 2013 Greenhouse gases. Determination of greenhouse gas emissions in organizations and reporting. Guidelines on application of ISO 14064-1

take the necessary measures to reduce them as much as practicable. Some of the actions to be taken include:

- Quantify GHG sources and amounts for the different Project stages and set reduction targets for each Project stage;
- Develop a detailed geological and cryological model of permafrost: distribution, thickness and temperature of frozen layers, structural features, section ice content, characteristic thermophysical properties, lithological composition and other parameters, for the reasonable adoption of measures to protect against permafrost thawing under engineering structures
- Prevent flooding/waterlogging of the Project site;
- Adopt BAT to increase energy efficiency and overall savings and set ambitious, but achievable, energy reduction targets;
- Set and enforce strict idling time requirements for all vehicles, limiting idling to the greatest extent possible;
- Prevent access to non-mining affected areas of tundra for both Peschanka and Pevek in any way that would damage the tundra such as driving off-road limiting this to the great extent practicable; and,
- Maintain a strict fire control regime and the facilities to quickly extinguish a blaze started inadvertently by personnel at either the mine or Pevek.

## 8.6.6. Climate Risk Adaptation

From the predictions of anticipated changes in climate it is clear that the proposed mine will be established and operated against a backdrop of continued changes in climate and in general terms a progressive warming and increased precipitation. These changes could over time bring about new environmental and social risks that are not at issue now, or could exacerbate risks that are not considered significant now to a point where they do become significant. At the same time the mine itself may face changes in other risk profiles as the climate changes and would need to recognize and prepare for those risks. The ways in which these risks could manifest and the associated response from the mine is illustrated conceptually in Figure 80.

<sup>&</sup>lt;sup>154</sup> At the moment, the draft federal law "On State Regulation of Greenhouse Gas Emissions and on Amendments to Certain Legislative Acts of the Russian Federation" is under public discussion.



Decree of the President of the Russian Federation of 30.09.2013 No. 752 "On Reduction of Greenhouse Gas Emissions"



Figure 80. Conceptual presentation of the risk management that is required in the face of climate change (after Intergovernmental Panel of Experts on Climate Change (IPECC))<sup>155</sup>

The two components of climate risk that need to be considered are a hazardous hydrometeorological event (HE) and a receptor with a certain level of vulnerability to such an event. In the following section the risks that could be posed by climate change are presented and described together with possible adaptation strategies.

# Climate change risks for the Project

# Dam failure as a result of unanticipated inflows

A key risk element is the increase in precipitation anticipated for the area in which the Project would be developed. Construction of the TSF would be done in stages with the progressive raising of the dam wall as the TSF fills to provide for more storage capacity. This approach provides some flexibility for adaptation where the latest hydrology can be used in designing the raising of the dam wall. The wall of the water reservoir in the Levaya Peschanka River will be built in one go for the entire duration of the Project as there is a fixed annual water requirement for the mine and processing plant. Whereas an emergency discharge can be included in the design of the dam wall for the water reservoir, that provision cannot be made for the TSF because there cannot be a downstream discharge of supernatant from the TSF. At the same time the greater the degree to which surface runoff can be prevented from entering the TSF the larger the risk reduction. This risk would obviously not apply to Pevek.

<sup>&</sup>lt;sup>155</sup> IPECC, 2014a cit. ex: "Report on Climate Risks in the Russian Federation". Roshydromet, 2017.



# Dam failure as a result of solifluction

Thawing of permafrost under the TSF and water reservoir would lead to increased infiltration of water and stimulate solifluction processes, active ice formation and bulging of soils. These factors may result in the destabilization of the dam walls. This risk would obviously not apply to Pevek.

## Polluted water entering natural water bodies

The key concern in respect of polluted water entering natural water bodies is in respect of the TSF. A failure of the dam wall would obviously result in a catastrophic discharge of supernatant and tailings from the TSF. A more insidious risk would be the progressive thawing of the permafrost layer under the TSF and infiltration of the supernatant into the underlying groundwater. Although there is provision for containment of some of this infiltration with the secondary containment wall, concerns relate to the capacity of that secondary storage and to what would happen post decommissioning of the mine and the closure of the TSF. This risk would obviously not apply to Pevek.

## Unanticipated increases of flow into the pits

There are two circumstances that could potentially bring about increases in water in the open pits and these are increased precipitations with resultant larger volumes of water entering the pit directly and through surface runoff and thawing of permafrost providing larger inflows into the pits from groundwater. At face value this risk is one that could be relatively easily managed through increasing the pumping capacity provided there was adequate provision made in the TSF for the increased volume of water. This risk would obviously not apply to Pevek.

## Increased rodent populations

Increased rodent populations could be brought about by several factors including warmer conditions and out migration of predators. This risk would also apply potentially for the Pevek facility.

## Proposed adaptation measures

The key to successful adaptation lies in the development of comprehensive environmental monitoring and continued refinement, as a function of that environmental monitoring data, of forecast changes in rainfall and temperature. In addition to that it will be necessary to:

• Develop a hydrological and hydrogeological model of the mine area that provides accurate forecasts of the water volumes that would need to be managed (either through dewatering the pits or accounting for the volumes of water that need to be retained by the dam structures; and,

## 9. SOCIO-ECONOMIC IMPACT ASSESSMENT

## 9.1. Introduction

The Peschanka Copper Project will result in a major economic injection into the region as a result of spending by the company in constructing the mine and also in the uptake of labour. While the economic development consequences of the Project are significant and positive in their own right with resultant knock on economic and tax revenue benefits, there are also some potentially negative impacts that could be brought about by an influx of work seekers from other parts of the country, the potential social disruption of a large,



predominantly male labour force and the vulnerability of especially Indigenous People to the attraction of the jobs and salaries offered by the Project that might serve to weaken the critical mass of people needed within such communities to continue their traditional way of life and maintain their livelihoods. In this section each of these potential impacts is assessed to ascribe significance and also to detail what can be done to reduce or prevent the negative effects while enhancing the benefits.

In many ways an environmental and social impact assessment is a form of cost benefit analysis where it is the economic development benefits of a given development that must be compared to the environmental and social costs (negative impacts) that would be brought about by the same development. It is of course extremely difficult to articulate that cost benefit assessment in a quantitative way so much of what happens is that certainly on the costs side much of the assessment can only be presented qualitatively as can be seen from the impacts presented in this section. The economic benefits can, on the other hand, be reasonably easily determined as in the value of the investment in the Project, the number of jobs, the foreign exchange earned through sales of the product, the contribution to tax revenues and so forth. In presenting the socio-economic impacts it is helpful to reflect on the Sustainable Development Goals (SDGs) developed by the United Nations as a series of the key indicators of what would constitute not just development, but sustainable development. The SDGs provide as such a series of parameters that can be used to contextualise the benefit of the proposed Project in the same terms as the negative impacts have been presented (Figure 81).



Figure 81. Schematic presentation of the 17 United Nations Sustainable Development Goals (SDG)



## 9.2. Economic Growth

## 9.2.1. Headline Benefits

The headline economic growth benefits can be summarised as follows. The Project will result in:

- Up to 5,000 jobs created during the construction phase at peak;
- A total cost of the project USD 5.5 billion;
- Up to 2,000 jobs created during operations over more than 20 years;
- Copper production in the RF increasing by approximately 15 to 20%;
- A more than doubling of the regional gross product for Chukotka; and,
- The budget of the Bilibinsky Municipal District increasing significantly due to increased tax revenues directly from the Peschanka Copper Project directly but also in the knock-on growth effects for other economic activities.

## Specific potential benefits

Direct and indirect spending, job creation and tax revenues that would be generated by the Peschanka Copper Project could be used to drive investment (and returns) for a number of the individual components of the SDGs. It is obviously not possible to state definitely how the additional revenues brought about by the Project would be used by the public sector but it is important to detail what it is that is required to make the SDGs achieve the targets set that are relevant to the area that would benefit from the Project:

## <u>SDG 1 – No poverty</u>

Neither the RF nor the Chukotka AO experience the extreme levels of poverty that this SDG serves to combat. That notwithstanding that does not mean that additional income that would likely be brought about the Project either directly through employment or indirectly through economic growth, would not be welcomed and not improve the general levels of welfare experienced by such beneficiaries. In addition, the additional revenues could also be used to bolster social protection systems for people without work or means of income, or those incapable of work. In addition, against a backdrop of a changing global climate, governments at all levels would need to work towards improved climate disaster resilience especially given the anticipated increase in flooding risk predicted for the area. Finally, but importantly improved education is seen as a global imperative and the increased revenues could be used to increase spending on education, which is again, and important requirement to meet this overall goal.

## <u>SDG 2 – Zero hunger</u>

In similar vein the global challenges of extreme hunger and malnutrition are simply not present in the areas that would benefit from the Project but food security is an important issue for all communities again most especially in the face of the possible consequences of climate change. In addition, economic growth would likely bring about increased food choices and the ability of families to thereby improve their nutrition.

## SDG 3 – Good health and wellbeing

The promotion of good health and well-being for the citizens of Chukotka is an important objective for the government of the Okrug. Key amongst these is continually improving



access to essential health services especially in the context of a growing burden of noncommunicable diseases, including mental health, and responding to the threat of increasing antimicrobial resistance. Other health interventions that could be pursued more effectively with increased revenues would include maternal, newborn and child health, immunization and sexual and reproductive healthcare. The control and combatting of infectious diseases could include HIV prevention, testing and treatment, tuberculosis and chronic HBV infections. Non-communicable diseases include mental health, which is becoming progressively more important as a key source of debilitation for people but also the 'big 4' fatality risks in cardiovascular diseases, cancers, chronic respiratory diseases and diabetes. In addition to these high fatality risk issues would also be reducing the suicide rate (obviously linked to mental health management), tobacco use and road traffic deaths. Economic growth and anticipated increases in disposable income would also facilitate better access to health systems.

#### SDG 4 – Quality education

There are very few places in the world where education could not be improved to ensure inclusive and equitable quality education and promote lifelong learning opportunities. Improved education is accordingly another potential area of benefit as a result of economic growth with a special focus on the literacy-numeracy, physical development, social-emotional development and learning of children.

#### <u>SDG 5 – Gender equality</u>

The objective of gender equality is one that could be targeted by both the Peschanka Copper Project itself together with the public sector as a function of increased tax revenues.

## SDG 7 – Affordable and clean energy

Although there are no major concerns about access to energy for citizens of the Okrug, both heat and electricity, the generation of that energy is based heavily, but not exclusively in fossil fuels. The challenge for the government is to diversify that supply into more renewable energy. For Pevek it is important to note that the current coal fired power station that operates in the town is to be replaced within the next 12 months by a floating nuclear power plant meaning that for the Okrug as a whole there will be a reduction in GHG emissions per unit of energy generated. This SDG also promotes getting a higher GDP return on energy used and the Peschanka Copper Project would facilitate such an improvement through its contribution to a doubling of the GRP for the Okrug. An important potential facilitator of reducing the GHG load associated with energy production is to have large-scale energy users that would warrant such investments. At the same time it is important to note that the supply the mine and processing plant would be fossil fuel based.

## SDG 8 – Decent work and economic growth

Of all the SDGs, it is the promotion of decent work and economic growth that would most directly benefit from the Peschanka Copper Project. The economic growth benefits of the Project have already been described in direct terns but within this SDG, the Project would be fully aligned with the overall goal of sustained, inclusive and sustainable economic growth, full and productive employment and decent work. While the Peschanka Copper Project would by no means ensure such work for all, it would for the people employed directly on the mine and for others who would gain employment indirectly as result of economic provide the formal employment opportunities for workers that are key to the



realisation of this goal. In addition to the formal employment it is presented that given the value system of the company developing the mine, together with IFI and Russian regulatory obligations, that such direct employment on the Peschanka Copper Project would also meet the criteria of combatting undue risks in the workplace. Mining is a hazardous occupation but the adoption of modern mining methods together with advanced technologies that can be used to provide early warning of hazardous situations and high levels of managerial commitment to ensuring that the Peschanka Copper Project provides a safe working environment would ensure that such hazards were minimised. Also, as previously described the Peschanka Copper Project should promote gender equal opportunity at its operation as another positive contribution to this goal.

## <u>SDG 9 – Industry, innovation and infrastructure</u>

This SDG seeks to drive the development of resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation. The Project itself would require various manufactured products that would potentially see an increase in existing manufacturing output or indeed the creation of new manufacturing capacity. Such increases in manufacturing would also see employment and a further contribution to economic growth. In addition, the various technical difficulties faced by the mine as a result of both its remoteness and the extreme weather conditions provide a potential incubator for research and innovation. Finally, but importantly the Project will assist in facilitating improved transport infrastructure in the Okrug that will present important benefits of vastly improved access to urban centres with the additional services that they have on offer.

## 9.2.2. Other Benefits

The other potential benefits that could be attributed to the economic growth and employment benefits of the Project include:

- General improvements in living standards through increased per capita incomes;
- Economic growth promotes new job creation in its own right although it has not been possible to determine the likely multiplier effect as a result of the Peschanka Copper Project specifically i.e. the number of indirect jobs created in response to the number of direct jobs;
- Greater business confidence in the area where other investors may be encourage to invest because of the success of the Peschanka Copper Project;
- Greater spending on public and goods and services without having to raise tax rates;
- Greater efficiencies in the provision of public services through economies of scale;
- Diversification of economic activities that makes the region more economically resilient; and,
- A wider range of choices for the citizens as new product and service providers are attracted to establish in the area.



Potential Social Benefit	Net improvements in human welfare		
Inherent benefit	Moderate-High		
Risk source	Likelihood of causes		
Overall economic growth in the Bilibinsky Municipal District and the Okrug as a whole.	Net improvements in human welfare are considered highly likely over an extended area of the Okrug given the almost doubling of the GRP that is expected to result from the Project and the multiple potential public benefits that could		
Construction and operational spending by the mine	accordingly be realised. At the same time none of the potential environmental costs associated with the mine are seen to be significant enough to undermine the welfare benefits provided by the natural environment and society		
Job creation	Net improvements in human welfare are considered highly likely as a result of the jobs that will be created by the Peschanka Copper Project. This benefit must be seen not just in the number of jobs but also in the formalised nature of the jobs together with the efforts that would be made to ensure that the workforce is kept safe during both construction and operations of the mine		
Residual benefit	High		

Table 68. Assessment of social impact significance in this case the expected benefits to occur as a	a
result of the proposed Project	

## 9.3. Employment Related Impacts

#### The Peschanka Site in the Bilibinsky Municipal District

Employment is an important benefit associated with both construction and operation of the Peschanka site facilities and to a lesser extent the marshalling yard at Pevek. The construction stage is expected to last from 2021 to 2026. The number of jobs that would be required during the construction stage is shown in Figure 82 illustrating the anticipated ramp up and then the demobilization of the labour force as the construction draws to a close. During the construction peak some 5,000 workers would be required. Rotational employees who will be accommodated in the construction camp at the Peschanka site for between 4 and 6 months will construct the mine. It is surmised that the bulk of the construction force that would be sourced from the Bilibinsky Municipal District would be unskilled. That implies that skilled labour would need to be brought in from other parts of the Okrug and potentially even the country.





Figure 82. Projected employment for the construction phase of the Peschanka Copper Project

Operations would start in 2023. The total demand in workforce per year during operations of the mine and processing plant is presented in Figure 83. The maximum number of permanent (operations) employees would be reached in 2028 at which point up to 2000 people would be employed. The number of employees will be distributed among employees at the mine, at the concentrator, at the site facilities, at the camp, and at the aerodrome. Again, it is expected that local workforce (in the Bilibinsky Municipal District) would be largely limited to unskilled jobs due the generally low numbers of qualified personnel available in the district. The positive effects of the employment creation that will be effected by the Peschanka Copper Project have been assessed earlier, in the section that follows the potentially negative effects of the employment for the Bilibinsky Municipal District and Chukotka AO are presented and assessed.





*Figure 83. Workforce demand during mine and processing plant operations* 

Table 69. Assessment of social impact significance in case the potential negative impacts to occu	r
as a result of the proposed Project	

Potential social risk	Net reductions in human welfare
Inherent risk	Moderate-High
Risk source	Likelihood of causes
Unemployment reduction in the Bilibino area	This potential impact is not considered to be a direct risk as such, as all opportunities for employment are obviously to be welcomed. It is simply to make the point that given the high level of employment (officially it is 97.3% based on the information provided in Social Baseline) and lack of qualified workforce (which, as previously described, is a general problem for the region) it seems most likely that most of the hired employees will come from other regions. The impact on unemployment in the area will consequently not be significant for Bilibino itself and will likely exacerbate labour influx and the potentially negative effects that such influx may bring about as detailed in the following sections. It seems highly unlikely that such a risk would result in a net reduction in human welfare but it is highly likely that there would be individuals who would experience the negative effects associated with labour influx.


Potential social risk	Net reductions in human welfare						
Inflationary effects of increases in income	Job creation associated with both the new mine and the knock-on effects of increased opportunities for other business (including small and medium sized projects) would result in income growth for many people but not for all people. A general growth of income is known to result in inflationary effects as business seek to maximise the profits, they can make in an environment of larger individual disposable income. For the people who do not benefit from increased incomes this translates into a negative effect as their purchasing power is reduced. The effect is particularly problematic for basic essentials and for economically vulnerable people, especially those on pension where pensions seldom track inflation over time. Again, it seems highly unlikely that such an effect would bring about a net reduction in human welfare, but it is important to recognise that for certain vulnerable groups such reduced welfare is likely. Mitigation needed is development and implementation of programmes of social support for vulnerable groups of people (to be determined within the Stakeholder Engagement Plan). Such mitigation would further reduce the likelihood of a net reduction in welfare.						
Labour influx and labour migration in general	Currently Bilibino has a sustained population of some 5,300 people together with the rural population of the Bilibinsky Municipal District of some 1,800 people (as of 01/01/2019). The Peschanka Copper Project has the potential to add an additional 5,000 residents to that population albeit on a temporary basis during the construction stage and an additional 1,000 permanent residents during mine operations. It is important to note that the Region has experienced similar effects with the additional of other large-scale mining projects (Kupol and Mayskoye). In this respect, labour influx is already a feature of the social baseline, which would likely serve to reduce the intensity of the effect.						
	is currently organized through Magadan-Keperveyem. The new aerodrome on the Peschanka site will become operational by 2021 at the latest. This means that the main labour flow will be brought to the site (in 2021 and later) from Magadan to Peschanka directly or through Omsukchan-Omolon. Another route would be from Anadyr to Keperveyem-Peschanka. This means that the workforce inflow would be distributed between several routes/locations (Keperveyem, Omolon, direct flights to Peschanka), reducing the intensity of the labour influx.						
Pressure on social infrastructure	Notwithstanding the experience of labour in-migration, influx caused by the Project will also create increased pressure on social infrastructure, such as hospitals, and other medical infrastructure, schools, recreation, accommodation, transport and others. Although this is likely to result in pressure on such services in the short term it is likely that the increased demand will, over time, see an extension of the social services that would result in additional benefits and enhanced economic development which would						



Potential social risk	Net reductions in human welfare
	obviously be beneficial. As such it is considered that it is highly unlikely that pressure on social infrastructure brought about by the Project would lead to a net reduction in welfare. Again, the key here would be support for potentially vulnerable groups who may be directly negative affected.
Social conflicts	Labour influx may cause conflicts between new and existing residents. Where the problem may be acute is single male labourers coming into Bilibino during time off with relative wealth and potentially seeking the company of women, who in some instances may already be married or have partners. Again, these effects are likely to be localized and it is highly unlikely that they would result in net reductions in welfare for the region and the city in particular
Increase in communicable disease	The Chukotka AO has a very strict policy of medical surveillance of labour migrants. This policy helps the Region maintain generally low rates of social diseases such as HIV and Hepatitis. At the same time the tuberculosis morbidity rate is twice that of the national average and so this risk cannot be discounted. It is considered high likely that such effects would occur by highly unlikely that these effects would lead to a net reduction in human welfare. This is also an area where the Project could reduce the risk through their own medical surveillance and occupational health management and also through programmes that highlight the risks of communicable diseases and how to manage those risks. The development of a Human Resource Policy that would address these issues and relevant organization measures would benefit the company itself but also the broader community by lowering the risk of spreading communicable diseases.
<b>Residual risk</b>	Low

# 9.4. Impact on Indigenous Peoples and Traditional Nature Use

Neither the Peschanka mining and processing plant nor the proposed Pevek marshalling yard facilities would directly affect the indigenous communities and traditional nature use:

- Although the Baimka License Area overlaps the area of traditional nature use utilised by the Burgakhchan Community no Peschanka Copper Project mine or processing facilities would be established in this area. In addition it is highly unlikely that air quality, water quality, noise or other off-site impacts originating from the mine would reach the areas being used by the Burgakhchan Community<sup>156</sup> (Figure 63); and,
- No IP communities have been identified in the vicinity of the proposed site of the marshalling yard at Pevek.

<sup>&</sup>lt;sup>156</sup> It's important to mention that in the Burgakhchan area drilling activities that not related to the Project are currently underway; they are conducted by another company (Polyus). The Burgakhchan Community clearly recognize this fact.



The only Project activity that can potentially impact the reindeer farming is transportation of products and materials. The preliminary assessment and focused consultation resulted on the following findings:

- Within the Pevek Urban District the existing winter road does not cross domestic reindeer pastures but is very close to the reindeer migration paths (to be verified during future consultations with the Association of Chukotka and Kolyma IPs and Chaunsky Agriculture Unitary Enterprise);
- In the Bilibinsky Municipal District:
  - The existing winter road does not cross either the domestic reindeer pastures or their migration routes;
  - The proposed federal motor road will affect wild reindeer migration pathways but not those of domestic reindeer herds. At the same time the road routing is close to the Ilirney Village, a well-recognised center of reindeer farming (Figure 85). What is also important is that there is some uncertainty regarding the exact positions of the reindeer pastures and the migration routes in the Bilibinsky Municipal District; and,
  - The access road from the proposed federal motor road to the Peschanka Copper Project site will cross the Burgakhchan Community's pastures (see Figure 84, Figure 85).

Consultation with the IP communities and representatives (reindeer farming enterprises, IP associations and the Burgakhchan Community) is currently included in the stakeholder consultation of the ESIA process.





Figure 84. Transportation route between the Pevek Port and the Baimka License Area





Figure 85. The reindeer migration pathways<sup>157</sup>

<sup>&</sup>lt;sup>157</sup> Produced by the Ecoline EA Centre; the input data for the map were kindly provided by the Pevek Urban District Administration and Chaunskoye Agricultural Enterprise.



Table 70. Assessment of social impact significance in this case the negative impacts expected to
occur amongst IP as a result of the proposed Project

Potential Social Cost	Risk of reduced livelihoods				
Inherent risk	Moderate-High				
Causes of risk	Likelihood of causes				
Potential fragmentation of TNU lands due to the access road construction	The construction of the Anadyr-Omolon road provided/financed by the Government (associated project) will run along the pastures of the Burgakhchan Community. Additional impact will occur with the construction of the access road from the main road to the Peschanka Copper Project. The impact will have both negative and positive effects one the one hand dividing the TNU land into two parts (fragmentation) but at the same time providing more effective access by the community to the district capital, Bilibino and regional capital, Anadyr. The impacts of the (federal) road to the TNU lands of Ilirney and Omolon in terms of reducing livelihoods is initially assessed as unlikely, through consultation with the Bilibino Municipal District Administration and agriculture enterprises engaged in reindeer farming in the area and other interested parties (continued within ESIA public consultation process)				
Declining IP communities' capacity to maintain traditional nature use due to their members seeking jobs on the mine.	This risk is especially important to small IP communities that are extremely vulnerable to the loss of community members in traditional nature use. For these communities (including the Burgakhchan) the risk is considered likely and for the Burgakhchan at least this would make the impact of moderate to high significance. The challenge in managing the impact though is that the free choice of the Burgakhchan cannot be impaired and if that is the choice they make then that choice must be accepted. It is nevertheless extremely important to ensure that there is a very close and free relationship between the mine and the Burgakhchan.				
Competition for forest fare (berries/mushrooms) by incoming labour.	The labour influx during the construction and operational stages is of course definite but in terms of the loss of livelihoods is highly unlikely for two reasons. The first reason is that the available yields are way in excess of the demand and the second is that for the mine at least there would be strict controls on personnel harvesting such products.				
Residual risk	Low				

## 9.5. Proposed Mitigation

 Close cooperation with neighboring IP communities (the Burgakhchan specifically) is strongly advised for the Company at the earliest possible stage of the Project development. This to ensure that Project developments are well understood by IPs and opportunity is provided with opportunities to resolve grievances as and when they arise; and,



• The Company shall develop, implement and enforce a strict anti-poaching policy amongst mine personnel. The same would be needed for the road and power line contractors.

## **10. STAKEHOLDER ENGAGEMENT**

GDK Baimskaya is intent on building long-term relationships with stakeholders. As such stakeholder engagement was started in the early Project stages and is on-going.

## 10.1. Background Experience and Future Steps

Interaction with stakeholders to date is summarized below:

- In October 2015, limited engagements were undertaken during the social baseline study in the Bilibinsky Municipal District. The Company engaged with the District Administration (Head and Deputy Head on Indigenous Affairs), the local reindeerbreeding enterprise (Ozernoye Municipal Agricultural Enterprise), Luch Mining Cooperative, and a local hospital (the Bilibino District Medical Centre);
- In April 2018, GDK Baimskaya participated in the Erakor 2018<sup>158</sup> Festival, a traditional festival of the indigenous peoples in Chukotka<sup>159</sup>; and,
- In May 2019 consultations took place with the representatives of the Bilibinsky Municipal District Administration, Ozernoye Municipal Agricultural Enterprise, Burgakhchan Community, Bilibino landfill representatives, Pevek Urban District Administration, and IP association representatives in Pevek<sup>160</sup> and Anadyr. In October 2019, a further series of round table discussions was held to discuss the Preliminary Environmental and Social Impact Assessment and the Stakeholder Engagement Plan, as well as the disclosure of the ESIA documentation.
- Public hearings on the full package of documents on ESIA were held in mid-November 2019 in Anadyr, Aniuisk, Bilibino and Pevek.

## 10.2. The Process of Public Consultations

The public consultation process was arranged to comply with the requirements of IFC PR1 for category A projects, in two stages:

- Stage 1. Public consultations of the Scoping/Preliminary ESIA findings;
- Stage 2. Public consultations of the ESIA findings.

Prior to the start of formal consultations as part of the ESIA process, consultations were held with multiple parties as part of the information collection process for the social assessment.

<sup>&</sup>lt;sup>160</sup> For more details please see the 2019 May Trip Report.



<sup>&</sup>lt;sup>158</sup> 'Erakor' is the Chukchi word for 'swift-footed deer'.

<sup>&</sup>lt;sup>159</sup> For more information please see the Report on the trip to the Erakor-2018 Festival, Ecoline EA Centre, 2018.

## 10.2.1. The Approach to Stakeholder Engagement

Stakeholder engagement has been conducted according to the legal requirements of the Russian Federation, IFC requirements and and good practice principles.

The Company considers stakeholder dialogue and cooperation as the core value seeks to maintain such a relationship throughout Project life. The strategic principles are:

- Transparency to all stakeholders, continual dialogue and two-ways communication; and,
- Focus on the affected stakeholders, prior attention to their needs and concerns.

Following these principles and IFC requirements, the stakeholder identification was conducted as the first step. The following stakeholders were identified<sup>161</sup>:

## Potentially affected parties

- Potentially affected parties (PAPs) of the proposed Peschanka Mine and Processing Plant:
  - A small Even community that has a registered place of residence in the Burgakhchan area, which is a part of Ozernoye Municipal Agricultural Enterprise and maintains a traditional lifestyle;
  - Luch Mining Cooperative (Luch LLC), which is engaged in placer gold mining in the area bordering the Peschanka License Area; and,
  - The family (two people) living in the Vesenny abandoned settlement (now closed and used by Luch LLC as a storage terminal).
- PAPs affected by the Pevek site entire Pevek community could be affected by the marshalling yard and associated facilities; and,
- PAPs affected by transportation for the mine Bilibino and Pevek communities and the IP communities whose pastures or migration routes are crossed by the roads.

The Burgakhchan Community should be also considered as a vulnerable group; the small size of the community defines the high sensitivity of that community to the external impacts. Other vulnerable groups may be identified during further consultation.

## Influential stakeholders

- The local self-governing bodies of the Bilibinsky Municipal District and Pevek Urban District;
- Environmental and social NGOs, interested in the Project (to be identified as a function of further consultations);
- Stakeholders involved in the Project approval process:
  - The federal authorities involved in the Project approval process; and
  - The Chukotka AO regional administration involved in the promotion of the Project;

<sup>&</sup>lt;sup>161</sup> More details on stakeholder identification is available in the Stakeholder Engagement Plan.



- The Administrations of the Bilibinsky Municipal District and the Pevek Urban District:
  - The Bilibinsky Municipal District Administration; and
  - The Pevek Urban District Administration;
- The IP associations.

## Interested stakeholders

• All other stakeholders who might be interested in the public consultations process (to be identified within consultation process).

In order to effectively organize the Stakeholder Engagement Process, a Stakeholder Engagement Plan (SEP) was developed.

## **10.2.2.** Informal consultations

Consultations with stakeholders was initiated in May 2019 as part of the Scoping/Preliminary ESIA and the collection of material for the social assessment. In May 2019, consultations occurred informally, without disclosing the ESIA documents (which were being prepared at the time), based on oral information presented by the ESIA team. During this period, consultations was conducted with:

- The administration of the Bilibino municipal district and urban district of Pevek;
- The territorial-neighboring community "Burgakhchan" (potentially affected party: the community lives on the border of the license area and grazes deer on pastures partially intersecting with the license area);
- The director of Ozernoye enterprise G. Novikov (potentially affected party: the enterprise grazes reindeer and pastures partially overlap with the licensed area);
- A representative of the Association of Indigenous Small-Numbered Peoples of Chukotka in the urban district of Pevek.

The information obtained through the informal has been used to describe the Social Baseline in the ESIA.

## 10.2.3. Stage 1. Public consultations of the Preliminary ESIA results

Formal public consultations were launched on 24 September 2019 during which the following materials were presented and discussed:

- Preliminary Environmental and Social Impact Assessment Report (document No. 01 of September 24, 2019); and
- Stakeholder Engagement Plan (document No. 02 of September 24, 2019).

On September 24, the materials were posted on Web sites and transferred to public visitor centres. On September 25, a meeting was held with the Committee of Natural Resources and Ecology of the Chukotka Autonomous Okrug, which was attended by representatives of regional and federal authorities, municipal authorities and public organizations. At the meeting, the findings of the Scoping/Preliminary ESIA were presented within the context of guidelines for effective engagement.



**Round tables** were selected as the most effective form of face-to-face discussion. The Stakeholder Engagement Plan (SEP), included plans for round table discussions in 4 settlements - Anadyr, Pevek, Bilibino and Anyuysk. However, during this first stage, round tables were held only in three settlements: in the city of Anadyr - October 22, in the city of Bilibino - October 26, in the village of Anyuysk - October 28. The roundtable scheduled for October 24 in Pevek did not take place due to bad weather in that prevented the ESIA team from flying to Pevek.

At the round tables, the main findings of the ESIA were presented and discussed and comment invited on the findings. The meeting Agendas and records of the questions and answers are available. Also, reports on the full ESIA and the Environmental and Social Management Program (ESMP) were disclosed, presented to the participants of the round tables and posted in public visitor centres.

During this period, a series of additional meetings were also held with representatives of the public and organizations of social infrastructure in the village of Anyuysk and in the city of Bilibino for the purpose of sourcing additional information.

## 10.2.4. Stage 2. Public consultations of the Full-scale ESIA.

stage 2 of public consultations (1 November – 31 December 2019), the full ESIA was presented for discussion:

- "Environmental and Social Impact Assessment". Document No. 03 Released: October 17, 2019
- "Environmental and Social Management Program". Document No. 04 Released: October 18, 2019

As well as the documents of the 1<sup>st</sup> stage, the full ESIA was disclosed for review on the website of Ecoline Environmental Assessment Centre: http://www.ecoline-eac.com and in four public visitor centres: in Anadyr (Public Library named after Tan-Bogoraz), in the city of Pevek (Administration of the Pevek urban district), in the city of Bilibino (Bilibino District Library), in the village of Anyuysk (rural library).

## 10.3. Forms and methods of the public consultations

The materials prepared as part of each stage were submitted for discussion. For information disclosure, the materials were posted on the Internet and in specially organized public visitor centres.

#### Websites:

All documents, submitted for public discussion, are disclosed for review on the Internet sites:

- Ecoline Environmental Assessment Centre http://ecolineeac.com/proekty/peschanka/eso.html ,
- GDK Baimskaya LLC http://baimskaya.ru



#### Public visitor centres<sup>162</sup>

Bilibino city, Bilibino district library,	Bilibino city, str. Lenin, 7
Albina Spasova,	LVT-50@yandex.ru
Director of the library	8 (42738) 2-57-31
Pevek city, Administration of the Pevek urban	Pevek city, str. Obrucheva, 29
district	<u>chaunadmin@mail.ru</u>
Natalya Vukvukay	8 (42737) 4-15-55
Anadyr city, Public Library named after Tan-	Anadyr city, str. Otke, 5
Bogoraz	<u>chopub@bk.ru</u>
Olga Pakhomova	8 (42722) 2-61-53
Anyuysk village, House of Culture, library Tatyana Doronina	Anyuysk village, str. Yubileinaya, 17

## In-person consultations / meetings:

In-person consultations were planned in the form of round tables and public hearings. When necessary, individual and / or group meetings, interviews, meetings with stakeholders were held.

## Hotline:

To quickly respond to questions from stakeholders with limited access to public visitor centres, a hotline was established:

- Phone: +7 (905) 574-46-92, Anna Kuznetsova
- Email: baimka@ecoline-eac.com,

## The Client's contacts:

- in Anadyr: 689000 Anadyr, str. Dezhneva, 1, r.silantiev@rmcgold.ru, 8 (924) 665-32-17, Ruslan Silantyev
- in Moscow: 115035 Moscow, str. Sadovnicheskaya, 4/1, a.kliachin@rmcgold.ru, 8 (495) 777-31-04 add. 1136, Alexander Klyachin

## 10.4. Key public consultations resultы

The following findings emerge from the public consultations conducted as part of the ESIA:

#### • High interest in the Project

Stakeholders engaged actively in face-to-face meetings, asking questions, and providing comments, views and suggestions. At the same time, very few questions have been received via the hotline and Project's public offices.

<sup>&</sup>lt;sup>162</sup> Initially, the opening of public receptions and holding face-to-face consultations was planned in three localities: Anadyr (the capital of the Chukotka Autonomous Region), as well as in Bilibino (the administrative center of the Bilibinsky District) and Pevek. In October 2019, on the recommendation of the administration of the Bilibinsky municipal district, a public reception was opened, and face-to-face discussions were scheduled in Anyuysk.



# • Generally positive attitude toward the Project

In general terms the proposed project was well received. There are, however, number of sensitive issues and the Company needs to adopt a proactive approach to managing them and find the decisions acceptable for all interested parties. The most sensitive social and environmental issues that have been frequently raised during the public hearings are summarised below.

## • Local employment

While local residents are very interested in employment opportunities associated with the Project, they are concerned that their access to these opportunities would be limited because the major part of workforce would be brought from other regions and abroad.

Representatives of indigenous communities are particularly concerned about access to employment at the planned mine and processing planned because part of the representatives of the Indigenous small-numbered peoples of the North are inclined to work in the mining sector with some of them already having experience of working for the Kupol Project (and other mining projects) and/or having acquired a degree/diploma in mining. These representatives of Indigenous Small-Numbered Peoples have drifted away from reindeer husbandry and are not likely to continue their traditional way of life. It is particularly important to consider how employment needs of these people can be addressed.

## • Support to Indigenous Communities and traditional lifestyles

The potential scale and forms of support the Project would be able to provide to indigenous communities is another issue of great interest for local stakeholders. During the roundtable meetings and public hearings held in Anadyr and Bilibino, the representatives of the Association of Indigenous Small-Numbered Peoples of Chukotka reiterated the suggestion that a fund supporting indigenous communities should be established similar to the one maintained by the Kupol Project.

It should be noted especially, that stakeholders are actively comparing the Company's social initiatives with those of other mining companies and projects (first of all, such as Kupol) but somehow omit the fact that the Project is at an early design stage when it does not even have a construction permit and is not able to generate any profit which could be used to finance social initiatives. It appears that local stakeholders compare the Project which is still in its infancy with other similar projects which already generate profits from mining and processing operations. It is feasible to develop the document explaining the Project's stakeholder engagement strategy in a broader context and timeframe.

## • Sensitive environmental issues:

- The TSF integrity during and after operation phase; risk of seepage and impact on aquatic ecosystems; and,
- The Project impact on biological resources including fish stocks, hunting resources, and berry harvest; risk of poaching and overexploitation of wildlife.



#### 10.4.1. Recommendations

- Regarding hiring policy and labour relations:
  - Develop and adopt an HR policy promoting local employment on a preferential basis provided that job-specific qualification requirements are met. It is recommended to ensure that such policy is established and actively disseminated before the commencement of construction.
  - Conduct a labour market assessment to clarify the availability of local labour, whether it can be used for the Project, and what kind of training/refresher training would be required. Recommended deadline: Q3 2020.
  - Develop training/refresher training programmes as required as a function of the market assessment. Recommended deadline: end of 2020.

## • Regarding stakeholder engagement

- Maintain ongoing dialogue with stakeholders as per the Stakeholder Engagement Plan adopted for the Project.
- Develop a broader and longer term (e.g. 5 years) stakeholder engagement strategy outlining priority areas for engagement at different stages of the Project cycle, for example:
  - At the design stage (till the construction permit is obtained for the Project), the sole focus should be on information-sharing engagement; formulating a Local Community Development Support Strategy during this period would be both possible and advisable;
  - It is recommended in respect of a Local Community Development Strategy, to consider the experience already available in the region on various mining projects. It also sounds promising to consider the supporting the development of processing infrastructure for reindeer farming products in Bilibinsky District and Pevek. If both parties find an arrangement that is acceptable for both of them. Such a relationship could be an unprecedented experience that would make the Company a leader in the area of corporate environmental and social responsibility.
  - During construction, information-sharing and communication focus should be expanded to include employment-related engagement with local communities and provision of limited support to affected parties, as well as keeping stakeholders informed of project progress.
  - During operations, broader support to local communities and information-sharing engagement with all stakeholders would be required.
- Regarding sensitive environmental issues
  - Enhance communication and keep stakeholders updated on each of the issues mentioned above, as well as other environmental issues causing public concern as they emerge;



## 11. SUMMARY AND CONCLUSIONS

This report contains the findings of the Environmental and Social Impact Assessment (ESIA) conducted for the proposed Peschanka Copper Project. The ESIA gives expression to the changes that could be brought about to the environment and society in which the project is to be developed and an assessment of the significance of those changes. The ESIA follows on from a Scoping Report that served to define the scope of the assessment and is the fulfilment of that scope of work. Environmental assessment fulfils two important project requirements namely:

- The local regulatory requirements for assessment of a project before it can proceed; and,
- Allowing lenders to satisfy their own internal sustainability policies on where they chose to lend or invest.

The first requirement is still to be completed through the development of the OVOS (the Russian equivalent of an ESIA) together with the required design documentation, which would be completed during the course of 2020. The latter requirement is addressed through this ESIA that has been prepared especially with such lender requirements in mind. The structure of the ESIA is a project description, the regulatory environment and the assessment method, the environmental and social baselines, and then the environmental and social impact assessments.

## The Project

The Project is the establishment of a large-scale open pit operation to extract and process copper ore in the Baimka Ore Field of the Chukotka Autonomous Okrug. The mine infrastructure would include two ore processing lines that will crush and grind the ore and then use flotation technology to concentrate the copper to commercial recovery. Tailings from the ore processing (concentrator) would be discharged into a dedicated tailings storage facility (TSF) to be built in the Peschanka-Yegdegkych River Valley. The mine will also include facilities for accommodation of mine personnel, offices and administration, maintenance workshops, stores, an explosives magazine, waste rock dumps and an aerodrome. In addition to the mine and processing plant facilities at Peschanka, a marshalling yard would also be established close to the port town of Pevek. The marshalling yard would be used during construction of the mine to bring in materials needed for the mine and then also to facilitate the same during mine operations together with the outgoing minerals product that would be transported to Pevek by road. The mine would be developed in an extremely harsh climate and as such will require provision in the design for such harsh conditions.

## Natural environment

Chukotka is sparsely inhabited with very little in the way of rural settlements due to the extremely harsh climate and the lack of access to much of the area. As such the rural/wilderness areas of the Okrug are almost pristine and natural. The tundra environment is one of extreme fragility despite the harsh conditions in which it occurs. Cryogenic processes are a key determinant of the nature of the soils, associated vegetation and habitat and the fauna that is to be found there. The area is not especially diverse in terms of vegetation or fauna (fish, birds and mammals) but there are important species of both that occur in the area, the sustainability of which cannot be threatened by activities at



the mine. There are no red-data species in the immediate project area but the flora and fauna in the area is nevertheless deserving of protection and on-going conservation.

## Social environment

In the area in which the Peschanka Copper Project is to be developed there is evidence of human activities in the placer mining of Luch Free and other historical mining operations together with the exploration activities especially this that have taken place for the Peschanka Copper Project. There is an important grouping of people in the Even that live to the south of the project area and who practice the traditional nature use that categorises them as 'Indigenous People'. This is the Burgakhchan community and although it is highly unlikely that the mine would impact on their traditional lifestyle directly, the importance of ensuring that there are no such impacts cannot be over-emphasised.

## Potential environmental and social risks

The impacts identified for the construction and operation of the mine and processing plant and the marshalling yard at Pevek are summarized in Table 71. The impacts have been identified as a function of the cause-effect relationships that exist in the natural and social environments, which can only be effectively understood as a system. The mine activities would result in environmental and social aspects (such as resource use, waste and pollution and social aspects) with the aspects bringing about potential changes in the receiving environment or society. The impacts are expressed as consequences of the changes and are assessed in terms of inherent risk (viz. what could happen) and then as a function of the specific circumstances of the mine and the environment in which it would be established, together with the mitigation that could be brought to bear to reduce the extent of the change, the likelihood of the inherent risk. The likelihood of the inherent risk provides a residual risk (viz. what is likely to happen) and it is the residual risk that then reflects the risks that would need to be accepted by the authorities and lenders for the benefits that would be associated with the mine. Those residual risks than also highlight which aspects require the most careful management attention during the implementation and operation of the mine.

Mostly due to the very small area that would be affected by the mine relative to the much larger wilderness are of Chukotka, none of the residual risks are considered significant and there is certainly no suggestion of a potential fatal flaw that would potentially disqualify the project from proceeding. At the same time the job creation, spending and resultant economic growth would like result in net improvements in human welfare at least in Bilibino and to a lesser extent but still importantly within the Okrug as a whole.



	Risk/Benefit	Inherent Risk/Benefit	Residual Risk/Benefit
Risk	Adverse human health effects	High	Low
Risk	Damage to vegetation and reduced habitat	Moderate – high	Low
Risk	Risk of material reductions in environmental quality	Moderate	Moderate
Risk	Deterioration of surface water quality	Moderate	Moderate
Risk	Deterioration of groundwater quality	Moderate	Moderate
Risk	Risk of reduced fish populations	Moderate – high	Moderate
Risk	Risk of reduced terrestrial fauna populations	Moderate – high	Moderate
Risk	Risk of impaired ecosystem services	High	Low
Risk	Contribution to climate change and its consequences	High	Moderate
Benefit	Net improvements in human welfare	Moderate – high	High
Risk	Net reductions in human welfare	Moderate – high	Low
Risk	Risk of reduced livelihoods	Moderate – high	Low

#### Table 71. Summary listing of impacts as assessed in this ESIA

## Environmental and social management

That is not say though that these impacts would take care of themselves. The impacts risks would require a broad range of mitigation to ensure that the residual risks are no worse than what has been predicted in the ESIA. Not only would that mitigation be required but there would need to be highly effective environmental and social management during the lifetime of the mine to ensure that it stays that way. To that end an Environmental and Social Management Programme (ESMP) has been developed for implementation with implementation of the mine, as the foundation of a fully-fledged operational Environmental and Social Management System (ESMS). The development of the ESMS would be premised on ensuring that none of the risks identified in the ESIA are ever allowed to get worse than they are predicted to be here and that over time there would be a process of continual improvement in the environmental and social management performance of the mine. The overall environmental and social sustainability objective of the project must be to maximise the social benefit of the project while minimising the environmental cost.



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   %D0%BE%D0%B3%D0%B5\_%D0%B6%D0%B2%D1%82%D1%82%D1%82%D0%BE%D0%B6%D0%B5%D0%D5%D0%D5%D0%D5%D0%D5%D0%D5%D0%D5%D0%D5%D0%D5%D0%D5%D0%D5%D0%D5%D0%D5%D0%D5%D0%B5%D0%B5%D0%B5%D0%B5%D0%B5%D0%B5%D0%B5%D0%B5%D0%B5%D0%B5%D0%B5%D0%B5%D0%B5%D0%B5%D0%B5%D0%B5%D0%B5%D0%B5%D0%D5%D0%B5%D0%D5%D0%D5%D0%D5%D0%D5%D5%D0%D5%D0%D5%D0%D5%D5%D0%D5%D0%D5%D0%D5%D5%D0%D5%D5%D0%0%D5%D0%0%D5%D0%D5%D0%D5%D0%D5%D0%0%D5%D0%D5%D0%D5%D0%D5%D0%0%D
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## ANNEX 1. 2019 ENVIRONMENTAL AND SOCIAL STUDIES

Environmental and social studies, carried out in 2015 – 2018 do not fully comply with the scope of EEI required both for preparation of OVOS materials and for development of the ESIA in accordance with the international lender requirements. This is due to the increase in the number of designed facilities and change in their location on the main production site. In 2019, such infrastructure facilities as an aerodrome, a warehouse complex near Pevek, a water intake and a reservoir on the Left Peschanka River and others were added, and water intake on the Bolshoy Anyuy River was excluded from consideration.

Changes in the design solutions required additional environmental and social investigations in the spring-winter and summer field seasons, a short list of which is given below. The additional investigation program developed in March 2019 was subsequently adjusted in accordance with the changes in the design of infrastructure facilities, as well as optimization of location of production facilities on the territory of GOK. Some of the works from the given list have already been completed or are being performed; analytical and inoffice works are being carried out. The joint analysis of underground and surface water is also being performed together with CSA Global.

Facility /survey	Input to ESIA/BFS	Input to OVOS / Russian Project design / Environmental Engineering Investigations
Spring-winter investigations: - snow composition analysis; - study of animal migration; - study of migratory bird migration	Information to ESIA	Information to OVOS and EEI
Aerodrome: full set of EEI163 according to RF requirements	Information to ESIA (biodiversity chapter)	The chapter to EEI: Environmental Engineering Investigations. Aerodrome
Water intake area, Left Peschanka: full set of EEI according to RF requirements	Information to ESIA	The chapter to EEI: Environmental Engineering Investigations. Water intake
Analytical works for water samples (as requested by CSA Global)	Information to BFS	Additional information to OVOS
Radioecological survey / radon hazard/physical factors		The chapter to EEI of for Peschanka site: Radioecological/physical factors
Full set of EEI according to RF requirements for the marshalling area at Pevek	Information for ESIA	The EEI for the marshalling area for OVOS and Project design documentation
Social baseline studies in Pevek, according to the international lender requirements.	Baseline information to ESIA	Information to OVOS

Table 72. List of Investigations required for preparation of the ESIA and OVOS (2019)

<sup>163</sup> EEI – Environmental Engineering Studies.



Facility /survey	Input to ESIA/BFS	Input to OVOS / Russian Project design / Environmental Engineering Investigations
Indigenous people (IP) and traditional lifestyle in the Project affected area		
Social baseline studies in Bilibinsky district (update).	Baseline information to ESIA	Information to OVOS
IP and traditional lifestyle in the Project area (update).		



## ANNEX 2. ECOSYSTEM SERVICES OF THE PROJECT AREA

#### Table 73. Summary table of ecosystem services in the Project area

Legend: significance of ecosystem services (ESSs):

High	An ecosystem service (ESS) is critical for its consumer
Medium	An ESS is not critical but still plays important role in supporting livelihoods
Low	An ESS is of low significance for its consumer
Zero	An ESS is not provided/not consumed



Ecos Ecosystem services	Ecosystems500-750 m – a belt of mountain-arctic deserts and tundras on cryostructural gravelly-stony near-the-root primary sediments400-500 m – a belt of larch tundra forests on the slopes, fluvioglacial plumes, upland terraces, on quaternary loose sediments of various genesis200-400 m – a pebble-boulder						200-400 m – a belt of river pebble-boulder and sand-p	D-400 m – a belt of river valleys bottoms on bble-boulder and sand-pebble alluviums					
Classification (according to Milenium Ecosystem Assessment, 2003)	Descriptio n	mountain- arctic deserts and crustose - lichen tundra of watershed surfaces	Lichen and shrub tundra of watershed surfaces	dwarf pine stony-lichen and grass- lichen with involvement of single larch transitional surfaces	dwarf pine shrub-lichen with spikes of larch forests of the upper parts of the slopes	larch tussock swamp forests of fluvioglacial and proluvial plumes, middle and lower parts of the slopes	larch green moss forests of fluvioglacial and proluvial plumes, middle and lower parts of the slopes	larch dwarf mossy forests of fluvioglacial and proluvial plumes, middle and lower parts of the slopes	larch green moss- shrub forests of fluvioglacial and proluvial plumes, middle and lower parts of the slopes	Burnt areas of larch forests of fluvioglacial and proluvial plumes, middle and lower parts of the slopes	Park larch forests, poplar-chosenia and meadow willows of low and high sandy-pebbly floodplains, shallow debris cones and plumes of sag-and-swell flood plains, composed of diffuse silty-sandy water- glacial sediments	Secondary willow and forb-grass groups of disturbed areas of river valleys	Rivers, streams
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Resource													
Food	Source of wild herbs		Mushrooms	Pine nuts, ling crowberries, b cloudberries	onberries, lueberries,	lingonberries, lingonberries, blueberries blueberries, cloudberries			lingonberries, blueberries, currant, raspberry arctic	Blueberries	Currant		
	Source of medicinal herbs		Cladonia, Cetraria	Cladonia, Cetr	aria, cloudberry	Cloudberry Fireweed Firewood				Parnássia palústris, astragalus arcticus, yarrow, Chamaenerion			
	Pastures for domesticat ed deer		Autumn pastures. Restrictions – low area elevation patterns.	Winter pastur – low area ele	es. Restrictions vation patterns.	Spring pastures. Restrictions – low area elevation patterns.					Summer pastures		
	Commerci al species	Brown bear, wild reindeer, fox, arctic fox, ermine, willow and rock ptarmigan										Brown bear, wild reindeer, fox, arctic fox, ermine, willow and rock ptarmigan	
Fresh water	Formation of freshwater runoff	The consume	The consumer is the local population								The consumer is the local population		
Fuel	Wood			Wood for the	needs of local po	pulation and businesses	S		Wood for the needs of local population and businesses	Wood for the needs of local population and businesses	Wood for the needs of loca businesses	al population and	Manchurian trout, east- Siberian grayling and Prosopium cylindraceum



Ecosystem services	Ecosystems500-750 m – a belt of mountain-arctic deserts and tundras on cryostructural gravelly-stony near-the-root primary sediments400-500 m – a belt of larch tundra forests of quaternary loose sediments of various gen					s on the slopes, fluvioglacial plumes, upland terraces, on 200-40 enesis pebble			200-400 m – a belt of river pebble-boulder and sand-p	200-400 m – a belt of river valleys bottoms on pebble-boulder and sand-pebble alluviums			
Classification (according to Milenium Ecosystem Assessment, 2003)	Descriptio n	mountain- arctic deserts and crustose - lichen tundra of watershed surfaces	Lichen and shrub tundra of watershed surfaces	dwarf pine stony-lichen and grass- lichen with involvement of single larch transitional surfaces	dwarf pine shrub-lichen with spikes of larch forests of the upper parts of the slopes	larch tussock swamp forests of fluvioglacial and proluvial plumes, middle and lower parts of the slopes	larch green moss forests of fluvioglacial and proluvial plumes, middle and lower parts of the slopes	larch dwarf mossy forests of fluvioglacial and proluvial plumes, middle and lower parts of the slopes	larch green moss- shrub forests of fluvioglacial and proluvial plumes, middle and lower parts of the slopes	Burnt areas of larch forests of fluvioglacial and proluvial plumes, middle and lower parts of the slopes	Park larch forests, poplar-chosenia and meadow willows of low and high sandy-pebbly floodplains, shallow debris cones and plumes of sag-and-swell flood plains, composed of diffuse silty-sandy water- glacial sediments	Secondary willow and forb-grass groups of disturbed areas of river valleys	Rivers, streams
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Regulating servi	ces												
Climate control	Contributi on to global climate control	Earth climate	arth climate stabilization								Earth climate stabilization	Earth climate stabilization	
Management of runoff and erosion	Ensuring a stable runoff and a certain level of erosion processes	Protection a	Protection against adverse and dangerous phenomena Protection against adverse and dangerous phenomena									Protection against adverse and dangerous phenomena	Protection against adverse and dangerous phenomena
Social and cultur	ral services												
Aesthetic	Beauty and aesthetic properties	Restriction –	Restriction – inaccessibility								Restriction – inaccessibility	Restriction – inaccessibility	
Recreational	Hunting and fishing tourism	Commercial Restriction –	Commercial species Restriction – inaccessibility										
Habitat	Living environme nt of the local population		Local population       Local population										



Ecos Ecosystem services	systems	ms 500-750 m – a belt of mountain-arctic deserts and tundras on cryostructural gravelly-stony near-the-root primary sediments				400-500 m – a belt of larch tundra forests on the slopes, fluvioglacial plumes, upland terraces, on quaternary loose sediments of various genesis					200-400 m – a belt of river valleys bottoms on pebble-boulder and sand-pebble alluviums		Watercourse ecosystems
Classification (according to Milenium Ecosystem Assessment, 2003)	Descriptio n	mountain- arctic deserts and crustose - lichen tundra of watershed surfaces	Lichen and shrub tundra of watershed surfaces	dwarf pine stony-lichen and grass- lichen with involvement of single larch transitional surfaces	dwarf pine shrub-lichen with spikes of larch forests of the upper parts of the slopes	larch tussock swamp forests of fluvioglacial and proluvial plumes, middle and lower parts of the slopes	larch green moss forests of fluvioglacial and proluvial plumes, middle and lower parts of the slopes	larch dwarf mossy forests of fluvioglacial and proluvial plumes, middle and lower parts of the slopes	larch green moss- shrub forests of fluvioglacial and proluvial plumes, middle and lower parts of the slopes	Burnt areas of larch forests of fluvioglacial and proluvial plumes, middle and lower parts of the slopes	Park larch forests, poplar-chosenia and meadow willows of low and high sandy-pebbly floodplains, shallow debris cones and plumes of sag-and-swell flood plains, composed of diffuse silty-sandy water- glacial sediments	Secondary willow and forb-grass groups of disturbed areas of river valleys	Rivers, streams
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Supporting													
involvement in the cycle of substances	Involveme nt of ecosystem s in the global biological cycle of substances	Geochemica	eochemical barrier for atmospheric pollution								Geochemical barrier for contamination of atmosphere and water	Geochemical barrier for water contamination	
Biodiversity conservation	Involveme nt of ecosystem s in the preservati on of the landscapes , species and genetic diversity	Ovis nivicola	is nivicola lydekkeri, Circus cyaneus, Falco rusticolus, Falco peregrinus								Ovis nivicola lydekkeri, Circus cyaneus, Falco rusticolus, Falco peregrinus	Red listed species have not been found	



#### ANNEX 3. HUNTING PLOT OF THE INDIGENOUS SMALL-NUMBERED PEOPLES OF EVEN M. DYACHKOV





Карта-схема охотучастьа охотника ЖМНЦ Кеячкова Михаила Константиновича OLOTT. SUNETT 87 Nº 0003709 Borgan 04. 10. 20122. Действительна при предъявлении экотникоро билета 1 Magazob Пеженк Superior P. HEHKON ð 1 Respectives \* C. JAIROJARQ Стариний госохотинстека Управления по охране и ис пальзованию животного мир Martinow A.D. A.F. Прохоров иливински Большой Анной

