



## **Summary of Environmental Management Plan 2017 of Oyu Tolgoi mine**

**Ulaanbaatar  
2017**

**Content**

**1. mitigation measures.....2**

1.1. Plan for mitigating potential adverse impacts on fauna ..... 2

1.2. Plan for mitigating potential adverse impacts on flora ..... 3

1.3. Water scarcity, water quality issues ..... 4

1.4. Land management plan ..... 5

    1.4.1. Land disturbance monitoring .....5

    1.4.2. Topsoil protection .....6

1.5. Plan for mitigating potential adverse impacts on air quality..... 7

**2. OFFSET PLAN.....9**

2.1. Biodiversity ..... 9

2.2. Additional environmental protection measures..... 9

**3. REHABILITATION PLAN .....10**

3.1. Technical rehabilitation plan ..... 10

3.2. Biological Rehabilitation Plan ..... 10

    3.2.1. Establishment of green spaces..... 11

**4. RELOCATION AND COMPENSATION PLAN ..... 11**

**5. HISTORICAL AND CULTURAL HERITAGE PROTECTION PLAN ..... 11**

**6. chemicals risk management plan ..... 12**

**7. waste management plan ..... 12**

**8. THE ANNUAL ENVIRONMENTAL MANAGEMENT PLAN IMPLEMENTATION ARRANGEMENTS F ..... 13**

**9. ENVIRONMENTAL MONITORING PROGRAM ..... 13**

9.1. Water level and quality monitoring..... 13

9.2. Air quality monitoring..... 15

9.3. Soil quality monitoring..... 18

9.4. Flora Monitoring ..... 18

9.5. Fauna Monitoring ..... 19

## 1. MITIGATION MEASURES

### 1.1. Plan for mitigating potential adverse impacts on fauna

Table 1. Plan for mitigating potential adverse impacts on fauna

	Environmental protection measures	Scope
1	Organize training sessions on threatened and endangered species listed in and protected by the Mongolian Red Book, Regional Red List and the International Union for Conservation of Nature (IUCN) Red List and other applicable laws and conventions	OT employees and contractors
2	Install short-circuiting isolators on high risk transmission lines to prevent birds from electrocution	6.3kW powerlines and substations of Gunii Khooloi
3	Using data gathered from the satellite collars on wild asses, track their location and timings of cross road movement and restrict vehicle movements when necessary.	OT- Gashuunsukhait paved road
4	Conduct inspections at the airport and relevant entrances to enforce regulations on illegal hunting and collection of wild plant species, trafficking and using raw materials of such origins.	OT employees, contractors and guests
5	Conduct employee trainings on and inspections for ensuring use of approved roads for driving and adhering to speed limits to prevent wild animals bolting or roadkills.	Along the OT-Gashuunsukhait road, OT employees and contractors
6	Conduct researches on endangered species and its' habitat protection and review prior to issuing Land Disturbance Permit (LDP), deny permits when necessary	Project activity area
7	Monitor activities related to disposing and burying food waste, prevent open dumping; monitor omnivorous bird counts	Waste Management Center at the project area
8	Determine high risk areas at the project site for wildlife collision with vehicles; place warning signs for reducing speed limits; prepare and deliver warning messages to employees.	License area
9	Assess the usage intensity of Oyu Tolgoi - Gashuun Sukhait paved road, and monitor any interference on the migration of rare mammals	OT-Gashuunsukhait paved road
10	Conduct regular monitoring of supernatant water supplied from the the Concentrator to TSF as specified in the environmental monitoring program for Underground water	Birds landing on supernatant pond of TSF
11	Removal and burying of animal carcasses in the project area and along the infrastructures	Mine site, along the infrastructures

## 1.2. Plan for mitigating potential adverse impacts on flora

Table 2. Plan for mitigating potential adverse impacts on flora

№	Environmental protection measures	Scope
1	Obtain long and short term land management plans in advance of 3 or more months and conduct baseline study in the specific area to determine measures to mitigate adverse impacts on rare and endangered plants and issue a recommendation.	Project area
2	Conduct baseline study in each area, for which a Land disturbance permit is requested, to determine adverse impacts on topsoil and vegetation of the area with classification of 1) streambed vegetation area with elm and poplar, which is a part of the critical habitat, 2) saxaul forest area and 3) pasture reserve, and issue recommendations on mitigation measures in accordance with mitigation hierarchy	Project area
3	Maintain plant registry in the disturbed area and report	Project area
4	Conduct observation and research to determine potential adverse impacts on plant species, which should not be disturbed, collect data, research methods and technologies to maintain genetic fund and take effective prevention measures.	Project area
5	Update and present to the land users the map of distribution of rare plants in mine license area	Project area
6	Ensure compliance with regulations on illegal collection, trafficking and use of wild plant species and raw materials of such origins, conduct inspection at the mine area	OT employees, contractors and visitors
7	Register any case of collecting wild plant species as environmental breach and take proper measures	OT employees, contractors and visitors
8	Conduct rehabilitation of areas, planned as habitats for wildlife after closure of operation, in accordance with defined indicators to ensure survival and independent growth of plant communities comprised of various species and types.	Project area

### 1.3. Water scarcity, water quality issues

Table 3. Plan for mitigating potential adverse impacts on on water resources

	Environmental protection measures	Scope
1	Commence closure and sealing of the selected 12 boreholes in cooperation with Khanbogd soum, Umnugobi aimag and the Tripartite Council	GHW5x2, GHW6x2, GHW14x2, GHW15x1, GHW15x2, GHW15x4, GHEB05, GHEB04, GHTPM01, GHTPM03, GHEB07, GHEB06
2	Minimize overall water consumption of the project and increase water recycling, explore additional opportunities and conduct trainings on proper use of water.	OT employees, contractors and visitors
3	Work on compliance of the water management plan, which was devised to regulate issues like TSF, acid rock drainage, WWTP, open-pit seepage and drainage systems.	Within the project operations
4	Open pit seepage is constantly drained into sump and treated, and then used in dust suppression around the waste rock dumps and shaft areas.	Within open pit mine operations
5	Operation of industrial and domestic waste water transmission pipeline network and equipment are monitored on regular basis, and damages, if any, are repaired immediately.	OT employees, contractors and visitors
6	Liquid waste and sludge are disposed at designated points.	When required
7	Avoid creating water surface in large area at the TSF.	TSF, Concentrator
8	Monitor whether diverted water flow joins back the main watercourse to retain/restore surface and ground water flow. Monitor the rehabilitated artificial Bor owoo spring water.	OT LLC's employees, Environmental Department
9	Monitor the underground water near the WWTP.	OT LLC's employees, Environmental Ddepartment
10	Prevent GKh aquifer water level drop below the recommended permissible level, and monitor water quality in the Gunii Hooloi aquifer.	Gunii Khooloi wells
11	Regularly monitor the WWTP influent and effluent.	WWTP, Environmental Department
12	Analyse TSF water sample on monthly basis and determine the cause if any changes are detected.	HSE Department
13	Prevent from chemicals leakage into drinking water source; ensure regular water quality test. Check sealing and intactness of chemicals' containers during transportation; inspect the existing warehouses for compliance with relevant standards, clean chemical spills with special purpose materials.	OT employees, contractors and visitors
14	Prevent any loss/spill/leak of fuel & lubricants; in case of spills or leaks, clean with special purpose materials.	Project operations

## 1.4. Land management plan

### 1.4.1. Land disturbance monitoring

Table 4. Plan for mitigating potential adverse impacts on land and soil

№	Environmental protection measures	Scope
	Continue implementing the revised procedure on Land Disturbance Permit in 2017	Project scope
1	Surface and subsoil degradation – ensure compliance with the (internal) procedure on Land Disturbance Permit prior to commencing any land disturbance task.	License area MV-006709
2	Surface and subsoil degradation - Ensure detailed planning for minimum land degradation, plan actions accurately to avoid expanding areas for buildings and construction unless it is critically required. Conduct rehabilitation measures.	Project site-side; Always
3	Surface and subsoil degradation - Design and shape walls and surface of mine excavations ensuring long term stability and sturdiness, rehabilitate and improve conditions of unstable or risky excavations and tailings facilities to ensure safety in the course of mine operation or after its closure.	Open pit, Waste rock dump, Concentrator complex tailings, Dugat pebble quarry
4	Surface and subsoil contamination – regularly check safety and integrity of equipment used at the Concentrator complex, Explosives plant, Fuel storage, Fuel depots and WWTP, take immediate measures for damages revealed.	Concentrator facility, Explosives plant, Fuel storage, Fuel depots and WWTP
5	Regularly check the TSF dam stability and prevent from cracks, breaks, burst or overflow.	Tailings Storage Facility
6	Limit the land disturbances within the license area	Mine license area
7	Limit land disturbance in new areas, and select locations and design drawings of constructions to avoid or mitigate adverse impacts on health, environment and biodiversity.	Area to be disturbed within the mine license area
8	Make efforts to minimum land degradation and do transportation only on approved routes.	Mine license area and its surrounding areas
9	Avoid increasing land occupancy by buildings and facilities unless it is critically required and rehabilitate areas that are not or will not be used	Mine license area and along with other infrastructure lines
10	Cumulative effects caused by the open pit and underground mine operations – avoid, mitigate and rehabilitate in accordance with Mitigation hierarchy and undertake regular and effective offset measures for the full duration of the impact.	Stockpiles of topsoil stripped from disturbed area
11	Protect topsoil stockpiles from wind and water erosion - strip the topsoil at an appropriate depth prior to any land disturbance activities, make and keep stockpiles properly.	Stockpiles of topsoil stripped from the disturbed area
12	Protect stockpiles from wind and water erosion - Continue with stockpile surface vegetation experiments, prioritize using the topsoil stripped from a particular area for the rehabilitation of the same area;	Surface and sides of the topsoil stockpiles to be kept for longer than 2 years
13	Protect stockpiles from wind and water erosion –Monitor the quality of topsoil stockpiles to be kept for longer than 2 years, maintain labeling and keep records of conservation and maintenance;	Topsoil stockpiles to be kept for longer than 2 years
14	Solid and liquid waste disposal, discharge of WWTP effluent not treated to the standard level may contaminate soil; also fuel and lubricants leak or spill from heavy equipment during transportation, storage and use of chemical substances, ash pool of the central heating plant, and seepage of wastewater from Concentrator to the TSF may contaminate soil – Waste should be segregated and disposed at a designated point only.	Project site
15	When transporting chemicals, always check containers’ seal and intactness; verify the existing warehouses for use/operation in compliance with relevant standards; clean chemicals’ spills and leaks with special purpose materials, and locate in proper/appropriate places.	Vehicles and equipment, transporting chemicals, chemicals storage, explosives plant
16	Regularly inspect safety and intactness of equipment and processes at the Concentrator, Explosives plant, Batch plants and WWTP, take immediate measures for damages, if any.	Concentrator, explosives plant, batch plant, WWTP

№	Environmental protection measures	Scope
17	Regularly monitor the level of wastewater accumulated in the <b>Liquid Waste Management Center</b> at TSF to avoid wastewater overflow, which will cause soil contamination.	Soil around TSF
18	Comply with the Waste Management Procedure and drive on the approved route for transporting and disposing ash and other wastes from the Central Heating Plant	Waste Management Center, transportation roads
19	Make a concrete basement in areas of potential fuel and lubricant spill and leak to prevent from soil contamination.	Gas stations, gas pipes and storage
20	Place neutralization substances and materials in appropriate places for availability in case of spills	Gas stations, gas pipes and storage
21	Mitigate soil degradation along Gunii khoooloi water supply line – develop a monitoring program for surface soil moisture and identify indicators for the impact caused by aquifer water level reduction	along the Gunii khoooloi water supply line
22	Mitigate soil degradation along Gunii khoooloi water supply line –Avoid creation of branch roads. Rehabilitate the land degraded by construction work.	along the Gunii khoooloi water supply line
23	Provide comprehensive training and instructions for all employees to raise awareness on handling industrial and domestic hazardous materials and place throughout the workplace sufficient amount of required tools and materials to be used in the event of spill or leak.	All employees
24	Establish designated dump site for disposing waste from Tsagaan Khad- Gashuun sukhait road construction work; transport the waste from the dump site to the centralized dump site of the soum as per the schedule specified in the waste management procedure.	Tsagaan Khad- Gashuun sukhait road construction area, during construction phase
25	Prepare workshops and fields (~40m <sup>2</sup> ) for vehicle and equipment repair works and ensure availability of necessary materials such as sand etc; Ensure no maintenance or repair is done in non-designated workshops and fields;	Tsagaan Khad- Gashuun sukhait and Khanbogd-Oyu Tolgoi road construction area, during construction phase
26	During any large or small scale earthworks, such as surface cleaning, leveling, finding borrow-pits, excavating ditches, channels or pits, which is done prior to road construction work, strip the topsoil at an appropriate depth, and temporarily stockpile for further use in reclamation, and rehabilitate work areas or quarries used during road construction work (as specified in the report); strictly prohibit excavation of backfill materials from places other than the designated quarries, carry out soil scarification and biological rehabilitation on the temporary roads created between the construction site and the quarry.	Khanbogd-Oyu Tolgoi-Javkhant bagh road construction area
27	Place signs prohibiting off-road driving and sign boards with messages to conserve the nature, soil and plants. For the construction works along the alignment, determine the width of internal and external roads, place barricades and signs. For road construction works, close old dirt roads and allow traffic on established specific route for transportation. Project implementor to monitor the road construction work performed by the contractor.	Khanbogd-Oyu Tolgoi-Javkhant bagh road construction area

## 1.4.2. Topsoil protection

Table 5. Control measures for topsoil protection in 2017

#	Environmental protection measures	Implementation documentation/ evidence
1	Prior to any land disturbance activities, strip the topsoil at an appropriate depth, and store properly	Pre-disturbance environmental study reports; Approved LDPs;
2	Determine the right topsoil storage area and monitor the stockpile construction (stockpile no taller than 3 meters, and leave 8 meters wide track for every 60 meters)	Approved LDPs; Fauna team reports
3	Keep long term topsoil registration and labeling records	Geo-database; Topsoil registration sheet; Labels/sign boards by the stockpiles
4	Protect stockpiles from wind erosion, and continue with stockpile surface vegetation experiments	Biological rehabilitation performance reports
5	Conduct quality control analysis on topsoil stockpiles	Laboratory test results; Annual environmental protection plan progress reports

6	<p>Monitor topsoil use:</p> <ul style="list-style-type: none"> <li>- prioritize re-use of the topsoil stripped from a particular area for the rehabilitation of that area;</li> <li>- choose the older stockpiles in case of using long-term stockpiles;</li> <li>- monitor and distribute the topsoil at the technical rehabilitation site with thickness determined by the environmental department;</li> <li>- ensure that the amount of topsoil transported from the long-term stockpiles is no more than necessary;</li> </ul>	<p>Topsoil registration sheet Technical rehabilitation performance reports</p>
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### 1.5. Plan for mitigating potential adverse impacts on air quality

Table 6. Plan for mitigating potential adverse impacts on air quality

№	Environmental protection measures	Scope
1	Mitigation of adverse impacts on climate - Record and calculate sources of greenhouse gas emissions	All project locations
2	Mitigation of adverse impacts on climate - Taking into account efficiency and fuel consumption indicators when purchasing new equipment and vehicles.	All vehicles and heavy equipment used at the mine site
3	Mitigation of adverse impacts on climate - Optimize the use of vehicles and make sure to turn off the engine when not running.	Project site
4	Mitigation of adverse impacts on climate – save energy and use efficiently	Project site
5	Mitigation of adverse impacts on climate – minimize waste generation and implement the 3R principle (Reduce, reuse, recycle) for wastes generated	Waste Management Center
6	Mitigation of adverse impacts on climate - Minimize the size of disturbed areas for construction and do post-construction rehabilitation	Construction areas
7	Watering the roads to suppress dust emissions	Project site roads, road to airport, all road that need watering during warm seasons
8	Reduction of dust emission within the project site- Road repairs and maintenance	Project site roads, year-around
9	Reduction of dust emission within the project site - Ensure compliance with speed limit (placing of speed limit signs, monitoring and assessing GPS-data installed in vehicles)	Project site roads, year-around
10	Reduction of dust created by the open pit operations - Suspend stripping, loading and unloading tasks during strong winds;	Open pit area, year-around
11	Water the dry surfaces and temporary roads during the raise and expansion of the TSF dam.	TSF extension construction area
12	Continue using foam dust suppression system to prevent dust emission created by the Concentrator primary crusher and ore storage	Ore storage, primary crusher
13	Use of coal types, suitable for the central heating plant technology, conduct maintenance as and when required, use filters to keep the contaminants emissions at the standard level	Central heating plant
14	Change filters on regular basis and conduct repair and maintenance in the incinerator to prevent air pollution by common pollutant emissions from the incinerator	Waste Management Center incinerator
15	Reduction of air pollutant emissions - Ensure that the vehicles, heavy machinery and equipment undergo a state inspection annually and the toxic fumes emissions are at the permissible level, conduct technical maintenance and repair on regular basis	All vehicles and heavy equipment used at the mine site, year-around
16	Conduct daily inspection to check if fuel tanks and lightning rods are intact, and strictly forbid open fires and sparks are	Gas station and fuel storage
17	To mitigate the unfavourable odor released from WWTP and WMC landfill and sludge area, domestic and food waste shall be transported by a special vehicle with closed cargo area	Waste Management center, Wastewater Treatment Plant
18	Conduct regular maintenance to ensure noise levels of equipment and vehicles do not exceed the level, specified by the manufacturer	Vehicles and equipment at and near the mine site, explosives plant, all facilities along the road



Environmental management plan – 2017

19	Perform blasting during daytime, between 1.30pm-3.30pm as recommended by the national and international standards on airblast and vibration.	Open pit mine and camps
20	Purchase refrigeration and air conditioning systems from a reputable international manufacturer, conduct repair and maintenance on regular basis	Buildings and facilities with refrigeration and air conditioning systems at the project site
21	Conduct technical inspection and maintenance on vehicles, trucks and machinery used for road construction as per the approved schedule on regular basis. Monitor the fuel quality and technical inefficiency	All vehicles and equipment used for road construction
22	Drive only on roads constructed for temporary use and place speed limit signs, inspect and monitor the compliance	Road construction areas, roads
23	During road construction, water the quarry/borrow-pit areas on regular basis	Quarries and borrow-pits
24	Pay vehicles emissions fee in compliance with relevant regulations and rates stated in the law on Air Pollution Fees.	Pay vehicles emissions fee in accordance with their classification
25	Use pebble crushing technology with minimum dust level, and clean concrete dust	Road construction areas
26	Take necessary arrangements to ensure noise levels, created by construction equipment, machinery and vehicles, do not exceed 70 dB	Road construction areas
27	Use special mobile facilities for noise isolation and sound absorption to mitigate noise impacts during construction works in the vicinity of households and communities in the impact zone.	When operating in the vicinity of households and communities/settlement areas
28	Manufacturer or service provider business entities, organizations and citizens, using a stationary air pollution source of a substantial size, shall have an assessment and analysis carried out by a professional organization, and obtain a permit from the soum or district governor.	Stationary air pollution sources
29	Business entities organizations and citizens, who use sources of air pollution, shall pay air pollution fees.	Air pollution sources

## 2. OFFSET PLAN

### 2.1. Biodiversity

Table 7. Offset plan

Environmental protection measures	Scope	Co-implementer	Implementation indicators	Applicable laws, regulations, standards
Nature and wildlife-friendly cashmere project	Nomgon and Bayan-Ovoo soums, Umnugobi aimag	Wildlife conservation society	2017 plan implementation	Decree #A-117 by the Ministry of Environment and Green Development, Resolution #55 by the Umnugobi aimag Citizens' Representative Khural
Project to fight against illegal hunting	Nomgon, Bayan-Ovoo and Khanbogd soums of Umnugobi aimag; Khatanbulag and Khuvsgul soums of Dornogobi aimag	Wildlife conservation society	2017 plan implementation	Agreements and Memorandums of Understanding signed with the authorities of project soums and partner organizations

### 2.2. Additional environmental protection measures

Table 8. Plan for additional environmental protection measures

№	Areas	Type	Scope
1	Ecological awareness raising among general public	Organize "Green" days/fairs on environmental and ecological awareness raising among the public:	Umnugobi aimag
		* National tree planting day	
		* World day to protect migratory birds	
		* World Biodiversity Day	
		* World Day to Combat Desertification	
2	Present biodiversity research and analysis findings and reports to the general public	* World Soil Conservation Day	At the national level, Khanbogd, Manlai and Bayan-Ovoo soums
		Provide information on biodiversity through public media and the local press	
3	Provide support to the Administration of the Small Gobi Strictly Protected Area	Provide the Small Gobi Strictly Protected Area rangers with necessary tools and equipment	within the territory of the Small Gobi Strictly Protected Area

### 3. REHABILITATION PLAN

#### 3.1. Technical rehabilitation plan

Table 9. 2017 Technical rehabilitation areas

#	Area	Size /ha/	Land disturbance permit #
<b>1.</b>	<b>License area</b>	<b>1.22</b>	
1.1	Sand quarry	1.22	None
<b>2.</b>	<b>Outside of the license area</b>	<b>3.50</b>	
2.1	BP-ML05 quarry (Manlai road construction work)	0.98	None
2.2	BP-KB01 quarry (Manlai road construction work)	2.52	LDP-110817
<b>Total area</b>		<b>4.72</b>	

#### 3.2. Biological Rehabilitation Plan

Table 10. Biological Rehabilitation Plan - 2017

Rehabilitation measures	Scope	Detailed scope	Area, hectares	Timeframe, months
<ul style="list-style-type: none"> <li>• Plant seeds by seeder</li> <li>• Plant 2-3 year old saplings and seedlings of <i>Zygophyllum xanthoxylon</i>, <i>Eur.cer</i> nurtured at NPPC</li> </ul>	Quarries, from which pebbles and aggregates were excavated for the construction work of Gunii Khooloi road and camps	BP-PL04	2.97	August – October
		Ger camp B	2.56	May – June
<ul style="list-style-type: none"> <li>• Plant 2-3-year-old saplings of shrubs nurtured at NPPC</li> </ul>	Rehabilitation of boreholes drilled during water exploration	Boreholes – A5, A4, A3, B6, B5, B3, U1, U2; Manlai - B1, B2, B9-12	3.50	August – October
	Sand deposit used for the mine operation	Khaliv sand deposit	2.03	August – October
	Areas outside the license area, where technical rehabilitation carried out	Areas, where technical rehabilitation carried out in 2016-2017	4.74	August – October
Total hectares			<b>15.80</b>	

### 3.2.1. Establishment of green spaces

Table 11. 2017 Plan for establishing green spaces in the license area

Objective	Scope	Area, hectare	Method	Implementation timeframe /Month
Establishment of green spaces in a settlement area	Mine license area	0.5	Plant and nurture 2-3-year-old saplings of trees and shrubs grown at NPPC at Khanbogd soum	15 April - 10 May ; 01 October - 25 October ;
	Neighboring soum centers	1		15 April - 10 May ; 01 October - 25 October ;

## 4. RELOCATION AND COMPENSATION PLAN

Khanbogd soum Governor & herder families and OT LLC signed 10 relocation agreements in 2014 and 89 compensation agreements in 2011 and 2012. It was agreed that the Company would provide livelihood support for the herder families, in ways of building livestock stables, restocking with cattle, boring wells, providing tuition fees for students and school supplies for children, involving the herders in short term training courses and providing part-time employment for specific period. The Company has fulfilled its contractual obligations in a timely manner and at present, is still fulfilling its training related obligations.

## 5. HISTORICAL AND CULTURAL HERITAGE PROTECTION PLAN

Table 12. Historical and Cultural Heritage Protection Plan

Actions	Scope	Measure	Quantity
Induction on cultural heritage	OT	Employees engaged in land disturbance	-
Cultural diversity/ Develop local cultural awareness package	OT	Awareness package	1
Conduct observation and monitoring in cultural and historical heritage sites	near OT site	Heritage sites	19
Develop and implement a plan to protect Bor ovoo	OT	Spring	1
Conduct cultural heritage exploration and rescue actions at new sites subject to land disturbance within OT licensed area	OT	areas subject to land disturbance	-

## 6. CHEMICALS RISK MANAGEMENT PLAN

Table 13. Chemicals risk management plan

Environmental protection measures	Scope	Quantity
avoid chemical waste at practicable potential extent, and make full use of the chemical substances.	OT Mine site	Reservation amount
Substances of incompatible use and storage with each other should not be stored together	OT Mine site	All types of chemicals
Check and ensure that containers are properly sealed and intact during storage, use or transportation of chemical substances.	OT Mine site	-
Water contaminated with chemicals, should not be disposed openly	OT Mine site	-
Avoid placing clothes and cloths contaminated by combustibles and lubricants in an open area, but immediately burn in the waste incinerator.	OT Mine site	-
Every chemical substance is stored, used and transported in accordance with relevant requirements and procedures.	OT Mine site	-
Chemicals and hazardous substances are stored in a special warehouse in conditions specified in MSDS. Storage, use and transportation of chemicals are regularly monitored.	OT Mine site	Reservation amount, total amount of chemicals in stock
Chemical left-overs and waste are disposed in accordance with applicable laws and regulations.	OT Mine site	-
Ensure that chemicals aren't stocked in excess	OT Mine site	-

## 7. WASTE MANAGEMENT PLAN

Table 14. Waste management plan

Environmental protection measures	Scope	Quantity
Reuse all waste metals and plastics from project operations	Waste Management Center	Total amount of accumulated waste
Develop and deliver waste-related reports and data within the established timeframe to the local administration.	Waste Management Center	Total amount of waste generated per quarter, per year
Develop hazardous waste transportation procedure; and transport separately avoiding mix with other types of waste, and store and dispose in a specially designed facility.	Waste generator Departments	Total amount of waste generated per year
Waste generators and authorized individuals, entities and organizations to maintain the waste registry in accordance with the approved form and "Coded list of waste at its source" and deliver the reports within the timeframe established by the procedure to the relevant soum, district Governor or a party, appointed by the Governor.	Waste management employee	Total amount of waste generated per year
OT to cooperate with local recycling companies, and provide recommendations for compliance with OT and international standards.	Water and Waste management Team, Compliance team	Meetings, field work

## 8. THE ANNUAL ENVIRONMENTAL MANAGEMENT PLAN IMPLEMENTATION ARRANGEMENTS F

№	Assessment	Company
1	Detailed environmental impact assessment of the project “Construction of a permanent local airport ” - 2011	“Ecotrade”
2	Detailed environmental impact assessment of the project “Use of Gunii khooloi underground water reserve for OT project”– 2010	To be selected

## 9. ENVIRONMENTAL MONITORING PROGRAM

### 9.1. Water level and quality monitoring

Table 15. Water level monitoring

№	Monitoring indicators	Type and method of monitoring	Location
<b>Proposed Environmental monitoring program at Shivee Tolgoi, Javkhlant, and Oyu Tolgoi mine site</b>			
<b>Water</b>	Water level	Water level, photomonitoring, longest and deepest part of the flow	Total of 72 water monitoring boreholes, and 18 wells, such as New Bor Ovoo, Khukh khad, Maanit, Burkhan spring, Khukh khad spring
	Yield	Yield	Shine Bor Ovoo spring
	Surface flow	Flood flow	4 points along the Undai dry riverbed
	Hygiene	Number of total microorganisms, and thermotolerant coliforms and pathogenic microorganisms in 100 ml	All sources of water being used, kitchen-sink faucets
	Water quality field monitoring	water quality common indicators: pH, temperature, TDS, electrical con	Manual wells and springs
	Chemical and physical properties	pH, TO, TDS, EC, anion, cation, suspended solids, hardness, heavy metal content, As, Ar, Ba, Be, B, Cd, Co, Cu, Cr, Ag, Se, Mo, Mn, Hg, Pb, Zn, Ti	Water points such as New Bor ovoo, Khukh khad, Maanitiin zadgai, Ekhen Burkhan, Khaliv River wells etc. Industrial water supply wells, and industrial wastewater
	Chemical, physical and microbiological properties of effluent	pH, mineralization, electrical conductivity, base anion and cation, suspended solids, hardness, <b>BXX</b> , <b>XXX</b> , Ar, Cd, Cu, Cr, Se, Mn, Hg, Ni, Pb, Zn, number of total microorganism and pathogens	Water Treatment Plant influent and effluent
	Contamination of acid rock drainage	ARD laboratory results from TSF tailings	
		pH, mineralization, electrical conductivity, base anion and cation suspended solids, hardness, heavy metal content, As, Ar, Ba, Be, B, Cd, Co, Cu, Cr, Ag, Se, Mo, Mn, Hg, Pb, Zn, Ti	Monitoring boreholes in the landfill area (wells projected, drilled and equipped)
<b>Water</b>	Chemical and physical properties	pH, mineralization, electrical conductivity, base anion and cation suspended solids, hardness	TSF monitoring boreholes (about 26 boreholes)

№	Monitoring indicators	Type and method of monitoring	Location
		Heavy metal content, As, Ar, Ba, Be, B, Cd, Co, Cu, Cr, Ag, Se, Mo, Mn, Hg, Pb, Zn, Ti	
		Water level	
		water quality common indicators: pH, Mineralization, electrical conductivity, temperature	
<b>Environmental monitoring program for the Gunii Khooloi pipeline operation</b>			
<b>Water</b>	Surface and groundwater	pH, mineralization, electrical conductivity, base anion and cation suspended solids, hardness, heavy metal content, As, Ar, Ba, Be, B, Cd, Co, Cu, Cr, Ag, Se, Mo, Mn, Hg, Pb, Zn, Ti. Perform marking and read readings of springs, temporary streams, and artificial waterpools nearby the water supply pipeline	Water points at Elgen, Khulgar, Munkh-Ovoo, Khairkhan shand, Ulaan tolgoi, Shar Khad, Gurvan shavagtai, Urulbu, Bulan toiom, 10 boreholes in Gunii Khooloi
		Water level	All manual wells
		water quality common indicators: pH, mineralization, electrical conductivity, temperature	4 manual wells of Hevtee bor khudag, Sukhai us, Shavag khudag, Ergiin us; 12 points, including springs and ponds in and near the project area, 8-10 boreholes in Gunii Khooloi
<b>Environmental monitoring program for the Gashuun Sukhait infrastructure construction and operation</b>			
<b>Water</b>	Surface and groundwater	Water level	Bugtur huuvur well, Dugat, Bor khoshuu, Gashuun sukhai, Khavtsal, Bulan ders well
		Water quality field analysis: pH, mineralization, electrical conductivity, temperature	Manual wells and springs
		Common indicators of water quality: pH, temperature, TDS, EC, pH, (CaCO <sub>3</sub> ), Ca, Mg, Na, K, SO <sub>4</sub> , NO <sub>2</sub> , NO <sub>3</sub> , NH <sub>4</sub> , As, Cd, Cu, Hg, Pb, Zn, Cr, Fe, Ni	Monitoring manual wells and wells in operation
<b>Environmental monitoring program for Undai River Protection and Partial Diversion Project</b>			
<b>Water</b>	Manual well, surface flow		Springs and 11 manual wells of herders along Undai River: Khukh Khad, Zurkh zuun salaa, Buurlyn spring, Ehen burkhant, Saglagar sair us, Khulsan well, New Bor-ovoo spring
	Undergroundwater	water quality common indicators: pH, temperature, TDS, EC, pH, (CaCO <sub>3</sub> ), Ca, Mg, Na, K, SO <sub>4</sub> , NO <sub>2</sub> , NO <sub>3</sub> , NH <sub>4</sub> , As, Cd, Cu, Hg, Pb, Zn, Cr, Fe, Ni	Manual wells and 5 monitoring boreholes
	Acid rock drainage	water quality common indicators: pH, temperature, TDS, EC, pH, (CaCO <sub>3</sub> ), Ca, Mg, Na, K, SO <sub>4</sub> , NO <sub>2</sub> , NO <sub>3</sub> , NH <sub>4</sub> , As, Cd, Cu, Hg, Pb, Zn, Cr, Fe, Ni	Urd dalan (Southern dam) water accumulation pond

## 9.2. Air quality monitoring

Table 16. Air quality monitoring

No	Monitoring indicators	Type and method of monitoring	Location
1	Weather	Temperature, wind velocity, direction, relative humidity, air pressure, rain and snow, evaporation, sun ray	Mine site
2	Weather	Wind velocity, direction	Air quality monitoring stations: Monitoring station 1, Monitoring station 2, Monitoring station 3, Monitoring station 4
3	Weather	Temperature, wind velocity, direction, relative humidity, air pressure	Air quality and noise control monitoring points
4	Weather	Soil humidity, evaporation, annual and quarterly average, temperature, precipitation trend	Khanbogd soum meteorological station data
5	Air quality - Dustiness	PM2.5 6a PM10	7 dust monitoring points at and nearby mine site: DMP-LA01, DMP-LA02, DMP-LA03, DMP-LA04, DMP-LA05, DMP-COS01, COS02 (Concentrator ore storage) Additional 16 points until air quality monitoring stations are installed and become operational: DMP-EP01 (Explosives plant), DMP-EP02 (Explosives Magazine), DMP-QrBP (Dugat pebble deposit), DMP-CHP (Central heating plant), DMP-PDS01 (Petrol depot station), DMP-PDS02 (Petrol depot station), DMP-TSF01, TSF02 (Tailings Storage Facility), DMP-WMC (Waste Management Center), DMP-Khaliv, DMP-OP01, OP02 (Open pit), DMP-PAP (Khanbumbat airport), DMP- UNRI01, 02, 03 (Undai riverbed adjustment field)
6	Air quality - Dustiness	<u>TSP (total suspended particulates)</u>	7 dust monitoring points at and nearby mine site: DMP-LA01, DMP-LA02, DMP-LA03, DMP-LA04, DMP-LA05, DMP-COS01, COS02 (Concentrator ore storage) Additional 16 points until air quality monitoring stations are installed and become operational: DMP-PAP (Khanbumbat airport), DMP-QrBP (Dugat pebble quarry), DMP-EP01 (Explosives plant), DMP-EP02 (Explosives Magazine), DMP-TSF01, DMP-TSF02 (Tailings Storage Facility), DMP-PDS01 (Petrol depot station), DMP-PDS02 (Petrol depot station), DMP-DS01 (near Diesel station), DMP-OP01 (Open pit), DMP-CHP (Central heating plant), DMP-WaHo (Main warehouse), DMP-BaPl (Batch plant), DMP-WMC (Waste Management Center), DMP-UnRi (Undai riverbed adjustment field), DMP-ML (Manlai camp)
7	Air quality - Dustiness	PM2.5, PM10 6a TSP (total suspended particulates –Heavy metals (Ag, As, Cu, Se, Hg, Al, Mo, Sb))	Air quality monitoring stations: Monitoring station 1, Monitoring station2, Monitoring station 3, Monitoring station 4
8	Air quality - Dustiness	<u>Heavy metals (Cd, Hg, Sb, As, Pb, Cr, Se, Cu, Ag, Mo, Al)</u>	At 5 points at and nearby mine site until air quality monitoring stations are installed and become operational: DMP-LA01, DMP-LA05, DMP-Manlai camp, DMP-TSF01 (Tailings Storage Facility), DMP-WMC (Waste Management Center)
9	Air quality - Dustiness	PM10, PM2.5	At 1 point - DMP- GHA01 at Gunii Khooloi borefield, near pump station and the road
10	Air quality - Dustiness	PM10, PM2.5	During the construction phase of Khanbogd-Oyu Tolgoi-Javkhant bagh paved road - in 50 meters from the sand and pebble quarry in the direction of the prevailing wind, in 50 meters from the construction site in the direction of the prevailing wind



№	Monitoring indicators	Type and method of monitoring	Location
11	Air quality - Dustiness	TSP, PM10 ба PM2.5	During the construction phase of Tsagaan Khad-Gashuun sukhait paved road - at every 5 kilometers along the temporary road, used for construction work; 3 points in the south east part of the road at 100 meters; one point each at 50 meters from the Batch Plant and the rock crushing facility
12	Air quality - Dustiness	Measurement specified in the methodology	Along the OT-Khanbogd, OT coal road, OT- Manlai roads
13	Air quality - Ambient gas in the air	SO <sub>2</sub> , NO <sub>2</sub> , CO, CO <sub>2</sub>	At 24 points until air quality monitoring stations are installed and become operational: GEMP-LA01, GEMP-LA02, GEMP-LA03, GEMP-LA04, GEMP-LA05, GEMP-PDS01 (Petrol depot station), GEMP-PDS02 (Petrol depot station), GEMP-DS01, GEMP-QrBP (Dugat pebble quarry), GEMP-WWTP (Waste Water Treatment Plant), GEMP-LaFi (Landfill center), GEMP-WaHo (Main warehouse), GEMP-EP01 (Explosives plant), GEMP-EP02 (Explosives Magazine), GEMP-BoBP (Batch plant), GEMP-WMC, GEMP-TWEP (Wastewater pond), GEMP-TSF (Tailings Storage Facility), GEMP-OP01 (near open pit); GEMP-CHP (Central Heating Plant), GEMP-PAP (near Khanbumbat airport), GEMP- UNRI01, 02, 03 (Undai riverbed adjustment field)
14	Air quality - Ambient gas in the air	SO <sub>2</sub> , NO <sub>2</sub> , CO, CO <sub>2</sub>	Air quality monitoring stations: Monitoring station 1, Monitoring station 2, Monitoring station 3, Monitoring station 4
15	Air quality - Pollutants in the exhaust fume	CO, SO <sub>2</sub> , NO <sub>2</sub> , γHC	Steam boilers of the Central Heating Station and Khanbumbat airport and the incinerator of the Waste Management Center
16	Air quality - Ambient gas in the air	NO <sub>x</sub> , SO <sub>2</sub> , CO	During construction phase of Tsagaan Khad to Gashuun Sukhait paved road –3 points 5km apart 100m south east of the temporary road used during the road construction, 1 point each respectively 50m apart along the wind direction around the batch plant and crusher area;
17	Air quality - Ambient gas in the air	Methane (CH <sub>4</sub> )	Gas exhaust pipeline of the landfill area at the Waste Management Centre
18	Air quality - Ambient gas in the air	SO <sub>2</sub> , NO <sub>2</sub> , CO, CO <sub>2</sub>	During the construction phase of Khanbogd-Oyu Tolgoi-Javkhant bagh paved road - in 50 meters from the sand and pebble quarry in the direction of the prevailing wind, in 50 meters from the construction site in the direction of the prevailing wind
19	Noise	Noise levels in outdoor environment	Air quality monitoring stations: Monitoring station 1, Monitoring station2, Monitoring station 3, Monitoring station 4
20	Noise	Noise levels in outdoor environment	Daytime and night-time noise measurement monitored at 4 points around the mine site, 1 point each at Manlai camp (air quality monitoring station 2 will be installed at Manlai camp, therefore when this staion becomes operational, NMP-Mcamp measurement will be discontinued) and Oyut camp: NMP-LA01, NMP-LA02, NMP-LA03, NMP-LA04, NMP-Mcamp, NMP-Ocamp; Daytime noise measurement at 4 points around Khanbumbat airport: NMP-PAP01, PAP02, PAP03, PAP04
21	Noise	Maximum level, minimum level, average level	During construction phase of Tsagaan Khad to Gashuun Sukhait paved road: at 50 zones, where activities with high noise level (such as drilling, blasting, excavation, loading and unloading) are performed. After the road commissioning: one point each at the beginning and the end, also at a point with most frequent stops
22	Noise	Noise level, dB	During the construction phase of Khanbogd-Oyu Tolgoi-Javkhant bagh paved road - in 50 meters from the sand and pebble quarry in the direction of the prevailing wind, in 50 meters from the construction site in the direction of the prevailing wind

№	Monitoring indicators	Type and method of monitoring	Location
23	Vibration	Noise and vibration created by blasting	At 8 points near the Open pit mine, camp, herders' winterquarters and Khanbogd soum: GVMP-0T01, GVMP-0T02, GVMP-0T03, GVMP-0T04, GVMP-0T05, GVMP-0T06, GVMP-0T07, GVMP-0T08 - Results of the assessments, conducted since 2010, show no adverse impacts by OT operation. As such this assessment will be conducted every 3 years.
24	Greenhouse gas - Deposit type and extraction volume	volume of earth materials, by types	Open pit mine, Underground mine
25	Greenhouse gas – explosives volume	explosives, by types	Explosives plant
26	Greenhouse gas - Use of chemicals	Technological process additional chemicals	Chemicals storage/warehouse
27	Greenhouse gas – volume of materials and products transported	transporting the specific material or product (ore, waste lubricant, plastics, scrap metal, other materials)	Storages and warehouses
28	Greenhouse gas - Distance traveled	Average distance traveled and total transportation turnover (air and land)	Means of transportation
29	Greenhouse gas – Fuel use- Diesel	Sort fuel use for non-energy purposes, by equipment type (mobile or stationary) in addition to transportation of product In case of generating power at site, sort fuel use for non-energy purposes, by equipment type (mobile or stationary)	Mobile (Heavy machinery, light vehicles, machines and mechanisms) equipment, fuel storage
30	Greenshouse gas – Fuel use - Petrol	Sort fuel use for non-energy purposes, by equipment type (mobile or stationary) in addition to transportation of product In case of generating power at site, sort fuel use for non-energy purposes, by equipment type (mobile or stationary)	Mobile (Heavy machinery, light vehicles, machines and mechanisms) equipment, fuel storage
31	Greenhouse gas – electricity volume	Monthly volume of electricity purchased from power supplier, by megawatts per hour	Power meters
32	Greenhouse gas – Fuel use – Coal	Amount of fuel used for heating	Central Heating Plant, Coal storage
33	Greenhouse gas - Average content of carbon in coal	info to be collected from the vendors	Coal storage
34	Greenhouse gas – Energy value of coal		Coal storage
35	Greenhouse gas - Amount of waste	Amount of solid (domestic waste, scrap wood & metal, old tyres & parts) and liquid (domestic wastewater, waste oil & lubricants) waste, by type	Waste Management Center
36	Greenhouse gas – Size of land disturbed and degraded (except mine deposit areas)	Determine type and size of new constructions and facilities	New constructions and facilities
37	Greenhouse gas - Size of rehabilitated land	Monitor, record and document under greenhouse gas emission mitigation measures	Rehabilitated areas

### 9.3. Soil quality monitoring

Table 17. Soil quality monitoring

№	Monitoring indicators	Type and method of monitoring	Location
1	Land surface	Changes in the general landscape	Mine license area of 8489.83 hectare
2	Surveillance and monitoring of the open pit mine wall collapse and slide	Current expenditure of an equipment used for monitoring and surveillance of the open pit mine wall collapse and slide; Certification	Open pit
3	Soil quality- Chemical and physical properties	Mechanical composition, rocks, density, humidity, humus content, pH, salinity, NO <sub>3</sub> -N, P <sub>2</sub> O <sub>2</sub> , K <sub>2</sub> O	At 2-4 points in the east and south east sides of TSF, at 1 point at the waste rock dump in the east of the direction of the prevailing wind, 2 points near Concentrator ore storage
4	Soil quality - Heavy metals	B, Cd, Se, CN, F, As, Co, Cr, Cu, Mo, Ni, Pb, SN, Sr, V, Zn	At 2-4 points in the east and south east sides of TSF, at 1 point at the waste rock dump in the east of the direction of the prevailing wind, 2 points near Concentrator ore storage
5	Soil quality - contamination by petroleum products	Volatile organic compounds (oil, oil products)	Gas station and Fuel storage
6	Soil quality - chemical and physical properties	Soil humidity, temperature, salinity, total nitrogen, total phosphorus, pH, humus content, mechanical composition, rock content	At Gunii Khooloi groundwater borefield, 1 point near the pumping station and the road DMP- GHA01
7	Soil quality - Heavy metals	B, Cd, Se, CN, F, As, Co, Cr, Cu, Mo, Ni, Pb, SN, Sr, V, Zn	At Gunii Khooloi groundwater borefield, 1 point near the pumping station and the road DMP- GHA01
8	Soil erosion studies (landscape change research)	Natural and human induced changes	At Gunii Khooloi groundwater borefield
9	Soil quality - chemical and physical properties	Soil humidity, temperature, salinity, total nitrogen, total phosphorus, pH, humus content, mechanical composition, rock content	During construction phase of Tsagaan Khad to Gashuun Sukhait paved road –3 points 5km apart 100m south east of the temporary road used during the road construction, 1 point each respectively 50m apart along the wind direction around the batch plant and crusher area;
10	Soil quaity – Heavy metals	B, Cd, Se, CN, F, As, Co, Cr, Cu, Mo, Ni, Pb, SN, Sr, V, Zn	During construction phase of Tsagaan Khad to Gashuun Sukhait paved road –3 points 5km apart 100m south east of the temporary road used during the road construction, 1 point each respectively 50m apart along the wind direction around the batch plant and crusher area;
11	Soil quality - chemical and physical properties	Soil humidity, temperature, salinity, total nitrogen, total phosphorus, pH, humus content, mechanical composition, rock content	During the construction phase of Khanbogd-Oyu Tolgoi-Javkhlant bagh paved road- for each 4 types of soil along the road
12	Soil quality- Heavy metals	B, Cd, Se, CN, F, As, Co, Cr, Cu, Mo, Ni, Pb, SN, Sr, V, Zn	During the construction phase of Khanbogd-Oyu Tolgoi-Javkhlant bagh paved road- for each 4 types of soil along the road

### 9.4. Flora Monitoring

Table 18. Flora research and monitoring

№	Monitoring indicators	Type and method of monitoring	Location
Flora, rehabilitation	Vegetation monitoring	Flora, vegetation growth, species and crop samples, soil moisture, temperature, pH, salinity, soil stability	32 fields across Khanbogd soum
	To ensure rehabilitation conformity with criteria determined, conduct rehabilitation monitoring to identify further improvement opportunities	The same type of monitoring in the fields, where dry and irrigated rehabilitation was carried out in the previous years	At 4 areas along Gunii Khooloi pipeline, where biological rehabilitation was carried out
		Monitor growth and winter survival of the seedlings planted at the rehabilitated areas in the previous years	Seedlings planted at 4 areas along Gunii Khooloi pipeline
		Monitor small mammals and insects in the areas, rehabilitated in the previous years	Seedlings planted at 4 areas along Gunii Khooloi pipeline
	Monitoring of seedlings, planted for green spaces	Winter survival and growth of trees and shrubs, planted for green spaces in the previous years	Seedlings and trees planted at Khanbogd, Manlai, Bayan-Ovoo, Dalanzadgad and OT site
	Plant phenology	Dynamic, growth and seed yield of the dominant species	Khanbogd soum level
Soil	Top/fertile soil quality monitoring	Fertility, agrochemical properties and mechanical structure of long-term topsoil stockpiles	33 points at 10 long-term topsoil stockpiles and 1 overburden stockpile at the mine site
	Soil quality monitoring	Soil fertility, agrochemical properties and mechanical structure	10 points selected to represent areas where biological rehabilitation have been done earlier or in 2017
	Seed reserve in the soil	Composition and quantity of the seeds in the soil, sprouting and survival	10 stockpiles of long-term topsoil
		Composition and quantity of the seeds in the soil, sprouting and survival	10 rehabilitated areas
Soil ecology research	Determination of soil microbial biomass and composition of the microflora	At 10 points selected to represent areas where biological rehabilitation have been done earlier or in 2017	

## 9.5. Fauna Monitoring

Table 19. Environmental monitoring program on fauna

№	Monitoring indicators	Type and method of monitoring	Location
Fauna	Reptiles	Composition of the species, population density and abundance	at 6 fields near the mine site: FMP-01, FMP-02, FMP-03, FMP-04, FMP-05, FMP-06, and 2 areas along the pipeline: FMP-07, FMP-08
	Birds	Species component, migration timeframe, spread and location of rare birds	At the Tailing storage facility, along the power lines and roads, Gashuun sukhait road, along 220 kW transmission line
	Small rodents	Species component, density and population dynamics	6 areas near the mine site: FMP-01, FMP-02, FMP-03, FMP-04, FMP-05, FMP-06, 2 areas along the pipeline: FMP-07, FMP-08
	Ungulate population at the mine site	Species component, population, location	At the mine site
	Wildlife mortality along the project infrastructure	Impacts on birds such as electrocution, collision with power lines and cars etc	Power lines, buildings, and roads at the mine area, Gunii Khooloi power lines 6 and 35kW, Gashuun Sukhait road, 220kW power line
	Steppe and desert ungulates	Head number, spread and locations of khulan and blacktailed gazelles	Along the project infrastructure lines
	Traffic control		Oyu Tolgoi- Gashuun sukhait paved road
	Collection of data on vegetation index (NDVI) and the snow cover (NDSI)	Vegetation and snow cover index	Umnugobi aimag level
Community-based wildlife monitoring	Head number, spread and location of ungulates, birds and reptiles	Khanbogd soum, some parts of the Small Gobi Strictly Protected Area 'B', south west part of Khatanbulag soum, Dornogobi aimag	

№	Monitoring indicators	Type and method of monitoring	Location
	Research on mortality of wild ass (khulan)	Number of Khulan carcasses, location and determining the reasons	Khanbogd, Bayan-Ovoo, Manlai, Khatanbulag, Khuvsgul, Ulaanbadrakh, Mandakh soums
	Migration and movements of wild ass (khulan)	Migration of satellite transmitter collared khulans, impacts of infrastructure	Umnugobi, Dornogobi aimag
	Nest research and spread of short-toedsnake- eagle	Registration of all dens, and observation of actively-used dens	Within 20 km radius of OT, along the Khanbogd soum array and Undai river swash