Chapter 6 – Alternatives Assessment

Vares Polymetallic Mine ESIA
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6 ALTERNATIVES ASSESSMENT

6.1 Introduction and Approach

This chapter details the feasible alternatives considered to achieve the Project objectives. Project alternatives have been considered throughout the engineering design process, including during the engineering Scoping Study, Pre-Feasibility Study (PFS) and Definitive Feasibility Study (DFS). There has been continuous liaison between the engineers and the ESIA team to ensure an integrated and iterative approach to project design was undertaken.

The chapter outlines how the chosen design is technically and economically feasible whilst simultaneously minimising the environmental and social impacts.

The Vares Project design has been developed by analysing potential alternatives from a technical, economic, environmental, and social perspective. The following project components and activities have been considered in the Alternatives Analysis:

- Mining activities:
    - Mining Operation and Method;
    - Infrastructure layout and land take;
- Crushing Plant location;
- Ore Stockpiling and Processing Activities;
- Management of Waste Rock;
- Management of Tailings;
- Water Supply and Management;
- Haul Route, haulage method, access roads, and transport;
- Power Supply;
- Resource Efficiency; and
- Project employment and accommodation.

The alternatives assessment considers several criteria, primarily options were considered to avoid or minimise impacts to identified sensitive receptors, for both social aspects and environmental. Key alternatives, considered during the design process are outlined below. We have also considered the zero option.

6.2 Alternatives Considered

Several alternatives for the aforementioned activities and project components were considered. These are summarised in Table 6.1 and detailed in the proceeding sections.

Table 6.1: Project Alternatives Assessed	
Project Components	**Approach to Assessing Alternatives**
Location of the mine and associated infrastructure	Minerals, including precious metals, can only be extracted where they occur in specific geological strata and deposits. The deposits of the Vares Project have been assessed as being high-grade polymetallic ore. Since the deposits have been classified as such, there is no alternative site option available for assessment.
Mining Methods	The methods of mining have been informed by the analysis of alternatives and their respective costs, environmental impact and efficiency. Mining methods considered at Rupice were: • Open pit mining; • Underground mining; • Combination of the two.
Crushing plant location	The ideal location for a crushing plant is close to the mined deposit to reduce the haulage distance of ore, and close to the flotation processing plant to once again reduce haul costs. Locations considered: • In the existing crusher building, operational when Veovaca Mine was operational. Located in the village of Tisovci; • Within underground workings at Rupice; and • Above ground and within Rupice surface infrastructure.
Operation and Location of Process Plant	Following locations were considered: • Site of former Veovaca Process Facility; • Located close to Rupice. The concentrate streams were amended across the design of the Project. The three streams considered were zinc, lead-silver and barite.
Management of Waste Rock	Several aspects of waste rock management were assessed: • Disposal of waste rock in permanent dumps; • Use of waste rock in backfill, leading to temporary waste rock stockpile; • Design of stockpile/dump • Classification of waste rock, including development waste, according to geochemistry, and assigning suitable uses accordingly.
Management of Tailings	Multiple tailings management options were considered and assessed based on how appropriate each method would be for the method of deposition, the tailings footprint, environmental impacts, and economic viability. The tailings management options included: • Conventional slurry tailings or dry stack tailings; • Utilisation of historic TSF vs a new purpose built facility; • Locations fora new TSF; • Use of tailings in paste backfill at Rupice; • Layout and footprint of TSF at selected location; • New TSF design and construction;

Table 6.1: Project Alternatives Assessed	
Project Components	**Approach to Assessing Alternatives**
	• Transportation of tailings from VPP to TSF (Piped,trucked or aerial ropeway)
Water Management	Several water supplies have been explored and assessed, namely: • Use of existing municipality supply; • Abstraction from numerous rivers and streams in the region (Borovici, Vruci Potok, Tristionica, Mala River); and • Upgrade to disused municipal pumping station in Buckovica River. The approach to water management was to maximise re-use and minimise fresh water requirements and to avoid as much discharge and run-off of contact waters as possible. Catchment and diversion ditches were designed with this concept in mind.
Haul Route and Operations	Options for transporting ore from different areas of the Project were investigated, whichincluded: • Overhead cable (aerial ropeway); • Conveyor belt transporter; and • Conventional haul trucks on haul routes. Haul and access road routing was considered taking into account the closest social and environmental receptors and land acquisition requirements. Land take was minimised by utilising existing roads.
Power Supply and Resource Efficiency	Options assessed as part of the power supply, include: • Installation of renewable energy (wind, solar); • Power cables to connect Rupice to existing grid – over head or underground. In addition to the above, the following were considered to improve resource efficiency for the Project: • Electric mine vehicles; • Transportation of workers to site; • Building fabrication to minimise heat loss; • Land clearance and tree felling requirements.
Accommodation Camp	The need for and potential locations of accommodation camps was assessed and options assessed included: • Onsite accommodation camp for the workforce; • Workforce lodging in nearby town of Vareš.
Onward Transportation of concentrate from Vares Processing Plant to Port	Options assessed as part of the onward transportation of concentrate include: • Movement by road; or • Transport by rail: o In bulk; or o Containerised.
Mine closure	Several options for closure were considered:

Table 6.1: Project Alternatives Assessed	
Project Components	**Approach to Assessing Alternatives**
	• Complete closure and rehabilitation of all Project aspects at end of mine life; • Partial closure, leaving key infrastructure such as road access, building platforms, key buildings, power and water supply in place if viable future uses can be identified prior to closure; • Progressive closure; • Post-closure land use.

6.3 Zero Option

The zero option was considered and would consist of not developing the Project at all. If this option were chosen it would:

- Maintain existing land use, predominantly forestry;
- Maintain the current state of the biodiversity of the region, including Priority Biodiversity features of Acidophilic spruce forests of hilly to mountainous belt, Alpine Rivers, Mountain Hay Meadows and Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels;
- Maintain Critical Habitat in the Zargarski stream, where breeding yellow bellied toad, (potentially Greek frog), agile frog and green toad have been identified.
- Potential identified negative environmental and social impacts (Chapter 5) would not come to fruition;
- Avoid post closure and legacy issues associated with land use, post closure management and maintenance of land that has been used for extraction and processing of metals.

In contrast, pursuing the zero option would mean that the following is not achieved:

- Economic opportunities that will arise from the Vares Project, including payment of taxes and royalties, direct employment, indirect employment associated with the supply chain and procurement for the project, and indirect opportunities due to anticipated in-migration;
- Opportunity to exploit a nationally important mineral resource with potential economics benefits to the region and country;
- Improvement of local infrastructure and resource management including: roads, energy, waste and water management;
- Capacity building and opportunities for local communities and businesses to develop and improve skills throughout the Project lifetime;
- Site remediation of the highly contaminated brownfield site, to be developed for the Vares Processing Plant.

Overall, the benefits of pursuing the Project outweigh and provide more opportunities than if the Project was not pursued.

6.4 Operational and Layout Alternatives

6.4.1 Mine Design Alternatives

For the development of Rupice, open pit and underground mining were considered. It was also considered to initially develop an open pit for overburden removal before moving to underground operations.

Open-pit mining is usually more suited for deposits located closer to the surface. The ore deposit at Rupice is relatively deep and because of this, the ratio between the overburden removal and ore deposit (strip ratio) would be too high. Underground mining incurs greater capital and operational costs however, the grade at Rupice is high enough to make this method economically feasible. Located on green field forested land, the development of any form of open pit would require a large amount of tree felling, impacting a Priority Biodiversity Feature requiring offsetting and meaning the project would incur greater Greenhouse Gas Emissions. Therefore, the preferred mining method is underground mining.

Underground mining at this location has further benefits, in that backfilling of the mine will be possible, minimising the required footprint for waste and tailings disposal. This will further reduce the visual and landscape impacts, the land take required and provides greater stability to the ground post-mining.

6.4.2 Processing Alternatives

Processing for the Vares Project comprises of a grinding circuit and a flotation circuit with two final products: lead-silver concentrate and a zinc concentrate. For processing, several alternatives have been considered regarding the final product concentrates and the location of the processing facility.

Initially it was planned to produce three saleable concentrates from the Rupice ore; those mentioned above with the addition of a barite concentrate. During the DFS stage it was decided to remove barite as a final product. This decision was predominantly economically driven. Barite has limited end uses and the price significantly dropped whilst engineering studies were ongoing. If this scenario changes, the barite rich tailings disposed of to the TSF could be recovered and sold.

Several locations for the processing plant were considered during the design stages. The assessment for these is provided in Table 6.2.

Table 6.2: Alternative Assessment of Locations for Processing Plant

Alternative Location	Environmental and Social Conditions
Historic Veovaca process plant site	Environmental and Social considerations: • Highly contaminated site due to abandonment of previous operations. Earthworks have potential to lead to emissions of dust, sediment and run off contaminated with heavy metals; • Contaminated soils, water and materials would require appropriate storage and handling during construction works; • Located close to several residential communities. The closest receptors are approximately 35m from the northern boundary of the site and would be impacted by noise, air quality and landscape/visual impacts. • Community concern related to health impacts from the previous operational period. Benefits: • Brownfield site, currently in a derelict state; • Existing utilities (power and water) in place; • Opportunity to clean up the heavily contaminated site; • Reuse of buildings, foundations and concrete pads reducing CAPEX requirements; • Limited land clearance requirements.
Located close to planned Rupice mine, on the western flank of Vrucki Potok Valley	This option has the following environmental and social considerations: • No residential receptors in close proximity with topographic barriers between the site and the nearest communities. This would minimise the requirement for noise, air quality and visual mitigation. • Greenfield site, leading to increased requirement for land clearance, tree felling and top soil removal. • Steep sloped valley meaning limited suitable level areas and increased need for cut and fill. • Selected technically feasible area was located outside of the concession boundary and across the border into neighbouring Kakanj municipality leading to complexities in the permitting requirements. • Increase closure costs and greater land area required for rehabilitation. End use of the site will be limited and full rehabilitation likely.

Through trade off studies, it was decided to place the processing plant at the site of the historic plant from the operation of Veovaca mine. This provides an opportunity to remediate a heavily contaminated site and improve the dilapidated state of the site. This site is logistically easier with good access roads and utilities in place and closer to the main access road for goods being brought in. The site also means that should the project progress to mine Veovaca, infrastructure will be in place nearby.

The overall plant layout has been through multiple iterations. The final design selected has placed the grinding circuit on the eastern side of the site, at the point furthest away from residential properties in Tisovci reducing noise issues and limiting the amount of road haulage required. During early-stage noise modelling it was determined that to meet the regulatory requirements at these receptors it would be necessary to install a noise barrier on the northwest boundary of the site. Shipping containers, an earth bund and a fabricated specialist barrier were assessed as potential options. To minimise visual impacts and land take, a fabricated barrier was selected. To reduce the height of the barrier required, further noise modelling showed that the fabric of the process plant buildings could be improved. This would both improve noise outputs and increase heat retention, thereby reducing heating costs and associated energy and fuel use.

6.4.3 Crushing Plant Location

Three options for crushing plant locations were examined by Adriatic for the PFS and FS. The plant sites were evaluated based on their distance to the underground mine, as well as the environmental and social considerations.

The location of the crusher was a key concern of local residents, identified during consultation for the ESIA. During the previous period of mining the crusher was located in the village of Tisovci, with residential receptors located 35m away. This was the initial option explored, however, it was ruled out due to the predicted noise levels and associated dust from crushing activities in addition to the community concerns.

The second option was to locate the crusher at the VPP site. Noise modelling was undertaken to establish whether predicted emissions would be acceptable. The results of this showed that noise levels would exceed the maximum allowable, no matter the configuration of the site, and significant mitigation in terms of noise barriers, building insulation, and improved glazing in residential properties would be required. Even with these mitigations, it remained uncertain that the noise emissions would be acceptable to local residents or in compliance with regulatory requirements.

The third choice, identified as the preferable option, was to move the crushing plant to Rupice, where receptors are restricted to employees due to the remote setting. FS review and optimisation was undertaken to determine the optimum location at this site where two options were proposed. The initial option included locating the crusher underground with crushed ore hauled or conveyed to surface, prior to stockpiling. The economic implications for placing the crusher underground, combined with the ventilation requirements and dust suppression required meant this option was least favourable. The selected location for the crushing plant is on the northern part of the Rupice infrastructure. From an environmental and social perspective, this location mean it is closer to the underground mine, allowing for more efficient haulage, whilst some earth moving (cut and fill) is required there are minimal receptors as there are no local communities, and decreases risks and impacts to employees. For these reasons, it was deemed the most appropriate location based on proximity to receptors, economics and logistics.

6.4.4 Management of Waste Rock

The production of development waste from adits and waste rock from mining is a necessary consequence of mining. The rock material is unmineralized and requires removal from the underground workings in order to access the ore.
Option for waste rock management included two key options that were evaluated. A permanent waste rock dump, located as close as feasible to the mine access portal, thus minimising transport requirements; and using the waste rock as backfill material during operations, thus reducing the need for a permanent stockpile.

An assessment of the designed waste rock dumps showed that the steep terrain in the region of Rupice meant the dumps as designed were not geotechnically stable. Multiple smaller dumps would have been required to ensure their integrity. Environmentally this would have resulted in greater land take, increased tree felling, potential for sedimentation to enter nearby water courses and the requirement for increased water management (drainage ditches) and treatment of ARD.

The use of waste rock in the backfill plant was investigated and deemed the preferred option based on several parameters:

- Reduction of land take required for waste rock dumps and larger tailings storage facility;
- Reduction in rehabilitation requirements at end of mine life; and
- Increased geotechnical stability, both within the mine, post closure and by not having large waste rock dumps in a steep sided valley.

By utilising waste rock in the backfill process a number of environmental and social benefits are realised. A temporary waste stockpile only is required and a permanent dump is avoided. After year 8 the stockpile will be depleted, and excess material from offsite will be required for backfilling purposes. Whilst some management in terms of water and geochemistry is required for the stockpile, this is significantly less than that required for permanent dumps. The stockpile area covers only 1ha, meaning rehabilitation will be more easily carried out during the operational phase of the mine and ground stability both during operations and post closure is significantly improved, reducing risk to mining personnel and post closure site users.

6.4.5 Management of Tailings

The excess tailings not required for backfill will require disposal in a tailings storage facility (TSF). A number of options were evaluated for the management and location of tailings including conventional slurry tailings vs dry stack, and potential locations including use of the historic tailings facility, a new TSF near the VPP and a new TSF option near to the Rupice mine infrastructure.

The location and positioning of the TSF was determined as part of the DFS design. A siting study was carried out by WAI to determine the most suitable location taking technical, economical, environmental and social aspects into consideration. Four options were considered for the placement of tailings, as per Table 6.3.

Table 6.3: Assessment of TSF Location Options	
TSF Option (Figure 6.1)	**Environmental and Social Considerations**
1. Dry stack in valley south of VPP	Steep sided valley with forested sides holding a small ephemeral stream leading to the Mala River. Any lining system will have to be puncture resistant or self-healing and able to be attached to steep faces as extensive subgrade preparation is unlikely to be achievable. Derelict buildings are present in the valley; these have been assessed for bat presence with none found. Land Acquisition of several parcels is required, none of these are residential dwellings or farmland. With an optimised design this valley could hold the required volume of tailings across the life-of-mine.
2. Historic TSF facility	Located within the concession boundary but owned by the State and developed during the mining of Veovaca open pit. The Mala River is currently culverted below the TSF which would require diversion. The starter embankment of the cross valley TSF and upstream raises are over-steepened and localised instability and seepage has occurred. In addition to this the water level within the facility is very high and the facility would require dewatering prior to the placement of dry stack tailings. Dewatering calculations showed questionable ability to dewater the existing facility to a suitable hydraulic level. Currently the majority of the tailings are stored sub aqueously. The water quality at depth is unknown. The mixing of tailings and the impact from exposing existing tailings to oxygen following pumping is unknown. A stream is located in the western valley, currently flowing into the TSF. Considerable work would be required to construct the western cut off drain and also divert the Mala River culvert from beneath the TSF. The historic TSF could hold the required volume of tailings across the life-of-mine. Impacts to biodiversity would require careful consideration prior to dewatering. It was further evaluated that the geotechnical stability of the historic facility was difficult to ascertain due to the minimal detail available on the construction and operational management under previous operations. Potential environmental and social risks, as well liability for taking on this facility were deemed too high for this to be the take forward option.
3. Western Valley north of VPP	The valley option is narrow, steeply sided and contains dense woodlands. A stream flows down the valley bottom into the historic TSF impoundment area.

Table 6.3: Assessment of TSF Location Options	
TSF Option (Figure 6.1)	**Environmental and Social Considerations**
	Peripheral residential properties (Pržići and Tisovci) overlook this densely wooded valley. The change in landscape would cause a dramatic visual impact to the closest receptors. The capacity of this valley is significantly less that that required for the life-of-mine.
4. Eastern valley, northeast of VPP	Narrow and steeply sided containing a combination of dense woodland and Mountain Hay Meadows Habitat (a Priority Biodiversity Feature that is difficult to offset). The capacity of this valley is significantly less that that required for the life-of-mine.
5. Hybrid, combined use of options 4 and 2.	Same considerations as stated above, though a combined larger land take and potential for greater impact on the Mala River due to two sources of potential pollution being developed.

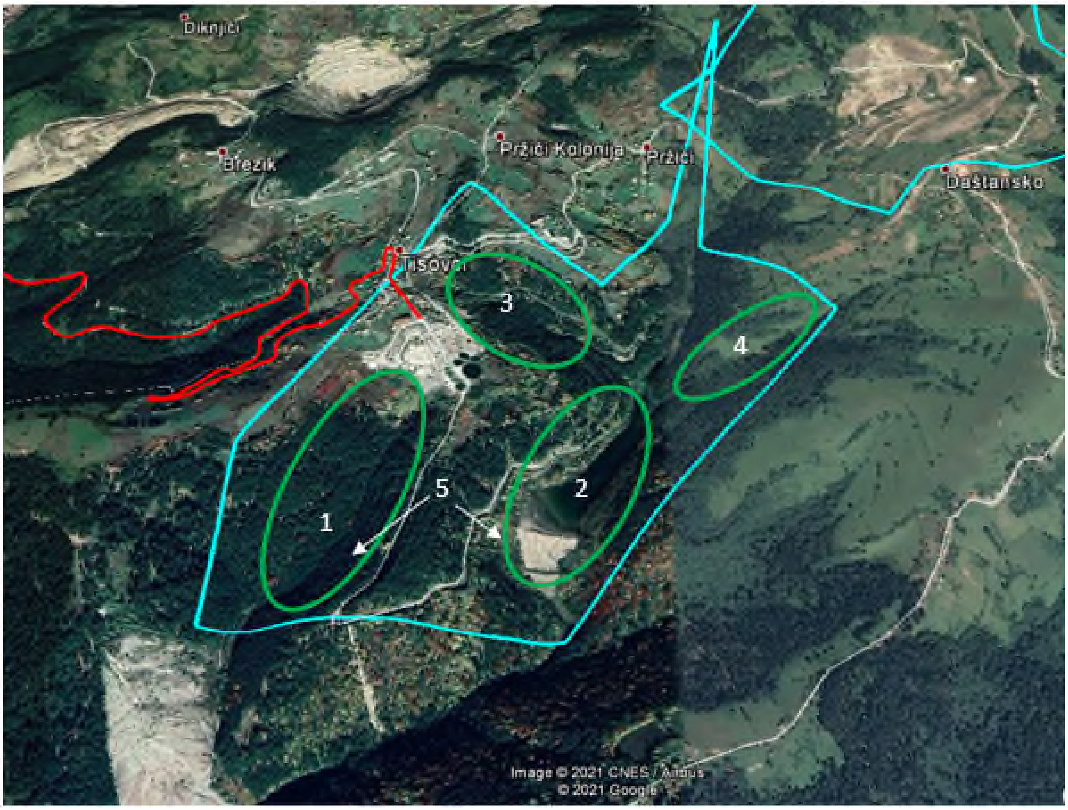

Figure 6.1: Location options for the TSF

Dry stack tailings storage is the most sustainable method used to store filtered tailings, particularly in a hydrologically sensitive area and due to the following environmental and social benefits has been chosen as the preferred option over traditional slurry tailings. Dry stacking tailings facilities do not require a dam, therefore provide an easier and safer construction removing the potential issue of dam failure and long-term storage issues; reduce the requirements for raw water extraction due to recycling water removed from tailings. The dry stacking option also produces a smaller footprint than a traditional slurry tailings dam.

In terms of location, the dry stack valley south of VPP was selected within the TSF optioneering study as the preferred location. This valley has the required capacity for the life-of-mine, has the smallest potential impact on the flora and fauna in the area, has the least water management considerations and is not time dependant on achieving dewatering of the existing tailings.

The footprint and design of the TSF has gone through multiple stages of optimisation. The final optimised design has been selected to minimise the requirement for land acquisition, with a total of six parcels required. The initial design for this area required 10 or 11 parcels of land.

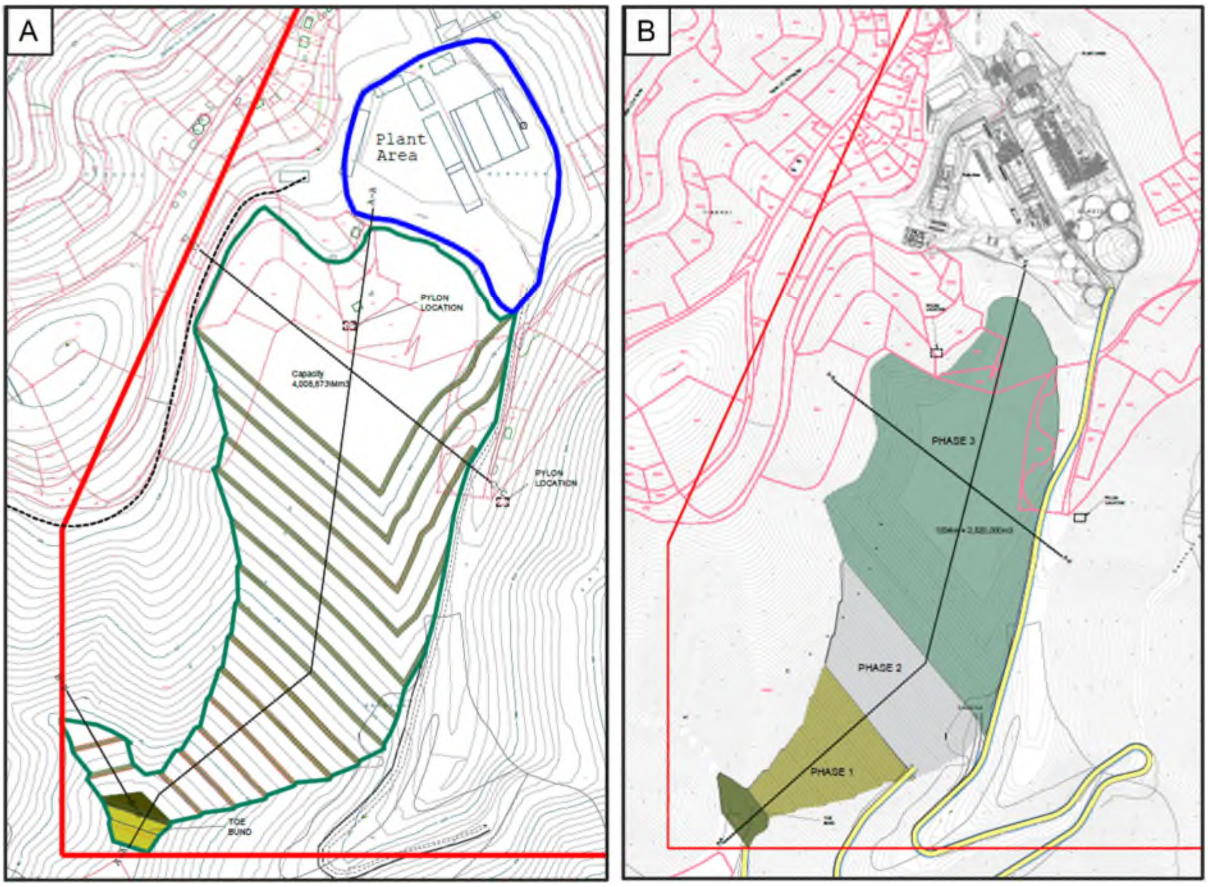

Figure 6.2: TSF Footprint Options. A) Initial Design B) Optimised Design

6.4.6 Water Management Alternatives

6.4.6.1 Water Supply Source Alternatives

A number of water supply source options have been systematically reviewed in order to find the optimum for the project including environmental and community compatibility. Supply options have been chosen based on a programme of water source selection studies undertaken with the owner's team from Adriatic including their environmental and community advisor and other stakeholders (impact assessment and environmental management team) commencing in February 2021. The water supply concept has been developed as follows:

a. 2019: VPP water supply moved downstream from its original intended location near the open pit margin with a smaller dam. This change was made for multiple exploration, blast safety, constraints and environmental factors including there being poorer water quality nearer the existing pit, limitation on liability with structures upstream of the old TSF and poor flow security;

b. February 2021: Opting as far as possible for dedicated supply sources from within the Rupice and VPP concessions. This followed the realisation that the Borovicki stream is fully utilised already by the inhabitants of Donja Borovica and houses populations of IUCN DD and FBiH VU Stone crayfish *Austropotamobius torrentium,* making it a Priority Biodiversity Feature (See Chapter 5.4). Therefore, more focus was given to monitoring and assessment of the Hot Stream supply (Rupice) and downstream Mala river (VPP);

c. End June 2021: Movement of the Rupice supply source further downstream towards the confluence of the Vruci Potok (Hot stream) to assess the viability of the Tristionica river to cature more reliable flow. It was becoming clear that the Hot stream was going to be affected significantly by the abstraction and would also struggle with assimilative capacity;

d. Mid July 2021: Following data on flows and sedimentation confirming that the Hot Stream was not going to be sufficiently reliable, the Rupice water supply concept was switched to a new dedicated source at Bukovica with liaison with JKP on providing water from this as a third party contract source; and

e. End July 2021: Given the sensitivities of the Mala river as a water supply, namely the presence of white clawed crayfish and their sensitivity to water quality changes, a decision was taken to avoid the potential impacts that might derive from using this source and, instead, consider using the current existing water pipeline to VPP, as a third-party contract source.

6.4.7 Haul Route and Operations

6.4.7.1 Operations

Two key options were considered for the haulage of ore from Rupice to Vares Processing Plant: use of trucks on existing and planned roads or use of an aerial cableway system. The factors considered the selection are shown in Table 6.4.

Table 6.4: Alternative Considerations for movement of ore	
Alternative Options	**Environmental and Social Considerations**
Haul Road	Benefits to the haul route development include: • Simple construction method, well established; • Any problems or damage will likely be technically easy to fix; • The road can easily be extended should future phases of the Project require; • Provides improved roads for forestry workers and access to rural communities, during operations and post-mining; • Potential to upgrade to electric mine haulage vehicles; • Lower CAPEX and OPEX required. In contrast, the haul route will lead to the following impacts or be subjected to the following difficulties during construction and operation: • Noise, air quality and visual impact at residential receptors located along the haul route, the closest of which is 7m; • Land take and land acquisition will be required to develop the haul route, resulting in an increased area of Priority Biodiversity Feature (Spruce forest) being permanently destroyed; • Removal of trees will result in increased erosion and potential sedimentation to crossed watercourses; • Need for continued snow clearance and maintenance, especially during winter months to ensure ongoing operation; • Community health and safety risk due to increased potential for road traffic collisions; • Driver fatigue will require management to avoid health and safety risks
Aerial Cableway	Advantages associated with development of aerial cableway include: • Minimises land take; • Minimises potential community health and safety incidents with regard to road traffic accidents; • Reduced risk of occupational health & safety hazards; • Reduces work-load requirements (and overall numbers of jobs) as no, or fewer, haulage contractors required; • Reduces vehicle noise, dust and gaseous/particulate emissions associated with road haulage In contract, adverse impacts associated with the aerial cableway includes: • Potential impacts on birds; • increased use of grid power for operations; • Noise and visual implications associated with the cableway; • Limited capacity; • Operation in high wind must cease; • Regular maintenance and surveys of pillars and cabling requires excessive downtime in operations; and

Table 6.4: Alternative Considerations for movement of ore	
Alternative Options	**Environmental and Social Considerations**
	• Cost prohibitive.
Conveyor Belt Transporter	Environmental and social considerations include: • Route requires large number of transporters for configuration of terrain resulting in a relatively large land take requirement; • Construction of bridges to maintain route direction which may impact on biodiversity aspects, surface water features and land take; • A large number of drive units required which are a source for dust. The whole length of conveyor belt would require covering to protect environment and social receptors from dust; • Belt transporters are sensitive to cold temperatures; • High gride energy consumption and associated emissions; • Degradation to terrain; • Excessive noise levels; and • Cost prohibitive.

It was ultimately decided that a haul road would be developed for the Project. The economic implications of the aerial cableway far outweigh those of the road. The dual use of the road for project, forestry and community purposes mean that the road provides a shared benefit for the local area. The road will be constructed and managed by the municipality providing a long-term benefit to the region, post-mining.

Once the preferred option was identified, optimisation studies to determine the most favourable routing were undertaken. The initial planned haul route traversed from VPP from the northwestern corner of the site, through the village of Tisovci and followed an existing road into Vares. The route passed around the abandoned Smreka Iron Ore Pit and then largely followed existing roads through Položac, Semizova Ponikva, Donja Borovica and Gornja Borovica. From here the road passed through an area of *Nardus stricta* species rich grassland (classified as Critical Habitat under EBRD PR6), then through a forested area into the Rupice Concession. Whilst this road was logistically easy, using predominantly existing roads, several concerns were raised:

- Increased community health and safety risks as a large amount of community members would use the route;
- Noise impacts at residential receptors, located in extreme proximity to the route, in an area that currently has very low ambient noise baseline conditions;
- Air Quality impacts at residential receptors;
- Significant disturbance to the rural way of life for numerous residential receptors;
- Passed within c.250m of known bear denning habitat;
- Road would lead to the destruction of approximately 1ha of critical habitat, with potential to impact on a larger amount due to associated air quality emissions and run off from the road.

A new route was planned to avoid these impacts as far as possible. The selected route traverses southward from VPP, predominantly away from residential properties. A new section of road will be constructed through the forested slopes of the Zagarski river valley, along and adjacent to the Zagarski stream and into Vareš. The road will pass around the Smreka Iron Ore pit, westward to Položac before turning north and routing around and away from residential receptors. The stretch of road from here follows partially along forestry tracks that will require upgrading, before reaching the Rupice site. As shown in Figure 6.3 the road traverses to the north quite significantly prior to entering Rupice. This section of the road has been placed here due to the topography of the region hence to minimise the gradient of the road. This route also utilises existing tracks as far as possible, with approximately a third of this section on forestry roads, thus further minimising impact from land take.

Figure 6.3: Haul Road Routing Options

This routing was selected as there are minimal residential receptors along the route, with 7 sensitive receptors identified within 70m of the road, compared to the previous route where in excess of 50 homes were present. The re-routing of the haul road also enabled the bear denning caves to be avoided at a much greater distance (over 2km), as well as areas of likely Priority Biodiversity Features (PBF) silicate rocky slopes and the PBF Borovički stream. In addition, as the road passes fewer communities there is likely to be less community use of the road, reducing the risk of road traffic accidents and community health and safety impacts.

Whilst the selected route does have a larger land take the impact to critical habitat has been minimised and instead new sections of road required traverse through predominantly Priority Biodiversity Features (PBF), (Acidophilous Spruce Forest, Mountain Hay Meadows and Hydrophilous Tall Herb vegetation). A section of the Zargarski River, where the new route passes, supports annex IV amphibians, making it a critical habitat under EBRD PR6. The BAP outlines the requirements to replace the breeding and sheltering habitat of this stream to achieve a net gain for these species, as well as actions to ensure a no-net-loss to both the Zargarski Stream and aforementioned PBFs.

6.5 Power Supply and Resource Efficiency

A high-level wind power feasibility study was undertaken by WAI for the Vares Project (Appendix 6.1) in 2021. The Rupice valley is sheltered from wind and thus not suitable for turbine development. The ridge above the valley would be considered suitable, however this is an area of critical habitat, *Nardus stricta* species rich grassland, thus the installation of turbines at this location was not taken further. At VPP, two or three turbines could be accommodated across the head of the valley where reasonably high wind speeds are present. Whilst this would effectively offset a proportion of grid electricity generated largely from lignite with low carbon renewable energy, Adriatic Metals have not yet taken this forward. A high-level cost analysis showed that the installation of wind power is economically comparable to current grid-electricity costs for Adriatic. With approximately 4 years for the CAPEX of wind installation to be paid off. This consideration may be taken forward at a later stage in mine life.

Existing infrastructure means that the Vares Project will be able to connect to the existing electricity grid, which has capacity, once some upgrade is undertaken for the life of the Project. This option was selected over diesel generators installed on site. An underground power cable will be installed adjacent to the haul route, connecting Rupice to the existing grid. The underground cable was selected by the grid operator, JP Elektroprivreda BiH, as this avoids the need for tree felling and land clearance.

Several options were implemented or reviewed to improve resource efficiency for the Vares Project, these are summarised in Table 6.5.

Table 6.5: Assessment of Considerations for Resource Efficiency

Consideration	Assessment
Renewable Energy	Both wind and solar have been considered for implementation at the Vares Project. The feasibility of installing wind has only been undertaken at a high level and requires further work to determine the possibility of implementation. A 32.4kWp roof-mounted solar PV array has been included at the VPP admin building. This is expected to save at least 20.6tCO_2e per year.
Electric Mining Fleet	The use of an electric mining fleet was discussed with design engineers. It was determined that at present the technology is not developed to a stage where electric mining equipment can be feasibly used for The Vares Project.
Worker Transportation	To avoid the requirement for employees travelling in private vehicles to Rupice and VPP, a park and ride service will be implemented. Buses will pick employees up in Sarajevo, Zenica, Kakanj and Breza before heading to Vareš. A car park will be provided in Vareš where a 20-seater bus will take workers to the two sites. This avoids the need for employees to own private vehicles or to rely on the minimal public transport services in the

Table 6.5: Assessment of Considerations for Resource Efficiency	
Consideration	**Assessment**
	area. The buses mean fewer journeys to both Rupice and VPP, reducing the associated green house gas emission by an estimated 40.4% CO_2e (see Chapter 5.2). With fewer vehicles on the road due to the park and ride service there is a reduced traffic collision risk as well as less dust, noise and gaseous emissions
Building Fabrication	To minimise noise emissions at VPP, the façade of the proposed processing building should provide a minimum of 39dB Rw. This improved façade will also result reduce heat loss, meaning the heating requirements and thus energy use are lowered at the plant site.
Land Clearance and Tree Felling	As mentioned in previous sections, land clearance and tree felling has been minimised for the Project as far as technically feasible whilst maintainingengineering and safety factors. Several components were considered for construction at Rupice and alternative locations/solutions have been found, reducing land clearance in this area, namely the Processing Plant and Waste Rock Dumps. As some land clearance and felling is required which affects critical habitat, Adriatic are working to meet the offset requirements of EBRD PR6 and will partner with the forestry authorities to improve management practices. These will be designed to enhance biodiversity value over an area of around 100ha of spruce forest to ensure nonet loss and net gain for the Project is achieved.
Water Use	Water abstraction requirements for the Project have been minimised as far as possible through several means: • Vares Processing Plant will operate as a zero-discharge facility i.e. the water balance is net negative. Anti-scalent will be added to process waters when there is ionic build up, negating the need for discharge and additional water supply. • Dry stack tailings have been selected over conventional slurry tailings due to the greater land and water use requirement of slurry tailings. • Use of mine water inflows for drilling rigs, crushers, dust suppression and other consumers. Groundwater will be pumped to water reservoirs within the transport ramp. As the mine develops transport ramps will contain reservoirs with pumps. Mine water will be stored in a header tank along with additional water required from the Bukovica source.

6.6 Employee Accommodation

Based on the expected number of workers for both construction an operations, a new accommodation camp was not considered necessary for the project.

Personnel and Project employees will be accommodated in the local town of Vares rather than in on-site accommodation. This will reduce the Project footprint and infrastructure costs in addition to providing economic opportunities for the local property owners and businesses who will provide the accommodation for the employees. There is currently an abundance of empty properties in Vares, due to the continued out-migration the area has experienced. The Project provides an opportunity to use these premises, whilst reducing the need for additional land take and construction and associated environmental impacts that this brings.

Through refurbishing local properties and encouraging employees to live in Vares, this will have societal benefits as well. Increased indirect economic opportunities are anticipated due to the anticipated in-migration. Further, the local housing and property market may also see economic benefits due to improved conditions and increased demand.

6.7 Onward Transportation of Concentrate to the port

Three options were considered for the onward transportation of ore to port. A summary of these and the associated environmental and social considerations is presented in Table 6.6.

Table 6.6: Assessment of Consideration of Onward Transportation of Concentrate to the Port

Consideration	Assessment
Road	• 300km distance – 36 trucks a day inbound, 36 per day return. Route is heavily congested during holiday periods and can have significant border crossing delays; • Significant levels of interaction with public road users leading to a high risk of road traffic accidents; • Full return loop requires vehicles to be double manned resulting in an increased work force requirements; • Noise and dust whilst transiting through local communities would be anticipated along the route; • High rates of fuel consumption and vehicle emissions, including Greenhouse Gas Emissions; • High risk of unannounced and unmanageable road closures/downtime impacting Project operations and economics; and • Operationally inefficient.
Rail - Bulk	• Limited use of public roads and impact on public road users; • Reduced risk of road traffic collisions; • Reduced labour requirements; • Reduced noise and air quality emissions; • Limited interruption to communities along the route; • More efficient use of labour and resource; • Risk of dust; • Double handling at the Port; and • High initial CAPEX due to lack of State Railway's bulk rolling-stock

Table 6.6: Assessment of Consideration of Onward Transportation of Concentrate to the Port	
Consideration	**Assessment**
Rail - Containerised	• Limited use of public roads and public road users; • Reduced risk of road traffic collisions; • Reduced labour requirements; • Reduced noise and emissions; • Reduced risk of rail downtime; • Limited interruption to communities along the route; • More efficient use of labour and resource; • Ability to customs clear and seal at VPP, reducing border crossing administrative delays; • Sealed and lined containers reduce risk of dust.

The option selected for onward transportation is rail, containerised. This option proves to be economically advantageous whilst reducing environmental and social impact and risk.

6.8 Closure Alternatives

A conceptual mine rehabilitation and closure plan (MRCP) has been developed which allows for a range of alternatives available for the site post closure and contains costings and suggested funding mechanisms for the options. The options described in the conceptual MRCP have been integrated into the mine design and will be further built upon later in the mine life.

The conceptual MRCP details the complete closure and rehabilitation of Rupice. During this process biodiversity specialists have input into the revegetation plan for the area. It is planned to restore the area to native forest through a mixture of planting locally native species and natural regeneration from the surrounding forest. Natural succession will allow a range of vegetation types and communities to develop spatially and temporally in places and planting will help work towards re-establishing PBF forest habitat. It is assumed 75% of the disturbed Project footprint will be planted with native forest species and 25% will be available for natural regeneration/ complimentary habitats such as species rich grassland. This plan will provide greater ecological benefits than planting a single species, or planting the whole area with trees.

The closure of Vares Processing Plant includes the removal of all mining equipment and infrastructure, allowing for the site to be used for light industry. The exact end use has not been fully determined and alternative options will be considered as the mine closure plan is further developed during operations. If no alternative users can be found, the site will be fully reclaimed.