

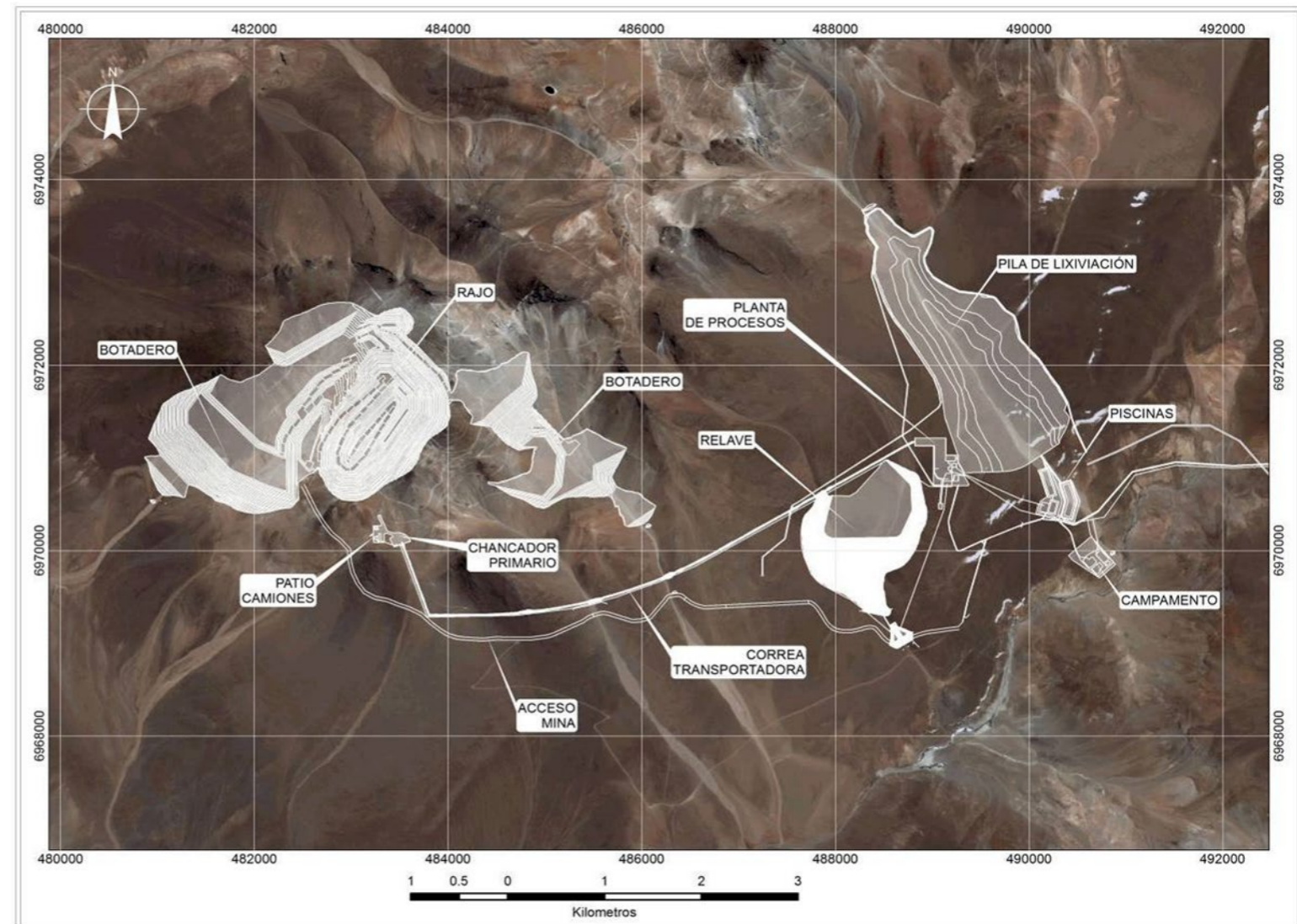


Environmental Design Criteria for Project Engineering

Simon Catchpole, April 2019

An Environmental Risk Model

- In the EA phase, the environmental professionals get a view of the whole project and how it works.
- Need to get from environmental assessment to engineering design, and influence future environmental performance.
- Good performance is only possible with good design.



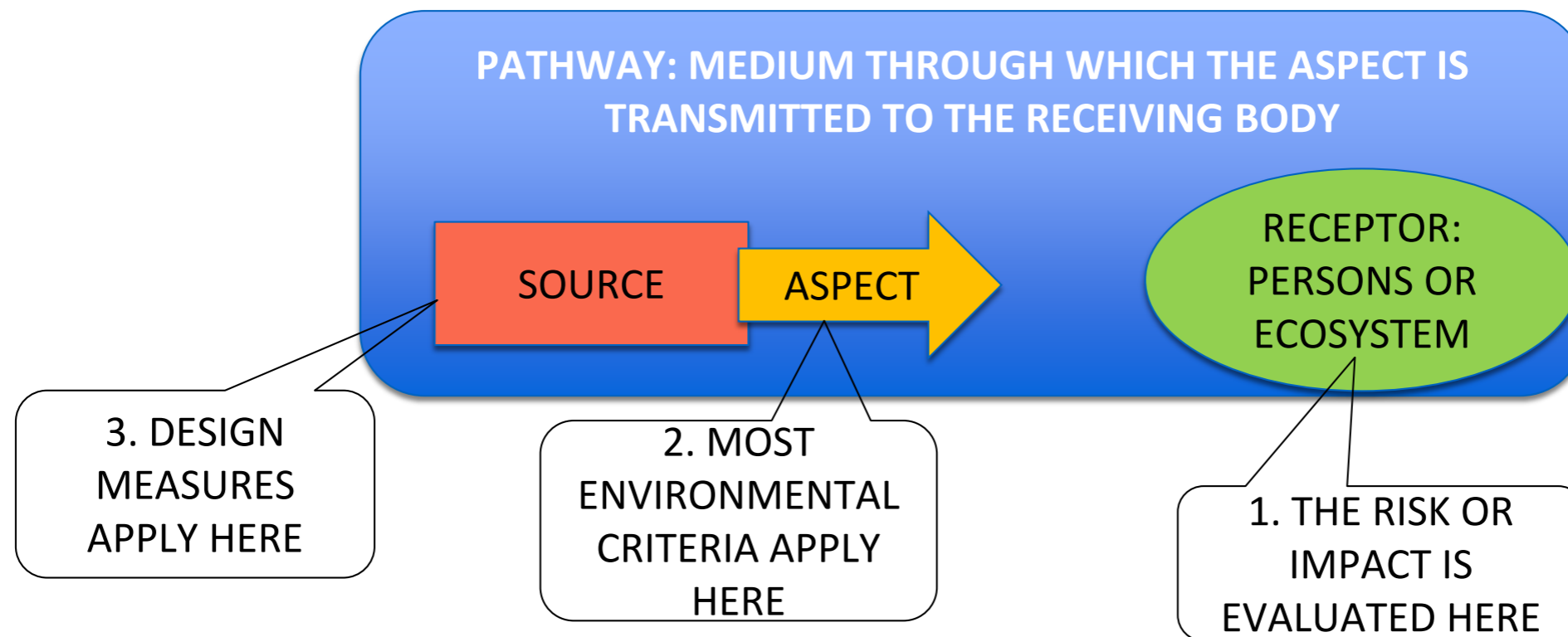
An Environmental Risk Model

- Environment professionals, and most environmental legislation see the project from the perspective of the environmental components (receptors), but designers and engineers see the project from the perspective of the installations and activities.



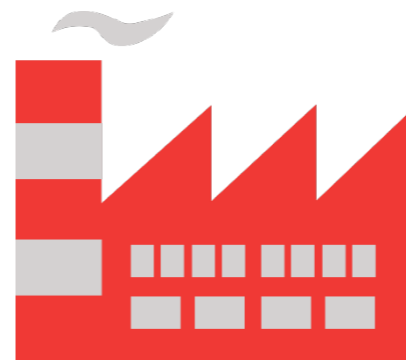
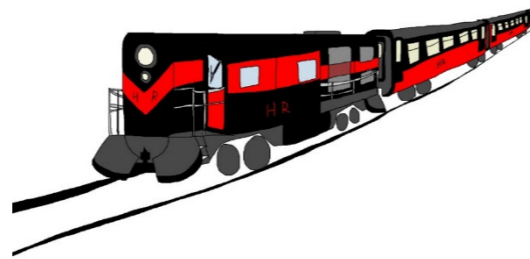
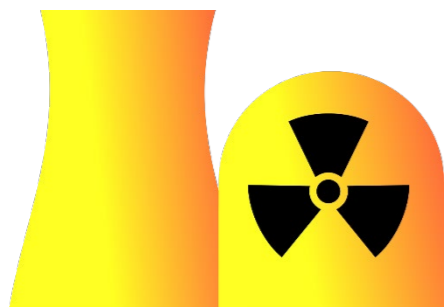
An Environmental Risk Model

- Can use the environmental risk assessment model to illustrate this (source, aspect, pathway, receptor).



An Environmental Risk Model

- Important to filter and focus, according to the type of project and type of environment. So, three steps to EDC:
 1. Use a matrix to relate installations and activities with environmental components through “aspects”.
 2. Classify environmental constraints or performance criteria, based on aspects.
 3. Apply this to the particular project and particular environmental setting.



Environmental Design Criteria in Three Steps

1a. Use a matrix to relate installations and activities with environmental components through “aspects”: firstly - activities to aspects

ASPECT GROUPING		Atmospheric emissions				Liquid effluents			Water Consumption		GW Modifications		SW Modifications
		Sedimentable Dust Emissions	Respirable Dust Emissions	Gas Emissions	Noise Emissions	ARD / ML Generation	Residual Water Generation	Sewage Water Generation	Industrial Water Consumption	Potable Water Consumption	Mine workings cone of depression	GW Drainage & Pumping	Stream Crossings / Drainage Diversions
ASPECT													
ACTIVITY													
Plant	Crushing												
	Grinding												
	Flotation												
	Tailings disposal												
	Water diversions & mgmt												
	Concentrate filtration												
External Infrastructure	Concentrate transport												
	Concentrate export												
	Water supply												
	Energy supply												
	Materials supply												
	Waste Mgmt (ind & dom)												
	Workforce transport												
Camp operation													

Environmental Design Criteria in Three Steps

1b. Use a matrix to relate installations and activities with environmental components through “aspects”: secondly - aspects to components

	ASPECT GROUPING	Atmospheric emissions				Liquid effluents			Water Consumption		GW Modifications		SW Modifications
	ASPECT	Sedimentable Dust Emissions	Respirable Dust Emissions	Gas Emissions	Noise Emissions	ARD / ML Generation	Residual Water Generation	Sewage Water Generation	Industrial Water Consumption	Potable Water Consumption	Mine workings cone of depression	GW Drainage & Pumping	Stream Crossings / Drainage Diversions
MEDIUM	RECEPTOR / COMPONENT												
Geosciences	Surface Ice and Snow Bodies												
	Periglacial Features												
	Landforms												
Air & Water	Air Quality Dust												
	Air Quality Gases												
	GW Hydrology												
	SW Hydrology												
	Water Chemistry												
Terrestrial Biota	Aquatic Biota												
	Soils												
	Flora and Vegetation												
	Wildlife and Habitat												
Marine	Oceanography												
	Marine Biota												

EDC in Three Steps

2. Classify environmental constraints or performance criteria based on aspects. Produce a general table of criteria per aspect. Note where criteria apply to the aspect or the receptor component.

Aspect group	Aspect	IFC Guideline	Aspect regulation	Potentially affected components and their regulatory references					
Liquid effluents	ARD / ML Generation	EHS Guidelines for Mining: Implementation of ARD and ML preventive actions to minimize ARD including: - Limiting exposure of PAG materials by phasing of development and construction, together with covering and/or segregating runoff for treatment - Implementation of water management techniques such as diverting clean runoff away from PAG materials, and segregating “dirty” runoff from PAG materials for subsequent treatment; grading PAG material piles to avoid ponding and infiltration	ARD / ML Generation Ley 20551/2011 Dec 41/2012 - MM	Water chemistry	Aquatic biota NCH.1333	Flora and Vegetation	Agricultural water users NCH.1333 NCH 409	Potable water users NCH.409	
	Residual Water Generation	EHS Guidelines for Mining: - The quality and quantity of mine effluent streams discharged to the environment, including stormwater, leach pad drainage, process effluents, and overall mine works drainage should be managed and treated to meet the applicable effluent discharge guideline values in Section 2.0 - Discharges to surface water should not result in contaminant concentrations in excess of local ambient water quality criteria outside a scientifically established mixing zone.	Residual Water Generation DFL 725/67 - Minsal DS 594/1999 - Minsal DS.90/2000 - MSGP DS.46/2003 - MSGP Dec1/1992 - Directamar DL 2222/1978	Water chemistry	Aquatic biota NCH.1333	Flora and Vegetation	Agricultural water users NCH.1333 NCH 409	Potable water users NCH.409	Marine waters and biota DL 2222/1978
	Sewage Water Generation	EHS Guidelines for Mining: Sanitary wastewater should be managed via reuse or routing into septic or surface treatment as described in the General EHS Guidelines - Environmental Wastewater and Ambient Water Quality: - Segregation of wastewater streams to ensure compatibility with selected treatment option (e.g. septic system which can only accept domestic sewage); - Segregation and pretreatment of oil and grease containing effluents (e.g. use of a grease trap) prior to discharge into sewer systems;	Sewage Water Generation DFL 725/67 - Minsal DS 236/1926 - Minsal	Water chemistry	Aquatic biota NCH.1333	Flora and Vegetation	Agricultural water users NCH.1333 NCH 409	Potable water users NCH.409	

EDC in Three Steps

3. Apply this to the particular project and particular environmental setting.

- a) Arrange by installations and activities, for the engineer.
- b) Hierarchy of criteria is: legislation, international guidelines, locally accepted practice. Need to justify constraints to the designer!
- c) Can apply some criteria from general rules (e.g. emission levels), but others need impact assessment (e.g. environmental quality standards).

EDC in Three Steps

Tabulation of EDC by:

- installation
- aspect
- receptor

Water Interception System - Process Plant					
		Environmental Context, (based on the current understanding of the project)	Vegetated area, some wetlands in stream course. Potential for archaeological sites in valley bottoms. Runoff will be diverted around the process plant and tailings facilities in order to reduce the water balance of these facilities and minimise the risks of their erosion. Runoff will be discharged back into the same basin. Wetlands and aquatic life in the water course may be affected.		
Components		Environmental Design Criteria (EDC)		Source of EDC	Level
Aspect	Residual Water Generation	Contact between natural waters and mineralized rock should be minimized and contact water should be separated from non-contact water, in order to protect the environment from geochemically altered water.		BGC experience with regulatory acceptance of this practice	Practice
		Implementation of water management techniques such as diverting clean runoff away from PAG materials, and segregating "dirty" runoff from PAG materials for subsequent treatment; grading PAG material piles to avoid ponding and infiltration		IFC EHS Guidelines for Mining	Guideline
		Art.13. Closure plan requirements. The closure plan must at least contain the supporting information and documents indicated as follow: e) The set of measures and activities proposed by the mining company to obtain physical and chemical stability of the site where the mining works are located...		Ley 20551/2011	Regulatory
Affected component	Water chemistry	No regulatory specification			
	Aquatic Biota	Use aquatic life standard		NCH 1333	Regulatory
	Flora and Vegetation	No regulatory specification			
	Wildlife Habitat	No regulatory specification			

EDC in Three Steps

Complete table per installation by:
installation / aspect / receptor

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Affected component	Water chemistry	No regulatory specification		
	Aquatic Biota	Use aquatic life standard	NCH 1333	
	Flora and Vegetation	No regulatory specification		
	Wildlife Habitat	No regulatory specification		
Aspect	Maintain to the extent possible, natural drainage paths and restoring them if they are disrupted; - Protecting stream channel stability by limiting in-stream and bank disturbance, and employing appropriate setbacks from riparian zones; - Constructing, maintaining, and reclaiming watercourse crossings that are stable, safe for the intended use, and that minimize erosion, mass wasting and degradation of the channel or lake bed.	IFC EHS Guidelines for Mining	Guideline	
	Maintain, to the extent possible, natural drainage paths and restoring them if they are disrupted; - Maintaining water body catchment areas equal or comparable to pre-development conditions;	IFC EHS Guidelines for Mining	Guideline	
Affected components	GW Hydrology	No regulatory specification		
	SW Hydrology	Art. 49. The obligation to maintain stream beds or works part of a drainage system, is of all those who report benefits from the same, in conformity with what is stated in the following articles: Ecological flow	DFL 1122/1981 DS 14/2012 MMA DS 71/2014 MMA	
	Aquatic biota	Aquatic life use guideline	NCH 1333	
	Flora and Vegetation	Site access routes and facilities in locations that avoid impacts to critical terrestrial habitat, and planning exploration and construction activities to avoid sensitive times of the year,	IFC EHS Guidelines for Mining	Guideline
	Wildlife Habitat	Site access routes and facilities in locations that avoid impacts to critical terrestrial habitat, and planning exploration and construction activities to avoid sensitive times of the year,	IFC EHS Guidelines for Mining	Guideline
	Water users	Water use is subject to the water rights conditions Divert run-off from undisturbed areas around disturbed areas including areas that have been graded, seeded, or planted. Such drainage should be treated for sediment removal; reducing or preventing off-site sediment transport (e.g. use of settlement ponds, silt fences)	DFL 1222/1981	Regulatory
	Aspect	Generation of Erosion	Stormwater drains, ditches, and stream channels should be protected against erosion through a combination of adequate dimensions, slope limitation techniques, and use of rip-rap and lining. Temporary drainage installations should be designed, constructed, and maintained for recurrence periods of at least a 25-year/24-hour event, while permanent drainage installations should be designed for a 100-year/24-hour recurrence period.	IFC EHS Guidelines for Mining IFC EHS Guidelines for Mining
Affected components	Water chemistry	No regulatory specification		
	Soils	Art. 50. If excessive humidification of the soils were due to artificial works, the party or parties affected will have the right to request their modification; this may not damage the owner's works or third parties.	DFL 1122/1981	
	Flora and Vegetation	Site access routes and facilities in locations that avoid impacts to critical terrestrial habitat, and planning exploration and construction activities to avoid sensitive times of the year,	IFC EHS Guidelines for Mining	
	Aquatic biota	Aquatic life use guideline	NCH 1333	
Aspect	Land Occupation	Land occupation of installations should avoid or minimize intervention in sensitive areas, such as: national monuments (including historical, archaeological and paleontological sites), protected areas within the SNASPE system (including national parks and reserves) and indigenous lands.	IFC EHS Guidelines for Mining	
Affected components	Archaeology sites		Ley 17288 de 1970	
	Aspect	Exposure to Geohazards	Minimize exposure to geohazards to ensure the integrity of critical infrastructure.	BGC experience with regulatory acceptance of this practice
			Plan and avoid sensitive areas and implement buffer zones; Conduct activities such that the risk of landslides, debris or mud flows, and bank or alluvial fan destabilization is minimized.	IFC EHS Guidelines for Mining

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Conclusions

- Note that environmental design criteria are not engineering solutions!
- Provide the criteria and the justifications, but let the designer do his work!





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