Infrastructure

Introduction

Infrastructure includes the design, construction, operation and decommissioning of industrial, commercial and residential facilities. These are addressed by this Environmental and Social Risk Briefing (ESRB).

Infrastructure

Infrastructure constitutes the basic physical service systems for society and includes (but is not necessarily limited to) ports, harbours and marinas, dams and reservoirs, railways and goods yards, roads, trams and subways, transfer pipelines, airports and industrial, commercial and residential buildings.

Ports, Harbours and Marinas

Ports, harbours and marinas vary dramatically in scale and purpose from large-scale industrial facilities designed and constructed to handle large volumes of cargo to small scale almost exclusively recreationally focused marinas for leisure boats and tourism activities. Port / harbour / marina facilities include berths, docksides, fuelling points and fuel storage facilities, lifting infrastructure for cargo handling, warehousing and ancillary office buildings. They also typically support a large number of smaller industries / businesses such as workshops, ship repair facilities, passenger terminals and amenities, customs and excise offices and car parks.

Methods for unloading and loading goods and cargo are numerous but the most common are cranes for lifting and moving sealed shipping containers or large-scale chutes, conveyor belts and / or flexible pipes for loading grain or liquid hydrocarbon products directly into the holds of bulk carriers. Specialist equipment is used for at LNG terminal port facilities.

Despite this variety of scales and types of ports, harbours and marinas, the environmental and socio-economic issues are similar when considered in the life-cycle of a development.

The development of a port, harbour or marina necessarily takes place on a coastline or within an estuarine or river environment. As such, they can and often do result in significant alterations to the local / regional waterway environments. Noticeable impacts might include erosion and salt deposition the effects of which may be felt at significant distances from the site depending on currents. Development often requires dredging of channels to accommodate larger vessels. Disposal of dredge spoil can be challenging especially where the port / harbour / marina development occurs in an already industrialised area with contaminated sediments. Impacts on marine and aquatic habitats may be more marked in greenfield developments. Example sensitive habitats include corals and fish spawning areas.

Ports, harbours and marinas can also result in adverse impacts on the terrestrial coastal environment due to the requirement significant support infrastructure such as roads, railways, car parks and support service facilities. Similarly these impacts will be most pronounced in greenfield developments.

From an operational perspective ports / harbours / marinas are high risk areas for fuel and chemical spills especially where bulk cargo handling of hydrocarbon products is the main activity. Spills of these products can have devastating effects on coastal ecosystems. Waste management is also a key issue for operations especially where “international wastes” are received from incoming vessels. Similarly, in-port or near-port disposal / transfer of ballast water may result in the introduction of exotic marine organisms. Application of the International Maritime Organisation standards for ballast water management can go some way to addressing such issues.

From a socio-economic perspective, the development of a port, harbour or marina in a greenfield site may mean the displacement of communities. Existing small-scale fishery port

facilities can be expanded to far larger industrial operations which usually results in the displacement of existing users / businesses. Aberdeen in Scotland is a good example where industrial development for the oil and gas industry displaced users of a former fishing port. Socio-economic displacement will be most pronounced where a port / harbour / marina project is proposed for a greenfield site in a developing country that has limited existing infrastructure. Economic displacement, resettlement and relocation can result in significant upheaval of a community and even breakdown of traditional social structures and cultures. If appropriately understood, planned and managed however, the socio-economic effects can be positive providing employment and drawing industry, trade and / or tourism to an area where opportunities for other economic development may be limited.

Dams and Reservoirs

Dams can be of various scales but are typically constructed for two primary reasons – water storage and supply or generation of electricity (i.e. hydroelectricity). Small-scale dams close to urban residential areas, however, may be constructed for recreational purposes (e.g. water sports/fishing etc.). Dam construction for the management of mine tailings wastes is addressed in the Mining and Metals ESRB.

The capital costs of dam construction are significant, with construction of larger facilities taking many years to complete. Dams can be made from a range of materials, the most common include rock / earth or concrete or a mixture of the two. Dam design must ensure that the structure can withstand the expected magnitude of any possible seismic in a given region. Most water dams' design will include overflow spillway provisions or drainage pipes for managing storm rain events and / or snow melts where relevant.

The construction of dams will often require the flooding of vast areas of land. The total area inundated will depend on the dam catchment size and shape of the valley being flooded. Often, damming and flooding of valleys requires resettlement of communities that may have previously established themselves within dam catchment. This displacement may result in the loss of agricultural and / or other sources of livelihood. Where it occurs in a developing country, economic displacement, resettlement and relocation can result in significant upheaval of a community and even breakdown of traditional social structures and cultures.

The converse effect of flooding valleys is the 'starving' of the downstream river system. A dam / reservoir development should typically include a provision for maintaining a level of flow in the downstream portion of a river system being dammed and this flow should mirror seasonal variations as closely as possible. In reality, however, it is likely that there will be a significant change to the downstream aquatic ecosystem. Spawning cycles of fish (e.g. salmon) may also be disrupted where a dam blocks upstream migration. The significance of any change would need to be assessed on a case-by-case basis as part of the development's planning and permitting.

Whilst capital costs for dams are typically are high, running costs are comparatively low being limited to general inspection and periodic maintenance of the dam wall structure and supporting infrastructure. An exception to this is the management of reservoir siltation. As natural and / or human factors erode soils and sediments within the dam catchment, these are transferred into the reservoir where they gradually build up thereby ever decreasing the storage capacity of the dam. If not appropriately managed, this can reduce storage for water supply or reduce the hydrostatic head for power generation in hydroelectric dams. Management of dams therefore also requires the de-silting of the reservoir. This is most commonly achieved through dredging, which leads to dredge spoil disposal issues.

Infrastructure

From a socio-economic perspective during dam / reservoir operations, the direct positive impacts of the development are likely to be relatively limited as dams / reservoirs are not necessarily large employers. In the case of some hydroelectric schemes however there is an option to directly benefit local communities by supplying them with power, which can be particularly beneficial in developing counties with poor utilities infrastructure and public services in deprived or remote areas.

Airports

Airports typically cover vast areas of land especially where major commercial and international operations are concerned. On average up to 75% of airport land is not occupied by buildings rather this open area comprises runways and taxiways, aircraft hard-stands and intervening grassed areas on the "airside" and on the "landside" includes primarily car parking space. Terminal buildings, hangers, administration, maintenance and servicing facilities (e.g. catering, freight handling) and leased activities for non-airport use (e.g. car hire, hotels, etc.) typically occupy the balance of airport land.

The development of airports can result in significant environmental impacts given the relatively large size of area required. Impacts include habitat loss and potentially dramatic changes to surface hydrological systems. As with most large-scale infrastructure developments, the construction of airports on greenfield sites can generate greater concerns. Greenfield site development in developing countries is likely to result in disruptions to communities and social structures and networks as well as individuals' access to sources of livelihood. Airports can also be major sources of employment and in some cases present an opportunity for economic development in an area.

A large range of operational activities are undertaken at airports including aircraft maintenance (involving the use of a variety of chemicals, fuels and lubricants), cargo storage and transfer; customs and excise facilities, quarantine, hotels, passenger facilities including shops and restaurants and ancillary transport infrastructure (e.g. coach / bus stations, car parks, train stations / monorails, etc).

From an operational perspective the main concern associated with airports is noise. Modern aircraft create significant noise emissions, especially during take-off, and these can result in significant disturbance of nearby receptors. Noise issues are most prominent where an airport is developed in close proximity to residential / commercial areas or where residential developments have 'engulfed' an airport over time. Biodiversity, flora and fauna in the vicinity of an airport can also be adversely affected by noise e.g. through the disturbance of animals or nesting birds. Noise disturbance can be partly managed through control of aircraft flight paths but urban planning also plays a significant role in minimising the likelihood that sensitive receptors are allowed to occupy land in close proximity to an airport.

Other operational issues of concern regarding airports include light spill and traffic congestion. Worker, customer / passenger and community health and safety has always been an issue in regards the potential for aircraft accidents during take-off and landing and the increased likelihood of airports becoming targets for acts of terrorism adds a new dimension to this risk. Fuel / chemical spills are also likely be relatively common events at airports.

Property

For the purposes of this ESRB, property includes light industrial, commercial and residential developments (i.e. buildings). The Oil and Gas, Mining and Metals and Manufacturing ESRB address heavy industrial facilities.

Infrastructure

Property development can occur on greenfield or brownfield sites and can include new builds or the refurbishment and upgrade of existing buildings including the renovation or alteration of exteriors and / or interiors. Typically developments occur either within existing population centres / built environments or relatively close to them although this is not necessarily always the case. Where development occurs close to an existing population centre / built environment and is a greenfield development, it is quite usual for the development site to have previously been used for agricultural purposes. Brownfield developments close to population centres / built environments typically have had some form of industrial historical use and therefore, may present risks associated with existing contamination.

New build property development includes the excavation of ground for building foundations and possibly underground car parking areas. Service utilities (e.g. water supply, sewage, power, etc) are also typically underground components of the development. Following construction of the foundations, the building superstructure / framework is erected before being externally clad and ultimately internally fitted-out. The exact extent of activities undertaken during construction will depend on the type and scale of the development.

New property development on greenfield sites can lead to ecological impacts and the potential for this is assessed through the impact assessment process. As new builds typically occur more often in built environments, environmental issues tend to centre around sustainability of building materials (including ethical sourcing and appropriate waste management), building energy efficiency (in some instances including a requirement for a building to generate ~10% of its own energy), shadowing of neighbouring properties, wind tunnelling and public access including for disabled persons to the building (i.e. available transport infrastructure) and in and around the building (i.e. inclusion of lifts, elevators and ramps). "Green roofs" are also an important consideration as local planning authorities strive to develop micro-ecosystems within the built environment. Other relevant issues include the building design sensitivity to surrounding architecture particularly where the development is to take place in a location with historical / cultural heritage. Visual impacts are of concern including the preservation of "protected views" (e.g. St Paul's Cathedral in London, United Kingdom).

During building construction, the management of transport (i.e. building material delivery and other goods and services) and worker and community health and safety are of importance to ensure health and safety of near by resident or members of the public and minimise disturbances. Accreditations such as the "considerate constructor" have been developed to assist developers and construction contractors meet these environmental and social management objectives.

Building demolition / decommissioning is effectively the reverse of building construction. Much more emphasis is placed however, on management of wastes during this stage of the property life-cycle. Where possible materials should be re-used rather than be sent to landfill.

Building renovation and refurbishment will require extensive health and safety surveying to identify potentially dangerous substances for safe removal and disposal. These may include insulating materials such as asbestos, and other hazardous substances (e.g. PCB transformers), which have been phased out by changes in regulation due to their associated health risks. Similarly contaminated waste/soils or building materials should be safely removed and remediated/destroyed. Removal of hydrocarbon-based substances (e.g. petroleum fuels/oils) for example from old industrial buildings used for fuel storage can present a risk of fire/explosion. Less commonly, in decommissioning and renovation of buildings used in the nuclear power/weapons manufacture industry for

example, removal and destruction/decontamination of concrete (and other porous materials) contaminated with radioactive tritium may pose a serious health risk to those likely to be exposed to it, and must be properly managed.

Pipelines

For the purposes of this ESRB, pipelines are considered to include any type and size of infrastructural pipe, cable or service line lying above or underground. Pipelines associated with the transfer of hydrocarbon products are addressed in the Oil and Gas ESRB.

Constructing pipelines for services such as sewerage and water involves ground excavation, pipe-lay and trench backfilling. In built environments, such activities cause disruption to the amenity of an area and particularly the footpath and road networks and users of such infrastructure. The disturbances are however, generally short lived.

Where more significant pipeline infrastructure is required (e.g. water mains supply from a reservoir; sewage disposal / discharge from a treatment plant) the probability increases that environmental issues will arise such as habitat loss / dissection and impacts at stream / river crossings increases. Similarly, social issues are likely to become more prevalent as the development may entail land acquisition causing permanent disruption to livelihoods and possibly resettlement requirements. Construction of major pipeline infrastructure also likely to necessitate the construction of pumping and metering stations, leading to further land acquisition.

Pipeline operations are relatively benign insofar as they typically only include monitoring and maintenance although as noted in the Oil and Gas ESRB, operation of oil pipelines includes "pigging" to remove build up residues on the inside of the pipeline which inhibit flow through the pipeline. Pigging wastes are hazardous and require careful management. As noted above, larger scale pipelines typically include pumping and metering stations and these are potentially large energy users of energy thereby giving rise to emissions and greenhouse gas (climate change) issues.

Corrosion of pipelines and associated risks of spills or leaks should be managed using preventative technologies in construction measures such cathodic protection. Corrosion occurs due to the passage of electrical currents from the "cathode" (the metal or pipeline, which acts as a conductor) to the soil and the subsequent weakening of the structure. Cathodic protection involves the use of protective sheets or lumps of metals (magnesium or similar) along the pipeline that degrade instead of the pipeline metal itself (usually iron or steel), ("Galvanic Protection") or the use of a power supply to control the voltage differential between the pipeline and the ground ("Impressed Current").

Decommissioning of pipelines is usually accomplished by either totally removing the pipeline or by burying it *in situ*. Decommissioning can result in the generation of significant amounts of potentially hazardous waste.

Linear Transport Infrastructure

Transport infrastructure includes roads and railways, tramways and subways. As linear structures they give rise to similar environmental and social issues as pipelines although also provide their own challenges as outlined in the following sections.

Roads

Road construction typically occurs as an addition to existing networks although new major motorways are often constructed through greenfield areas in order to connect smaller 'isolated' networks. Construction includes the clearing of the right of way, earthworks (i.e. "cutting and filling") to even out pronounced rises and dips in the topography, foundation laying (i.e. deposition

and compaction of substrate), surfacing with either concrete or asphalt, installation of barriers, fences, lighting, traffic monitoring and control systems, signage and road markings. On large-scale road infrastructure projects, there will be a probable need for construction of bridges for stream / river crossing, flyovers or roundabouts for intersections with existing roads and possibly tunnels. Construction of slipways for entry and exit from the main roads may also be necessary.

As noted, road construction gives rise to similar environmental issues as with pipeline construction such as habitat loss / dissection. These issues are best mitigated through careful route selection and considerate construction techniques. Social issues may include compulsory land acquisition potentially leading to loss of income / livelihoods where, for instance, access to agricultural land is lost. Resettlement requirements may also arise.

An issue that is more unique to road construction is the inevitable disruption to existing road infrastructure and existing road users especially where a road is being developed as and enhancement to an existing road network. Disturbances can take the form of traffic jams that add considerably to a road users' travel time. Road construction sites also often represent "black spot" accident zones. Construction activities can also generate considerable amounts of dust and can foul road surfaces further detracting from the safety of other users. Major roads often constitute a visual impact especially where these transect an otherwise undisturbed landscape.

From an operational point of view, roads can contribute to surface water pollution due to the build up and eventual washing-off (during heavy rain) of greases and oils. They can also be major sources of noise and light spill potentially resulting in disturbances to residents that are close to the road development. Noise abatement techniques such as sound barriers and low-level directional lighting can partly mitigate these negative social impacts. Roads also need to be continually monitored for surface integrity so as to minimise the likelihood of hazards developing which compromise road user safety. While not necessarily strictly due to the infrastructure itself, roads also represent a significant risk to human life due to user behaviour (e.g. speeding and reckless driving).

Road decommissioning includes the excavation of the road surface and subsequent ripping of the ground to foster vegetation regrowth. Direct planting may also be undertaken. In urban / built environments, it is fairly uncommon however, to decommission roads rather as the number of car owners and the demand for quick easy access over large distances increases, roads are more typically widened and upgraded. In some instances however, minor roads in rural areas may be closed but more often than not, these are simply left to deteriorate and 'naturally' recolonise with vegetation over time.

Railways, Tramways and Subways

Railways, tramways and subways infrastructure projects typically require narrower linear areas of land than roads but the facilities also require land for stations and rail depots / rail heads.

As with roads, construction of railways can include significant earthworks to create cuttings, embankments, tunnels and bridges. Railway construction also requires aggregate to provide a base for track laying. Stations and other support infrastructure are also required. Typical environmental issues include habitat loss / dissection and land disturbance associated with borrow pits (for sand or gravel extraction). Social issues of land acquisition / loss of livelihood often come into play. Again these are best mitigated through careful route selection.

Railway engineering yards and goods depots range in size and the nature of activities undertaken (i.e. from small maintenance sheds

Infrastructure

to large scale manufacturing sites). Such activities include the use of a wide range of chemicals and other solvents and often historically have resulted in the contamination of soil and groundwater.

Both passengers and freight are transported by rail, so operational processes may include the storage and transfer of cargo as well as passenger activities and services.

Tramway construction commonly occurs in developed urban settings. Corridors of land will be required for the lines stops / stations and tram storage and maintenance depots. Due to the more urban setting, environmental impacts are of typically of lesser concern but significant disruption may be caused to the amenity of areas during construction. Construction of underground subways is likely to require re-routing of services (e.g. pipes, sewers and cables). Construction of stops / stations is likely to result in changes to urban environment similar to those experienced with property / building development.

Operational issues include noise, light spill and power consumption.

Infrastructure

Key Sector Risks and Headline Issues

In **large-scale** infrastructure sector projects some critical issues of particular public concern may result in reputation or credit risk to a lender or an investor, these include:

- Significant loss of natural habitat (on-shore and / or off-shore e.g. marina);
- Significant impacts to cultural property (historical or religious);
- Land acquisition leading to loss of access to source of livelihood;
- Involuntary resettlement requiring relocation of populations and associated compensation;
- Political and litigious issues resulting from environmental and social risks of the project in a transboundary and / or cumulative impact context;
- Security of operations and human rights violations of workers and communities - child labour, terrorism and sabotage, social conflict and unrest;
- Supply chain and revenue transparency / bribery and corruption particularly in developing economies and states with weak governance structures;
- Climate change - long term impact from ozone depletion and global warming from greenhouse gas emissions from energy consumption; and
- Sustainable community development - economic dependency of project affected communities.

With respect to dams and reservoirs, maintenance of structural integrity during natural catastrophic events (e.g. earthquakes) is a key concern from community health and safety perspective.

With respect to **smaller scale** infrastructure projects in urban settings in developed countries, key issues include:

- Building / facility design sustainability; and
- Disruption to other users (road, pedestrian, etc.) during construction

The following tables detail potential environmental and social risks associated with industry processes and appropriate control measures. These may include **Environmental and Social Management Plans** and may form part of a wider **Environmental Social Management System**.

Infrastructure

Environmental Risks

Life Cycle Phase and Activity	Environmental	
	Risks	Controls
Construction		
	♦ **** New Build** ♦ **Habitat depletion, fragmentation and degradation** - excessive land clearance requirements and increased geotechnical / landslip risks mud slides/landslides ♦ **Disruption and pollution to surface water (hydrological) and groundwater (hydrogeological) systems and flows** ♦ **Landscape scarring and visual impact** ♦ **Atmospheric emissions**: - Pollutants (VOC, NOX, SOX, PM10, CO, CO2, etc) vehicle, machinery, plant exhaust emissions - Greenhouse gas production climate change - Dust and noise due to use of heavy machinery and equipment during construction and operation phases ♦ **Employee health and safety** - ventilation, asbestos containing materials, welding fumes, solvents) ♦ **Handling, storage and use of hazardous materials** - (i.e. chemicals, fuels, oils, paints and varnishes) ♦ **Liquid and solid wastes (production and disposal)** - generation of hazardous e.g. asbestos and non-hazardous wastes including wastewater ♦ **Disruption and pollution to surface water (hydrological) and groundwater (hydrogeological) systems and flows** -	♦ **Minimize facility footprint** - appropriate site alternatives assessment and harmonisation of the project design with the natural landscape - erosion, re-vegetation and reforestation ♦ **Emissions management** - use of modern machinery and implementation of appropriate maintenance schedules to ensure operation in accordance with design specifications - Dust, noise and vibration reduction measures leading to compliance with discharge limits - Noise and Vibration Management Plan ♦ **Use of Best Available Techniques Not Entailing Excessive Cost (BATNEEC)** - in emission stack design, development of emissions inventory, implement air quality monitoring and on-site treatment of liquid effluents to meet quality standards prior to discharge ♦ **Hazardous materials storage, handling and use**- implementation of appropriate procedures and protocols for storage, handling and use of hazardous substances ♦ **Waste management plans** - implementation of appropriate waste identification, segregation and disposal protocols and procedures ♦ **Employee management plans** – e.g. Code of Conduct for Workers and Occupational Health and Safety Management

Infrastructure

Life Cycle Phase and Activity	Environmental	
	Risks	**Controls**
	due to spills and / or uncontrolled erosion / sedimentation ♦ **Supply chain sustainability** - construction materials	System (training, monitoring and reporting) ♦ **Emergency response and spill prevention programs** ♦ **Partnering and supporting with host governments -** - Encourage revenue transparency and good governance - Compliance with national / regional / local regulations
Operations		
	♦ **Natural hazards and risks** - natural disasters: earthquakes, tidal waves, floods and fires leading to failure of infrastructure facility ♦ **Handling, storage and use of hazardous materials** - (i.e. chemicals, fuels, oils, paints and varnishes, etc.). ♦ **Atmospheric emissions**: - Pollutants (VOC, NOX, SOX, PM10, CO, CO2, etc) vehicle, machinery, plant exhaust emissions - Greenhouse gas production climate change ♦ **Employee health and safety** - ventilation, asbestos containing materials, welding fumes, solvents ♦ **Handling, storage and use of hazardous materials** - (e.g. chemicals, fuels, oils, paints and varnishes) - hazardous chemicals / fuel spills ♦ **Liquid and Solid wastes (production and disposal)** - generation of hazardous and non-hazardous wastes including wastewater ♦ **Disruption and pollution to surface water (hydrological) and groundwater (hydrogeological) systems and flows** -	♦ **Minimize facility footprint** - continual monitoring of infrastructure integrity with periodic maintenance as required ♦ **Emergency response and spill prevention plan -** -Installation of anti-leak and spill technology such as cathodic protection against corrosion of oil pipelines - Adequate emergency response plans to protect communities and workers against facility failure scenarios **-** Insurance for natural disasters ♦ **Emissions management** - greenhouse gas emissions - climate change offset programmes ♦ **Waste management plans** - waste minimisation, re-use and recycling – appropriate waste disposal techniques

Infrastructure

Life Cycle Phase and Activity	Environmental	
	Risks	**Controls**
	due to spills and / or uncontrolled erosion / sedimentation ♦ **Pipeline corrosion and associated spills/leaks**	
Decommissioning and Closure		
	♦ **Contamination remediation, land rehabilitation** ♦ **Removal and destruction/decontamination/recycling of contaminated wastes and materials** ♦ **Vegetation re-instatement or alternative site development**	♦ **Decommissioning and closure plan** - including contamination remediation ♦ **Waste management plans** - waste minimisation, re-use and recycling – appropriate waste disposal techniques

Infrastructure

Social Risks

Life Cycle Phase and Activity	Social	
	Risks	Controls
Construction		
	♦ **Land acquisition - loss of access -** to economically productive land / water (agricultural lands, forests, fishing grounds) ♦ **Land acquisition – displacement and relocation** - (temporary and / or permanent) - disruption to family / community hierarchy / ♦ **Loss of livelihoods – economic displacement** - job competition, assets ♦ **Disruption of social / community cohesion and exclusion of vulnerable groups** - Breakdown of social networks and structures - Social exclusion of ethnic minorities and indigenous peoples - Socio-cultural tensions between local and foreign workforce from influx and outflow of migrants/ temporary workers and attraction of seasonal residents to project area ♦ **Communicable diseases** – spread of diseases in local populations ♦ **Employee health and safety** - working conditions and poor labour standards, child labour ♦ **Public nuisance** - public complaints, public safety (accidents) and damage to private property or business	♦ **Minimize facility footprint** - appropriate siting of facility and minimisation of footprint ♦ **Resettlement and relocation management** – including development proper compensation schemes, restoration of livelihoods and living standards ♦ **Community/stakeholder relations management** - Management of interface between local communities and outsiders/foreign workers through stakeholder identification and consultation and disclosure (including governmental/national/regional/local stakeholders). - Management of community tensions, grievances and concerns through transparent formal grievance mechanism - Employee skills training in community relations management and cultural awareness - Management of relations with NGOs and national advocacy groups (through consultation and project disclosure) ♦ **Human resource policies** - maximization of local employment ♦ **Social / community baseline assessment** - establish community profiles (e.g. social hierarchy, ethnic groups, socio-cultural and religious practices, skills profile and public services/resources) in the project area, through detailed

Infrastructure

Life Cycle Phase and Activity	Social	
	Risks	Controls
	activities ♦ **Community health and safety** – noise, vibration, dust creation, traffic, emissions and air quality ♦ **Stakeholder / public consultation and disclosure** - negative stakeholder feedback, negative publicity and media coverage (NGOs, local and national advocacy groups) ♦ **Cultural and archaeological heritage** – traditional livelihoods, damage/destruction of cultural/historical/archaeological/religious sites ♦ **Host country governance, human rights violations and revenue transparency** - black market procurement and unregulated trade	social baseline assessments to inform mitigation measures and the development of long term agreed community investment/development ♦ **Community health and safety plans**- vaccinations and awareness raising on communicable diseases ♦ **Supply chain sustainability –** local procurement and supply chain management ♦ **Cultural / archaeological heritage plans** - including site / feature "watching brief" " (continuous visual monitoring) ♦ **Community development and investment (both long and short term)** - e.g. health care facilities, micro-finance initiatives ♦ **Employee health and safety -** Code of Conduct for workers ♦ **Partnering with and supporting host governments** - Encourage revenue transparency and good governance - Compliance with national / regional / local regulations
Operations		
	♦ **Communicable diseases** - spread of diseases from workforce to local communities and visa versa ♦ **Disruption of social / community cohesion and exclusion of vulnerable groups -** - Breakdown of social networks and structures - Social exclusion of ethnic minorities and indigenous peoples - Socio-cultural tensions between local and foreign workforce from influx and outflow of migrants/ temporary	♦ **Community health and safety plans**- vaccinations and awareness raising on communicable diseases ♦ **Human resource policies -** maximization of local employment ♦ **Employee health and safety** ♦ **Supply chain sustainability -** local procurement and supply chain management ♦ **Community/stakeholder relations management -** ensure

Infrastructure

Life Cycle Phase and Activity	Social	
	Risks	Controls
	workers and attraction of seasonal residents to project area ♦ **Employee health and safety** - employment /poor labour standards - child labour and poor working conditions (labour intensive, long working hours, low pay, work by hand) ♦ **Host country governance, national economy and revenue transparency** - sustainable growth and inflation, bribery, corruption and extortion, security around operations, bribery and corruption ♦ **Strain on infrastructure and public nuisance** - infrastructure and social services - capacity to absorb new / foreign populations (supply and demand) (e.g. water resources, power, health, education and housing) ♦ **Site security -** vandalism, acts of terrorism	that appropriate consultation is completed during design process ♦ **Partnering with and supporting host governments -** - Encourage revenue transparency and good governance - Compliance with national / regional / local regulations ♦ **Community development and investment (both long and short term)** - e.g. health care facilities, micro-finance initiatives ♦ **Employee health and safety** - labour / Workplace Policy, standards and codes of conduct for workers ♦ **Site security plans**
Decommissioning and Closure		
	♦ **Host country governance, national economy and revenue transparency** - sustainable growth, inflation and economic dependency of host communities post facility closure	♦ **Community sustainable development planning**

Infrastructure

Facility Specific Environmental Risks

Life Cycle Phase and Activity	Environment	
	Risks	**Controls**
Ports, Harbours and Marinas		
Construction	♦ **Disruption and pollution to local hydrological / oceanographic systems and flows** - resulting in sedimentation and / or erosion ♦ **Habitat depletion, fragmentation and degradation** - loss, dissection and / or degradation of marine and / or coastal habitats ♦ **Impact on terrestrial and aquatic ecology** - impacts on fisheries and fish nursery areas ♦ **Disruption and pollution to local surface (hydrological) systems and flows -** modification to channel depth and cross section – increase in saltwater intrusion to groundwater or surface waters ♦ **Impact on terrestrial and aquatic ecology** - as a result of dredging activities during construction ♦ **Sub-terrain/submarine utilities** - cables and pipelines (fuel and wastewater) ♦ **Use of anti-fouling paints such as Tributyltin (TBT) in ship repair and servicing during construction and operations** ♦ **Solid and liquid wastes (production and disposal)** - dredging sediments, hazardous / non-hazardous waste and construction waste and materials ♦ **Borrow pits, quarries and asphalt and concrete plants**	♦ **Minimize facility footprint** - hydrodynamic modelling at design stage to understand full impacts of project design on marine habitat effects of erosion, re-vegetation and reforestation ♦ **Biodiversity management plan** - damages of dredging ♦ **Water disposal and monitoring systems** - continuous monitoring of water quality while conducting dredging activities ♦ **Emissions management** - ensure chemicals toxins emitted have not been put on global prohibition standards or have been phased out of specific chemicals and toxins (e.g., IMO prohibition of TBT on ships as of the 1st of January, 2008) ♦ **Partnering with and supporting host governments -** - Encourage revenue transparency and good governance - Compliance with national / regional / local regulations ♦ **Batching plant management plans** ♦ **Borrow pit reclamation**

Infrastructure

Life Cycle Phase and Activity	Environment	
	Risks	**Controls**
Operations	♦ **Solid and liquid wastes (production and disposal)** - international ship wastes - (turbidity) during port operations ♦ **Natural hazards and risks** - accidents - port, harbour or nearby waters leading to oil and / or chemical spills and fires	♦ **Waste management plan** - including international (ship) waste management protocols and procedures ♦ **Emergency response and spill prevention plan** **-** Adequate emergency response plans to protect communities and workers against facility failure scenarios **-** Insurance for natural disasters (on-site and off-shore) ♦ **Water management plan** - compliance with IMO requirements for ballast water management, hull fouling and waste management ♦ **Employee health and safety** - prohibition of unsafe / non-seaworthy vessels from port (c.f. double-hull vessels for bulk cargo carriers)
Decommissioning	♦ **See Common Environmental Risks**	♦ **See Common Environmental Controls**
Dams		

Infrastructure

Life Cycle Phase and Activity	Environment	
	Risks	Controls
Construction	♦ **Impact on terrestrial and aquatic ecology** - upstream catchment impacts on ecology / biodiversity as a result of catchment flooding ♦ **Impact on terrestrial and aquatic ecology** - impacts on downstream ecology as a result of reduced water flows ♦ **Biological disease and pestilence** - breeding of vectors of water borne diseases (in particular snails and mosquitoes) ♦ **Habitat depletion, fragmentation and degradation** - geotechnical instability as a result of dam construction	♦ **Minimize facility footprint** - appropriate site selection and design for dam facility ♦ **Habitat protection plans -** - Restoration/rehabilitation and Transport Management - Limit disturbance to vegetation and landforms - Use "thumpers" in preference to explosives - Limit the use of vehicles - airlift equipment to remote greenfield sites if possible - Protect / avoid water resources - Erosion and Sedimentation Management Plan (particularly for high risk areas including geo-technically unstable areas) ♦ **Water management** - use of multiple level outlets in dam design to avoid the discharge of anaerobic water

Infrastructure

Life Cycle Phase and Activity	Environment	
	Risks	**Controls**
Operations	♦ **Odour** - production of noxious gases toxic to aquatic life as a result of (anaerobic) decomposition of inundated vegetation on the bottom of reservoirs ♦ **Liquid wastes (production and disposal)** - catchment based erosion and sedimentation leading to reduced storage capacity / hydrostatic head and impairing flood control capacity of catchment area ♦ **Liquid wastes (production and disposal) -** increased siltation of reservoir leading to dredging requirements including dredge spoil disposal ♦ **Impact on terrestrial and aquatic ecology** - - Due to changes in downstream hydrology - impairment of ecosystems - Loss of control of downstream water flows during flood events (over-topping of dam) leading to downstream ecological impacts and erosion ♦ **Natural hazards and risks** - dam failure due to seismic event	♦ **Habitat protection plans** - Restoration/rehabilitation and Transport Management - Stripping of catchment vegetation prior to flooding – use for stripped material for commercial purposes where possible - Catchment based erosion control plan including addressing any geo-technically unstable areas - Dredge Management Plan including dredge spoil disposal - Replication, as close as possible, of natural downstream river flows including seasonal and / or flooding events - Catchment Flood Management Planning ♦ **Emergency response and spill prevention plan -** adequate emergency response plans to protect communities and workers against facility failure scenarios
Decommissioning	♦ **See Common Environmental Risks**	♦ **See Common Environmental Controls**
Airports		
Construction	♦ **Borrow pits for aggregates / soils** ♦ **Liquid wastes (production and disposal)** - concrete batching plants and associated contaminated water run-	♦ **Borrow pit reclamation plan** ♦ **Batching plant management plan**

Infrastructure

Life Cycle Phase and Activity	Environment	
	Risks	**Controls**
	off	
Operations	♦ **Noise -** significant noise emissions resulting in disturbance of near-by receptors (human and wildlife) ♦ **Pressure on natural resources** - power and fuel consumption: ♦ **Atmospheric emissions -** atmospheric emissions including greenhouse gas ♦ **Community health and safety** - traffic congestion on airport approach roads and within airport "landside" area	♦ **Emissions management** - - Aircraft Noise Abatement and Management Plan including flight path control, noise abatement technologies and continuous monitoring of noise levels to ensure compliance with legal requirements - Greenhouse gas emissions - Energy efficiency policy - minimisation of energy and fuel consumption - carbon / greenhouse gas offset programmes - Air Quality Management Plan - pollution abatement measures and - continuous monitoring of air quality in the project area and neighbouring community to ensure compliance with legal requirements ♦ **Traffic management plan** - traffic route planning and control systems
Decommissioning	♦ **See Common Environmental Risks**	♦ **See Common Environmental Controls**
Property Development		
Construction	♦ **Potential for encountering contaminated land in brownfield developments** - ♦ **Shadowing and wind tunnel effects** - ♦ **Building sustainability issues** - (i.e. energy efficiency, build material sustainability, etc.)	♦ **Rehabilitation and remediation plan** - including disposal ♦ **Minimize facility footprint -** - Shadowing and wind tunnel studies during design - Building sustainability appraisal and ranking (e.g. Building Research Establishment Environmental Assessment Methodology (BREEAM) / EcoHomes)
Operations	♦ **Pressure on natural resources** - power and water	♦ **Minimize facility footprint** - energy efficiency policy – energy savings strategies / carbon neutrality

Infrastructure

Life Cycle Phase and Activity	Environment	
	Risks	Controls
Decommissioning	♦ **Contamination remediation, land rehabilitation**	♦ **Waste management plan** - waste re-use / recycle policy – Waste Management Plan
Pipelines		
Construction	♦ **Liquid waste (production and storage)** - hydrotest water disposal and use of chemical additives	♦ **Hydrotest water management plan**
Operations	♦ **Site security and vandalism**	♦ **Site security plans**
Decommissioning	♦ **See Common Environmental Risks**	♦ **See Common Environmental Controls**
Roads and Railways, Tramways and Subways		
Construction	♦ **Habitat depletion, fragmentation and degradation -** potential for encountering contaminated land in brownfield developments ♦ **Habitat depletion, fragmentation and degradation -** creation of geotechnical hazards (land slip potential) in cuttings	♦ **Rehabilitation and remediation plan** - including disposal ♦ **Minimize facility footprint** - appropriate siting and design of infrastructure – slope stabilisation measures
Operations	♦ **Delays and damages** - incurred during maintenance works	♦ **Traffic management plan**
Decommissioning	♦ **See Common Environmental Risks**	♦ **See Common Environmental Controls**

Facility Specific Social Risks

At the level of assessment afforded by these ESRB, the social issues associated with construction, operation and decommissioning each specific infrastructure project type are considered to be quite common as presented in the "Common Social Risks" table above. For this reason, "Facility Specific Social Risks" tables are not deemed warranted.

Infrastructure

Key Considerations

Pipelines

1. Does the process require authorisation, and if so has this been obtained?
2. Is the business in compliance with authorisation requirements and other environmental, planning and health and safety regulations?
3. Are there any outstanding legal actions or prosecutions relating to the plant, including problems of public nuisance such as odour, which may become a liability?
4. Has a detailed study (e.g. EIA) been commissioned to assess the environmental impacts in respect of the pipeline?
5. Has the chosen route for the pipeline taken into account the environmental impact of both construction and operation?
6. Has the level of public consultation undertaken been considered as adequate?
7. Where possible, is the ROW being minimised and is land damaged during construction being reclamated (i.e. the replanting of trees etc.)?
8. How potentially hazardous are the products being transported?
9. What leak/spill monitoring and preventative measures are in place?
10. How are waste materials treated and disposed of? For hydrotest effluent, are biodegradable chemical additives used where possible?
11. For an existing pipeline operation, are all necessary environmental authorisations and permits held and is the operation in full compliance with their requirements?
12. Are there any outstanding legal actions or prosecutions relating to the construction and operation of the pipeline that may become a liability?

Dams and Reservoirs

1. Do the governments wanting to become involved in dam projects believe that private sources of funding will involve fewer environmental constraints or conditions than those imposed by the international development agencies – such as the World Bank or IFC?
2. Are you under the assumption that limiting involvement to funding contractors / suppliers to a dam project (rather than the project itself) insulates you from the risk of adverse publicity linking the bank directly to a controversial project?
3. Have you considered the potential for the reservoir to increase the chances of seismic events?

Ports, Harbours and Marinas

1. Is the type of cargo handled and stored on-site potentially hazardous or contaminating?
2. What support sites exist within the port (e.g. refuelling, waste management, storage yards, workshops, maintenance facilities etc.)?
3. Are fuels, oils, paints, solvents or chemicals used by these activities stored appropriately?
4. Where possible, these should be stored in a covered, bunded area to prevent any spilled materials from entering the soil or surface water drains?

Infrastructure

5. Does the company hold all necessary environmental authorisations and permits?
6. How long has the site been operating? (Generally, the longer the company has been located on the premises, the more likely it is that the site is contaminated).
7. Has any landfilling ever taken place on the port site?
8. Have there been (or are there pending) any legal actions or prosecutions relating to the port's activities that may give rise to a liability?
9. Are there any changes in legislation expected that may affect the port operationally or financially (e.g. the need to increase or introduce waste management treatment facilities as a result of international agreements to reduce the dumping of waste at sea)?
10. Is any ship repair or servicing undertaken on the site? If so, what are the antifoulant agents used to treat ships? If TBT is used, are companies involved aware of its phase-out and have replacement substances been identified and costed?
11. What emergency contingency plans has the port in place to deal with oil or chemical spills within the harbour and surrounding area?

Railways, Tramways and Subways

1. How long has the site been used for this purpose? The risk of contamination may increase with time.
2. Is the site built on previously infilled ground or has any on-site waste disposal of potentially contaminated material ever taken place (e.g. contaminated ballast, clinker, ash, or herbicide residues etc.)? How are waste products treated and disposed of in general?
3. Has timber ever been treated on the site?
4. Are there, or have there ever been, liquid chemicals, solvents, paints, fuels or oils stored on-site? If so, were they stored appropriately? Where possible, these should be stored in a covered, bunded* area to prevent spilled materials from entering the soil or surface water drains.
5. A bund is an impermeable wall and base, which surrounds above ground storage tanks to a size, which should contain a volume not less than 110% of the tank's capacity.
6. Is there, or has there ever been, a maintenance depot or engineering works on-site?
7. Does the operation hold all necessary environmental authorisations and permits and is the operation in full compliance with their requirements?
8. Has the company been prosecuted or served with any warnings for environmental offences, including problems of public nuisance such as noise? Are there any outstanding prosecutions against the site?
9. Does the company face any significant capital expenditure to replace electrical equipment containing PCBs or from having to remove asbestos from buildings or on-site "dumps"?
10. What types of herbicides are used along the trackside and how is herbicide use controlled and monitored? Does the company face any significant capital expenditure to replace current herbicides with more environmentally friendly products?
11. What procedures and/or resources exist to manage environmental risks (e.g. an environmental management system or personnel with specific responsibility for risk mitigation)? Are these procedures considered to be adequate/robust?
12. Does the company face any significant expenditure to meet conditions attached to process authorisations or permits (both current and pending)? In particular, is appropriate pollution abatement plant fitted to control atmospheric and liquid emissions?

Infrastructure

Airports

1. What procedures/resources exist to manage environmental risks (e.g. an environmental management system or personnel with specific responsibility for risk mitigation)? Are these procedures (particularly covering air quality, noise pollution and fuel storage) considered adequate/robust?
2. Does the airport hold all necessary environmental authorisations and permits and is the operation in full compliance with their requirements?
3. Has the airport been prosecuted or served with any warnings for environmental offences, including problems with noise? Are there any outstanding prosecutions against the site?
4. Does the operating company face significant expenditure to meet conditions attached to environmental permits (both current and pending)? In particular, is appropriate pollution abatement plant fitted to control noise, atmospheric and liquid emissions?
5. What chemicals, solvents, paints, fuels or oils are stored on-site and in what quantities? Are they stored appropriately? Where possible, these should be stored in covered, bunded* areas to prevent any spilled materials from entering the soil or surface water drains.
6. How does the airport deal with nearby local communities?
7. Are there any plans to expand the airport to accommodate future air traffic growth?
8. Is the airport subject to environmental campaigning or public protest – if so why?
9. Does the company produce a Corporate Environmental Report setting out its impact on the environment and what steps are being taken to mitigate these impacts. If not, is one planned?

Property

1. Is the developer aware of any past industrial uses carried out on the site, and is there a potential for contamination or other environmental problems?
2. Has the construction/development got planning consent from the appropriate body?
3. Is the developer aware of any conditions attached to the planning consent, which relate to environmental matters?
4. Are measures being taken to reduce the impact of the construction/development on the environment? Discharge of sediments to watercourse should be prevented or controlled; noise and dust mitigation measures should be in place.
5. Are fuels, oils and other chemicals used on site stored appropriately?
6. What is the nature of the proposed development? A proposed sensitive end use (e.g. for residential housing) is likely to require remediation work involving additional costs.
7. If contamination is an issue, has the customer identified the work required to remediate the site? What is the cost of the remedial work?
8. Have the regulatory authorities agreed the proposals for remedial work?
9. What controls/checks the customer has put in place to ensure that remedial work will carry out has been completed correctly?
10. Is the development located next to features that may blight the value of the property and have these been factored into the valuation?
11. Has an Environmental Impact Assessment been commissioned to assess the environmental impacts of any proposed construction/development?

Infrastructure

Regulation and Best Practice

Permits, consents and licences are likely to be required for infrastructure developments the specifics of which will depend on the relevant regulatory framework in the location of the operation/facility. In developing regions, weaker governance structures may mean that there is less stringent implementation of local controls and regulations or indeed there may be no controls at all. In such cases the project proponent should ideally adopt international environmental and social standards and industry best practice.

In the case of almost all large-scale new build, expansion and development projects an Environmental and Social Impact Assessment (ESIA) will be required particularly where project debt financing is being sought. A comprehensive ESIA undertaken to international standards allows both the project sponsor and the investors to assess the full range of potential environmental and social impacts related to a project development, operation and decommissioning. Part of the ESIA process is to design appropriate mitigation measures and to set a framework for the monitoring the performance of these measures on a long-term basis. This limits and controls compliance and remediation costs as well as long term credit and reputation risks.

For smaller scale projects and operations a full ESIA may not be required. Focused studies on particular issues of concern may however, be helpful in identifying potential environmental and social risks associated with certain project activities.

The table below lists key international standards and publicly available best practice reference materials relevant to the infrastructure sector.

Infrastructure

Source	Agency / Body
International	International Finance Corporation – Performance Standards http://www.ifc.org/ifcext/enviro.nsf/Content/PerformanceStandards International Finance Corporation – Environmental, Health and Safety Guidelines http://www.ifc.org/ifcext/enviro.nsf/Content/EnvironmentalGuidelines World Bank Pollution Prevention and Abatement Handbook, 1998 http://lnweb18.worldbank.org/ESSD/envext.nsf/51ByDocName/PollutionPreventionandAbatementHandbook The Equator Principles http://www.equator-principles.com/principles.shtml UN Rio Convention on the Environment http://www.un.org/documents/ga/conf151/aconf15126-1annex1.htm UN Convention on Biological Diversity http://www.biodiv.org/convention/default.shtml The Habitat Agenda and the Istanbul Declaration on Human Settlements http://www.unhabitat.org/ Convention on International Trade in Endangered Species of Wild Fauna and Flora http://www.cites.org/ UNESCO Convention Concerning the Protection of the World Cultural and Natural Heritage http://www.unesco.org/whc/world_he.htm ILO – International Labour Standards http://www.ilo.org/public/english/standards/index.htm Aarhaus Convention – Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters http://www.unece.org/env/pp/ Convention on Transboundary Effects of Industrial Accidents http://www.unece.org/env/teia/welcome.htm Espoo Convention – Environmental Impact Assessment in a Transboundary Context http://www.unece.org/env/eia/ EU Policies: Integrated Pollution prevention and control. http://europa.eu/scadplus/leg/en/lvb/l28045.htm EU Water Framework Directive Lessons Learned with regard to Water Pollution http://ec.europa.eu/environment/water/water-framework/pdf/gwd_economic_study.pdf Summary of EU Legislation regarding Water Pollution http://europa.eu/scadplus/leg/en/s15005.htm Summary of EU Legislation regarding Air Pollution http://europa.eu/scadplus/leg/en/s15004.htm World Commission on Dams http://www.irn.org/wcd/

Infrastructure

Government	Environment Agency UK Monitoring Guidance notes for emission levels http://www.environment-agency.gov.uk/business/444217/444661/444671/466158/monitoring/?version=1&lang=_e Key areas to be consulted in with regards to Land Use http://www.environment-agency.gov.uk/yourenv/consultations/782294/?version=1&lang=_e Environment Agency UK Waste Disposal Legislation http://www.environment-agency.gov.uk/subjects/waste/1032477/800036/?version=1&lang=_e Health and Safety Executive Noise Regulations (complete) http://www.hse.gov.uk/noise/regulations.htm Health and Safety Executive Guidance for Employers for the Control of Noise at Work Regulations 2005 http://www.hse.gov.uk/pubns/indg362.pdf Air Quality Criteria for Particulate Matter - Environmental Protection Agency United States Government http://cfpub2.epa.gov/ncea/cfm/recordisplay.cfm?deid=87903] Highways Agency British Government http://www.highways.gov.uk/ Department of Trade and Industry Information about Oil and Gas Offshore Pipelines http://www.og.dti.gov.uk/information/bb_updates/appendices/Appendix14.htm
Industry Association	British Ports Association http://www.britishports.org.uk/public/uk_ports_industry International Airports Association http://www.airport-int.com/categories/foreword-by-aci-airports-council-international/voice-of-the-worlds-airports.asp Airports Council International http://www.airports.org/cda/aci/display/main/aci_content.jsp?zn=aci&cp=1-2^4382_9_2__ International Association of Ports and Harbours http://www.iaphworldports.org/ World Pipelines Association http://www.worldpipelines.com/Pipelines/WP_home.htm Regulate Online Dam related Hazard Warning System http://www.regulateonline.org/content/view/609/31/