

SAFEGUARDS AND SUSTAINABILITY SERIES

Volume 2, Issue 1, December 2015

Integrated Safeguards System

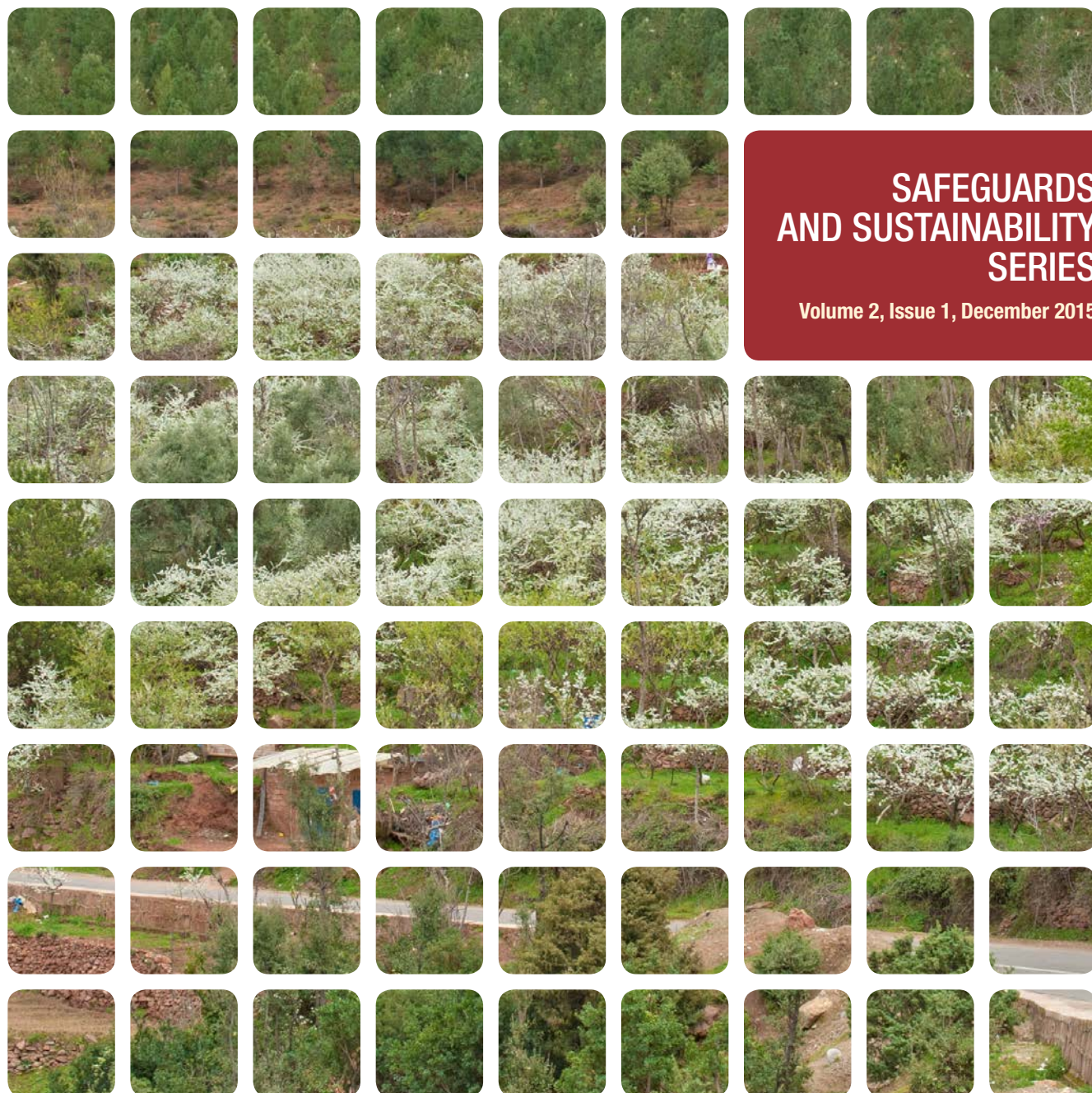
Guidance Materials

Volume 3: Sector Keysheets



AFRICAN DEVELOPMENT BANK GROUP

Quality Assurance and Results Department (ORQR)
Compliance and Safeguards Division (ORQR.3)



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Safeguards and Sustainability Series: Integrated Safeguard System Guidance Materials

Note: In this report, "\$" refers to US dollars. 1 UA = \$1.53

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Acronyms and Abbreviations

ARAP	Abbreviated Resettlement Action Plan	IESIA	Integrated Environmental and Social Impact Assessment
CSP	Country Strategy Paper	ISS	Integrated Safeguards System
DFI	Development Financial Institution	ISTS	Integrated Safeguards Tracking System
ESA	Environmental and Social Assessment	MDB	Multilateral Development Bank
ESAP	Environmental and Social Assessment Procedures	IDEV	Operations Evaluation Department
ESCON	Environmental and Social Compliance Note	OPSM	Operations of Private Sector and Microfinance
ESCR	Environmental and Social Completion Report	ORQR.3	Compliance and Safeguards Division
ESIA	Environmental and Social Impact Assessment	OS	Operational Safeguard
ESMF	Environmental and Social Management Framework	PAR	Project Appraisal Report
ESMP	Environmental and Social Management Plan	PBO	Program-Based Operations
ESMS	Environmental and Social Management System	PCN	Project Concept Note
ESS	Environmental and Social Scoping	PCR	Project Completion Report
ESSM	Environmental and Social Scoping Memorandum	PEN	Preliminary Evaluation Note
E&S	Environmental and Social	PIC	Public Information Centre
FI	Financial Intermediary	RCM	Request for Categorization Memorandum
FRAP	Full Resettlement Action Plan	RISP	Regional Integration Strategy Paper
GECL	General Counsel and Legal Services Department	RMC	Regional Member Country
IPRR	Implementation Progress and Results Report	SESA	Strategic Environmental and Social Assessment
		TOR	Terms of Reference
		VCM	Validation of Categorization Memorandum

FOREWORD

The African Development Bank has revised its existing Integrated Environmental and Social Impact Assessment (IESIA) Guidelines which dates back to October 2003. The IESIA Guidelines are intended to be used as a systematic process for addressing projects' environmental and social impacts with clear understanding of the specific sector characteristics. The IESIA guidelines reflect the scope and content of the new Integrated Safeguards System and Operational Safeguards as well which have been adopted by the Bank in December 2013.

Tremendous practical knowledge, resources and best practices have been used in developing these guidelines which are brought to best international standards. They are intended for national Environmental and Social Assessment practitioners, process managers as well as Bank staff with the intention of:

- Assisting in the project design at early stages, as many potential adverse impacts can be avoided or mitigated by modifying or adding certain project components to the initial design. As well, improvements in the project design can enhance several beneficial impacts at a minimal cost.
- Providing necessary guidance on how to adequately consider the Bank's priority safeguards themes in both the preparation and assessment phases. Thus the staff of the Bank and RMCs should refer to the IESIA Guidelines from the beginning of the project cycle to the end.

The IESIA guidelines are published in the Safeguards and Sustainability Series in three sets:

- Volume 2 Issue 1 containing 10 general guidance notes on ESA – responding to the requirements set out in OS1, providing specific guidance in the form of checklists on specific themes and requirements in the OSs as well as on sector-specific assessment issues. The guidance notes cover environmental mainstreaming, strategic assessments, impact assessments, environmental management plans, and environmental management systems, supervision of compliance and use of country systems.

- Volume 2 Issue 2 which deals with Sector Keysheets for 27 sectors and sub-sectors including transport, power generation, sustainable land and natural resources management, oil and gas, urban and rural water supply and sanitation as well as social infrastructure.
- Volume 2 Issue 3 providing 10 specific guidance notes on specific OS requirements such as consultation, working with vulnerable groups, and grievance mechanisms. Some address specific areas of environmental and social risk not previously covered by Bank policies, such as cultural heritage, environmental flows, biodiversity, labor standards, HIV AIDS, dams and large scale land acquisition. These are not “manuals” but provide sufficient information to enable Sector Department staff to understand fully the requirements of the OSs.

This new set of guidance materials has which will be completed with other items and updated using new knowledge and emerging best practices as it a leaving material has three critical advantages:

- It provides a system of technical support both for its own staff and for borrowers or clients to cover not only project preparation but also implementation – with a new emphasis on monitoring, reporting and supervision,
- Puts in place a dynamic and customized resource that can respond to current needs and be adapted to future safeguard implementation challenges faced by Bank staff, in both regional and sector departments, and its borrowers or clients; and,
- Offers a basis for capacity building in the Bank and in RMCs with respect to implementing the safeguards.

The Bank hopes that the provision of high quality technical guidance is key to ensuring effective compliance, capacity and ownership of the ISS for Bank staff and borrowers alike. Therefore, it is our hope that Regional Member Countries will optimally use them when undertaking

Environmental Assessments for Bank financed projects/ programs. The Bank encourages its own Operational staff to refer to it when reviewing and clearing ESA studies and in project supervision.



EXECUTIVE SUMMARY

Context and process

The African Development Bank (the Bank) is introducing the Integrated Safeguards System (ISS) to update and articulate more clearly its environmental and social safeguards to support inclusive and sustainable growth in the region. The ISS consists of four interrelated components (Figure 1):

- An Integrated Safeguards Policy Statement declaring the Bank's commitment to environmental and social sustainability and the management of risks associated with non-compliance with the Bank's Policies and Procedures;
- Operational Safeguards (OSs) – which are a set of brief and focused policy statements that clearly set out the operational requirements with which Bank-financed operations must comply; and
- A revised set of Environmental and Social Assessment Procedures (ESAPs) that will provide information on the specific procedures that the Bank and its borrowers or clients should follow to

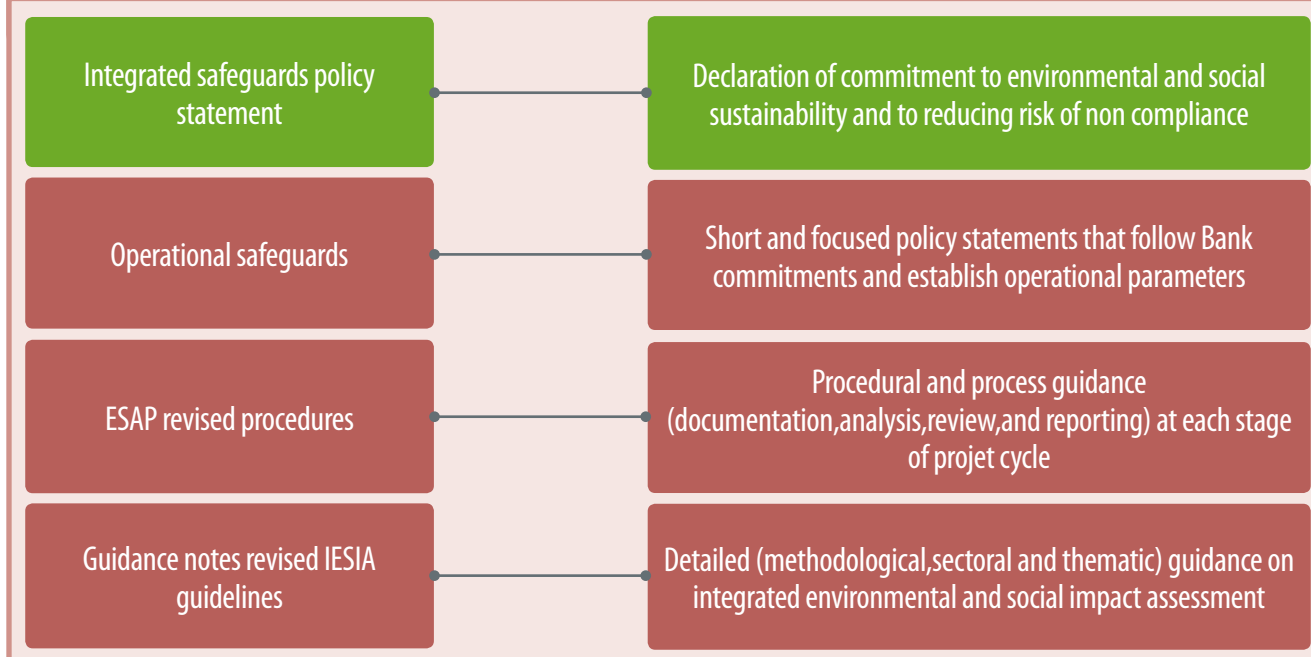
ensure that Bank operations meet the requirements of the OSs at each stage of the Bank's project cycle.

- Integrated Environmental and Social Impact Assessment (IESIA) Guidance Notes that provide technical guidance for the Bank and its borrowers or clients on safeguards instruments, methodological approaches and specific topics or project types relevant to meeting the new OSs.

The first two components of the ISS were approved by the Board in December 2013 and became operational in July 2014. The last 2 components have been adopted by OpsCom in October 2014.

The development of the ESAP and the IESIA Guidance Notes have benefitted from Bank-wide consultations on the ISS and reflect the guidance provided during these consultations. Training sessions have been carried out at the HQ on the documents for Task Managers and Environmental and Social Safeguards Experts. Three regional training sessions have also been carried out in Dakar for staff in Western, Central and Northern Africa,

Figure 1: Structure of the Integrated Safeguards System



in Nairobi for Eastern Africa and in Pretoria for Southern Africa. The feedback from these training sessions have also been incorporated into the development of these procedures and guidelines. Key revisions applied in the ESAP procedures are summarized below:

The implementation of the ISS enables the Bank to (i) promote social and environmental benefits, (ii) protect against harm, (iii) pursue a more sustainable approach to development which can generate benefits in terms of environmental security and human well-being, and (iv) manage projects' trade-offs in the best interest of Africa's development. But more than that, the Integrated Safeguards System is one of the strongest tools the Bank can use to promote the well-being of our true clients, Africa's people while the ESAP and the IESIA Guidance Notes provide a strong procedural basis for the operationalization of the ISS at country level.

Scope of the guidelines

The Integrated Environmental and Social Impact Assessment (IESIA) Guidelines provide a systematic process for addressing projects' environmental and social impacts with

clear understanding of the specific sector characteristics.

The IESIA complements the guidance and formats provided in ESAP and provides guidance to RMCs when undertaking Environmental and Social Assessments for Bank financed projects/programs. It will also be used by the Bank's Operational staff in reviewing and clearing these studies and in project supervision. The provision of high quality technical guidance is key to ensuring effective compliance, capacity and ownership of the ISS for Bank staff and borrowers alike. The development of the IESIA Guidance Notes has been guided by the following principles:

- Need to address the new and more challenging elements and required outputs of the OSs – in particular those set out in OS 1 on Environmental and Social Assessment;
- Addressing emerging or challenging issues or topics relevant to the scope of the set of OSs, in particular it seeks to address the implementation challenges with that are anticipated in the ISS and responds to the changing profile of Bank operations;
- Provision of specific support to identifying and managing the key environmental and social risks

Key Environmental and Social Assessment Procedures (ESAP) Revisions

Revision	Brief Description of Revision
Broadened ESAP scope – to cover private sector projects.	<ul style="list-style-type: none"> • The revised ESAP cover not only public, but also private sector Bank lending operations.
Introduction of Integrated Safeguards Tracker (IST).	<ul style="list-style-type: none"> • The revised ESAP contain an IST system. The IST's basic purpose is to facilitate the verification of project compliance with the requirements set out in the Operational Safeguards (OSs), over the course of the Project Cycle. A more detailed description of the IST is provided in the revised ESAP document itself.
Introduction of Environmental and Social Categorization Memorandum (ESCM).	<ul style="list-style-type: none"> • The revised ESAP require the Sector Departments to draft an ESCM during the project identification phase of the Project Cycle. This ESCM assigns the project a Category and requests ORQR.3 to review and clear the Category.
Broadened use of Environment and Social Scoping Memorandum (ESSM) – to cover Category 4 projects and private sector projects.	<ul style="list-style-type: none"> • The revised ESAP require that, during the project preparation phase of the Project Cycle, the Sector Departments develop an ESSM not only for Category 1 and 2 projects, but also for Category 4 projects. The revised ESAP require that an ESSM is developed not only for public sector projects, but also for private sector projects.
Broadened use of ORQR.3 compliance check – to cover private sector projects and Environmental and Social Management System (ESMS).	<ul style="list-style-type: none"> • The revised ESAP require that an ESSM is developed not only for public sector projects, but also for private sector projects. • The revised ESAP require that ORQR.3 engages in a PCN compliance check not only for public projects, but also for private projects. • The revised ESAP require that ORQR.3 engages in a PAR compliance check not only for public sector projects, but also for private sector projects. • The revised ESAP require that ORQR.3 engages in an ESMS compliance check for Category 4 projects during the project appraisal phase of the Project Cycle.
Increased ORQR.3 responsibility for disclosure.	<ul style="list-style-type: none"> • The revised ESAP require that ORQR.3 itself is responsible for disclosing the ESA and ESMP summaries (and where applicable the FRAP / ARAP) during the project appraisal phase of the Project Cycle.

associated with operations in a number of priority sectors;

- Ease of use, accessibility and effectiveness in meeting the practical needs of project staff involved in Bank operations and in borrower institutions;
- Appropriate scope and scale drawing on the experience of other MDBs and development agencies and taking into account the lessons learned over the years in the Bank in implementing safeguards.

The IESIA Guidance Notes, which are designed to be reviewed and updated on a regular basis and as necessary, offer three critical benefits:

- provides a system of technical support both for Bank staff and for borrowers or clients to cover not only project preparation but also implementation – with a new emphasis on monitoring, reporting and supervision;
- puts in place a dynamic and customized resource that can respond to current needs and be adapted to future safeguard implementation challenges faced by Bank staff, in both regional and sector departments, and its borrowers or clients;
- offers a basis for capacity building in the Bank and in RMCs with respect to implementing the safeguards.

Structure and content

The IESIA Guidance Notes are presented in three standalone volumes that provide guidance in the three essential components of (i) the Environmental and Social Assessment process, (ii) specific topics and operational safeguard requirements, and (iii) technical guidance on key sectors and subsectors that have been proposed by operational departments as areas where guidance is needed:

Volume 1: Environmental and Social Assessment Instruments and Outputs

In OS1 and the ESAP, several new environmental and social assessment instruments and outputs are introduced. These include the use of Strategic Environmental and Social Assessment (SESA) for policy and programme lending and the use of Environmental and Social Management Frameworks and Systems (ESMFs and ESMSs) for programme lending and Financial Intermediaries. There

is also greater emphasis on compliance monitoring during project implementation as well as greater attention to country systems.

For Bank operations staff and their counterparts in borrowers or clients, it is vital that they have clear and easy to use guidance on these different instruments and outputs. This guidance is therefore designed specifically to complement the ESAP Annexes, which provide templates and report formats in many cases. The main purpose of this category of guidance should be to:

- Make it clear to staff what is the nature of the different instruments in the specific context of the OSs and ESAP
- Assist them to prepare TORs, report formats and select high quality consultants
- Evaluate the quality of reports and deliverables to judge if the OS1 requirements are followed satisfactorily
- Highlight key issues of importance for good compliance.

Volume 2: Environmental and Social Assessment Topics

The OSs introduce or elaborate on a number of key ESA requirements and topics. It is of great importance to provide Bank and borrower staff with clear and easy to use guidance to ensure a high level of understanding of what is required, best practice on meeting the requirements and where appropriate sources of good technical information.

Some of these topics reflect specific OS requirements such as applying safeguards to policy and programme lending, public (free, prior and informed) consultation and grievance mechanisms. Some address specific areas of environmental and social risk not previously covered specifically by Bank policies, such as vulnerable groups, cultural heritage, environmental flows, biodiversity, GHG emissions and labour standards. Others cover topics long recognised to be of great importance and where compliance may be improved through better technical guidance, such as resettlement or pollution control.

It should be noted that the Bank has introduced a Climate Safeguards System (CSS) to complement the IESIA and has also integrated the associated climate vulnerability and adaptation requirements and procedures

into the ISS. The CSS can be accessed using this link <http://css.afdb.org:8080/AfDB-CSS/afdbhomepage.html> and following login instructions Login: Tmanager, PW: taskmanager.

Volume 3: Guidance on Specific Sectors called Sector Keysheets

30 specific project types, within four key sector areas for which checklists should be prepared. The aim of such checklists should be to identify typical project components, sources of impacts, commonly applied assessment methods and likely management options. These can be used by Bank staff to assist in the process of screening projects in the early stage of the Project Cycle as well as for tailoring TORs for Environmental and Social Assessments.

The preparation of such checklists and sector specific guidance by development agencies has been common over the past two decades or more. Many have been produced in a variety of different “shapes and sizes”. However, it is interesting to note that few if any MDBs are currently applying sub-sector guidance of this kind within their safeguards systems. For example, the World Bank

Group’s Environmental, Health and Safety Guidelines are organised around types of pollution or risk.

It is important for the Bank to take full account of how useful such guidance has been for other agencies, what format and scale would be best suited for use by Bank staff and the selection of specific sectors for which checklists may be useful. Extensive consultation with the Bank’s environmental and social specialists for different sectors will be essential to determine how sub-sector specific guidance would be valuable.

The ESAP and IESIA Guidance Materials will be uploaded in the online Integrated Safeguards Tracking System (ISTS) that has been jointly developed by ORQR and CIMM. The ISTS is linked to the Bank’s project management/SAP database system to provide to Bank staff an automated and one-stop platform for processing Bank projects’ environmental and social due diligence. The ISTS aims at facilitating the verification of project compliance with the requirements set out in the OSs, over the course of the project cycle.

TRANSPORT SECTOR: ROAD INFRASTRUCTURE

Investment in road infrastructure facilitates the movement of people and goods contributing to economic development and enhancing the quality of life. However, their construction, rehabilitation and maintenance have often caused widespread adverse impacts on natural and human environments. Damage may include disruption or contamination of drainage systems, soil destabilization, habitat destruction and loss of fauna and flora and opening up frontier areas containing pristine landscapes. Road development may also be a source of adverse impacts on the human environment, particularly the displacement and resettlement of affected families and businesses and health and safety.

Scope and structure

This keysheet provides a summary of the activities, typical environmental and social impacts, and potential mitigation and management measures relating to the development of road infrastructure. The types of road infrastructure covered are: major urban and inter-urban roads; rural feeder and tertiary road programmes; and upgrading of major roads or rural feeder and tertiary road networks.

This keysheet should be used specifically to help with drafting ToRs for ESIA's of road infrastructure operations and with scoping and conducting ESIA's and preparing ESMPs. It can also help in reviewing ESIA's. It should be used in conjunction with the Bank's Guidance Notes on ESIA's (including coverage of cumulative impacts) and with the Guidance Notes on specific safeguard topics including transboundary projects.

The keysheet is organised under the following headings, with substantive information provided in table form:

- Project components and activities.

- Sources of impact and receptors/resources.
- Mitigation and management options.

The phases of road infrastructure projects considered are: design and planning, including route selection; construction; operation and maintenance; and where appropriate decommissioning (closure).

Project components and activities

The components of road developments are provided in Table 1, along with the activities involved in developing new or upgraded roads, broken down by project phase.

Sources of impact, receptors/resources, and mitigation

Table 2 summarizes the main aspects of road development activities that lead to typical impacts, the receptors and resources they affect, and options for mitigation. It considers impacts on the physical, biological and socioeconomic environment. The mitigation measures described assume that higher level design and route planning measures, as described in Table 1, have already been implemented.

The guidance on impacts and options for their mitigation can be used to help discussions with the borrower or client and improve their understanding of the Bank's requirements. They should also be used to assist preparation of ToRs for an ESIA so that they are tailored to the particular circumstances of the road development under consideration.

Table 1: Summary of Activities associated with Road Infrastructure Development

Components	
Road <ul style="list-style-type: none"> • Road surface (paved or graded). • Road reserve ("hard shoulder"). • Crossings (e.g. bridges, culverts). • Drainage and erosion control structures. • Safety and security measures (e.g. barriers and fencing). • Other elements (e.g. signage). 	Ancillary facilities <ul style="list-style-type: none"> • lay-bys or service areas. • temporary construction facilities (e.g. workshops, laydown areas, working corridors outside the road reserve, workers' accommodation, and borrow pits) • security posts and toll stations. • access roads within and between temporary facilities and the road being developed. • landscaping features, etc.
Activity	
Design – Route Selection and Planning	Screening , Scoping and ESIA Preparation of ESMP Agreement of loan covenants
<ul style="list-style-type: none"> • Strategic planning (transport options analysis, cost-benefit analysis, strategic route selection, initial design), and for major road or network development, strategic environmental and social assessment (SESA), to establish. • Major constraints and alternatives (e.g. with respect to major settlements, watersheds and areas of biodiversity conservation importance). • Design procedures such that environmental and social considerations are given equal weight to engineering and financial ones. 	
<ul style="list-style-type: none"> • Site-specific planning (detailed design), taking account of environmental and social sensitivities and consultation with communities, draw upon the following environmental and socioeconomic documentation, all of which should comply with national regulations and international good practice: <ul style="list-style-type: none"> – Environmental and Social Impact Assessment (ESIA); – Environmental and Social Management Plan (ESMP); – Stakeholder Engagement Plan (SEP); and – Resettlement Action Plan (RAP). 	
Construction	Monitoring of ESMP performance Monitoring of compliance with loan covenants Monitoring of sub-contractor contract provisions
Construction activities will include: <ul style="list-style-type: none"> • Establishing temporary access to work and ancillary areas, demarcating clearance zones, establishing access control. • For road upgrading, erection of temporary diversions where needed to manage existing traffic. • Clearance and levelling of the corridor, and major earthworks where required (e.g. cuttings, embankments). • Location and development of borrow pits (and possibly quarries), import of materials, e.g. gravel, clay, bitumen. • Sourcing and establishing of a water supply from surface and/or groundwater. • Improvement of existing drainage and introduction of new road drainage, including culverts if required. • Surfacing and sealing of the carriageway, including use of bitumen mixing plants where the road is to be sealed. • Water crossings, e.g. construction or upgrading of bridges and culverts, including concrete batching for structures. • Establishment or improvement of safety arrangements e.g. modification of camber, barriers, improving sight lines. • Landscaping, as required. 	
The equipment required will include heavy mobile plant (e.g. graders, bulldozers, excavators, rollers) and temporary fixed plant such as bitumen mixing plant, concrete batching plant and power generators.	
Operation and Maintenance	Project implementation: Compliance Monitoring
During operation any public road is likely to a range of different vehicle types including heavy and light vehicles, as well as other forms of traffic such as bicycles, carts and pedestrians. All of these may contribute to direct and indirect impacts described in Table 2.	
Road maintenance will entail many of the activities described above for the construction phase, although in general they are likely to be smaller in scale and spatial extent.	
Decommissioning (Closure)	Project Completion: Compliance Report
Where temporary roads are developed during construction they should be decommissioned and rehabilitated in accordance with a site-specific closure plan developed in consideration of international good practice.	
The closure process will include site clearance, removal of all equipment, and appropriate disposal of waste materials, soil ripping and re-grading where necessary.	

Table 2: Road Developments: Impacts and Mitigation

Impacts	Mitigation
<p>Geology/Hydrogeology</p> <ul style="list-style-type: none"> • Interruption of hydrogeology and groundwater flows from excavation and ground clearance. 	<ul style="list-style-type: none"> • Detailed alignment to take account of local groundwater conditions, e.g. by avoiding areas with springs or where the water table is shallow. • Limit sealed or compacted areas as much as possible, to maintain natural recharge of the water table • Avoid removing material below the water table.
<ul style="list-style-type: none"> • Pollution of groundwater from discharges and accidental releases. 	See Pollution of Soils and Water below
<p>Soils, Run-off and Flooding</p> <ul style="list-style-type: none"> • Loss of soil / sediments and pollution of watercourses, and interruption of drainage patterns, as a result of ground clearance and earthworks. 	<ul style="list-style-type: none"> • Minimisation of cleared areas and soil disturbance, with revegetation as soon as feasible, with native species. • No vehicle use to be used outside designated areas. • Early installation and regular maintenance of drainage and diversion structures, silt traps, etc; drainage outlets to discharge into vegetated areas if possible; vegetation along watercourses and drainage lines to be retained if possible. • Avoidance of areas liable to flooding, slope instability, and water crossings where possible. • Retention of topsoil for restoration (including tilling and revegetation) as soon as practicable. • Restrictions on work and other activities around waterbodies (e.g. vehicle washing), and minimisation measures around water crossings where this not possible. • Careful design: e.g. alignment, minimal diversion, timing of works (overall duration and seasonality).
<p>Pollution of Soils and Water</p> <p>Discharge of construction site/camp sewage effluent polluting watercourses.</p>	Installation of sewage treatment to meet required standards; hygiene training for workforce.
<ul style="list-style-type: none"> • Release of hazardous substances during construction, or operation (e.g. vehicle spills) leading to soil, surface or groundwater contamination. 	<ul style="list-style-type: none"> • Materials handling and control procedures. • Control of construction vehicle movements and prohibition of vehicle washing in watercourses, and similar practices. • Emergency response plans during construction (contractors and local authorities) and operation (local authorities).
<p>Air Quality</p> <ul style="list-style-type: none"> • Dust from construction, and other emissions during construction and operation, could affect human health, vegetation (including crops) and wildlife. 	<ul style="list-style-type: none"> • Sensitive local route selection and siting of construction facilities. • Dust control and suppression measures. • Modern equipment with meeting appropriate emissions standards, and regular preventative maintenance. • No use of ozone depleting substances during construction.
<ul style="list-style-type: none"> • Emissions from vehicles during operation affecting sensitive receptors (human and flora/fauna). 	<ul style="list-style-type: none"> • Sensitive route selection, grading of inclines, etc. • Speed controls and other traffic calming measures to reduce excessive acceleration around towns.
<p>Noise and Vibration</p> <ul style="list-style-type: none"> • Noise and vibration from equipment, traffic and activities during construction (and maintenance) at worksites and associated facilities, may disturb sensitive noise receptors (human and fauna). 	<ul style="list-style-type: none"> • Sensitive local route selection, grading of inclines, etc. and siting of construction facilities. • Use of modern equipment fitted with abatement devices (e.g. mufflers, noise enclosures); good maintenance regime. • Strict controls of timing of activities, e.g. blasting and other high noise emissions; prohibition on night working if possible. • Observance of seasonal sensitivities (e.g. breeding seasons) , and alteration of activity to reduce noise levels at that time. • Speed controls and other traffic calming measures to reduce excessive acceleration around settlements/sensitive receptors.
<ul style="list-style-type: none"> • Noise and vibration from traffic during operation may disturb sensitive noise receptors (human and fauna). 	<ul style="list-style-type: none"> • Sensitive local route selection (e.g. by-passes around communities, grading of inclines), and siting of permanent facilities. • Speed controls and other traffic calming measures to reduce excessive acceleration near settlements/sensitive receptors.

Impacts	Mitigation
<p>Resources and Waste</p> <ul style="list-style-type: none"> Construction (and possibly operation) will require supply of water from surface or groundwater, which could affect existing supply for human communities and ecosystems. 	<ul style="list-style-type: none"> Water study prior to any abstraction, to inform a Sustainable Water Management Plan. No abstraction without prior approval of relevant authorities at all locations. Promotion of water efficiency (including leak detection, preventative maintenance of equipment) and water recycling.
<ul style="list-style-type: none"> Inefficient waste management during construction and maintenance leading to excess materials consumption, generation of wastes/emissions, soils and water pollution. 	<ul style="list-style-type: none"> Preparation of Waste Management Plan following the waste hierarchy, supported by staff training. Earthworks to be designed to achieve a balance between cut and fill wherever possible. Use of authorised contractors for hazardous and any other wastes which the project cannot dispose of safely.
<p>Loss, fragmentation and degradation of habitat, and severance of animal migration routes and pathways</p> <ul style="list-style-type: none"> Land clearance for new roads and upgrading of existing roads may cause loss or fragmentation of protected areas and other areas of conservation interest, and degradation following poorly managed rehabilitation. 	<ul style="list-style-type: none"> Careful route selection and siting of all project components, with advice from biodiversity authorities/wildlife specialists. Wherever feasible, establishment of buffer zones around conservation areas, watercourses, and other locations identified as ecologically sensitive and avoidance or minimisation of activity within these zones. Rehabilitation of cleared areas with native species, and ecosystem restoration in habitats of conservation value, using specialist advice and input, backed up by a long-term monitoring programme and corrective actions as necessary.
<ul style="list-style-type: none"> Severance of terrestrial routes and watercourses used for migration or for access to feeding and breeding areas. 	<ul style="list-style-type: none"> Sensitive planning of road alignments. Wildlife crossings for terrestrial animals, and design of culverts/crossing structures to avoid impacts on animal movement.
<ul style="list-style-type: none"> Construction impacts on habitats and species (e.g. from changes in drainage, soil erosion, pollution of water, soils or air, introduction of invasive species, and general human disturbance). 	<p>Where development in sensitive areas cannot be avoided, mitigation may include:</p> <ul style="list-style-type: none"> Minimisation of area impacted, clear demarcation of remaining intact areas of habitat, and prohibition of activity into those areas for any purpose; maintenance of wildlife corridors between fragmented areas wherever possible. No ground clearance upstream of sensitive areas unless appropriately engineered drainage installed. Habitat rehabilitation and ecosystem restoration of areas no longer required after construction, as soon as possible. If loss of Critical Habitat is inevitable, development/implementation of an Offsets Programme. See relevant sections re. control of impacts from pollution, invasive species, and induced access
<ul style="list-style-type: none"> Traffic disturbance and emissions affecting the integrity and viability of areas of conservation interest. 	<ul style="list-style-type: none"> See control of air quality and noise / vibration impacts above
<p>Impacts from Induced Access</p> <ul style="list-style-type: none"> Road developments into remote areas will facilitate access, and can lead to land clearance for agriculture, and increased disturbance and pressure on natural resources through bushmeat hunting, logging, fire, etc. 	<ul style="list-style-type: none"> Careful route selection and siting of all project components, with advice from biodiversity authorities/wildlife specialists to avoid remote and previously inaccessible areas where possible. A construction camp siting strategy regarding siting to avoid attracting people towards more remote areas, where possible. Restrictions on access to all temporary access roads, and their removal after construction. <p>See also Bushmeat Hunting below</p>
<p>Bushmeat Hunting</p> <ul style="list-style-type: none"> Construction activities and access to remote areas could lead to greater demand for bushmeat (from workforce and wider community), stimulate the wildlife trade and facilitate access to hunting areas. 	<ul style="list-style-type: none"> Bushmeat Hunting and Wildlife Trade Management Plan, agreed with government authorities and implemented jointly. Prohibition on workforce hunting, selling, or purchasing bushmeat, and training to support this requirement. Prohibition on workforce (except security personnel) having guns in work areas or accommodation. Sensitisation and public awareness campaigns against hunting and bushmeat the trade amongst local communities.

Impacts	Mitigation
<p>Direct Impacts on Flora and Fauna</p> <ul style="list-style-type: none"> • Clearance of vegetation may lead to loss of plant species and habitat of conservation interest. • Road development could displace animals and disturb their habitats, by direct disturbance during construction and operation (e.g. from noise, light disturbance at night, general human presence). 	<ul style="list-style-type: none"> • Careful route selection and siting of all project components, with advice from biodiversity authorities/wildlife specialists. • Careful planning of phasing and timing of construction activities. • Demarcation and avoidance of areas of conservation interest (high value species, feeding or breeding sites, migration routes, etc.) where possible, and wildlife rescue and translocation where appropriate, under expert supervision. <p>Also see measures under Soils, Run-off and Flooding, Pollution of Soils and Water, and Induced Access above, and Invasive Species below</p>
<p>Invasive Species</p> <ul style="list-style-type: none"> • Movement of plant a workforce into areas, and of road traffic during operation, could introduce invasive species which adversely impact fauna, flora, ecosystems, and crops. 	<ul style="list-style-type: none"> • Invasive Species Management Plan, which should be developed and implemented in consultation with authorities, including appropriate eradication measures for different species/groups of species. • Staff training and awareness raising in communities. • No introduction of exotic species (e.g. for site rehabilitation) without specialist vetting and government approval.
<p>Physical and Economic Displacement of People, Property, Assets and Resources</p> <ul style="list-style-type: none"> • Development or upgrading of roads may physically displace people, or lead to the loss of assets. 	<ul style="list-style-type: none"> • Careful route selection and siting of all project components, and avoid occupation of areas which are inhabited or regarded as of high value by communities (e.g. horticulture, community orchards) where possible. • Early development and sensitive implementation of resettlement planning, in accordance with national regulations and international good practice to compensate for any losses (both physical and economic).
<p>Economic Development and Employment</p> <ul style="list-style-type: none"> • Direct employment of local population in workforce, and stimulation of local economy through demand for goods and services will enhance livelihoods and economic activity in local communities, but potentially adverse effects if community relations are not well managed. • Procurement of local goods and services for the road development and workforce could deplete resources available for local communities. 	<ul style="list-style-type: none"> • Development of an Employment Plan, with clear employment requirements and procedures for the construction workforce. • Transparent and culturally appropriate communication with communities regarding employment opportunities. • Fair and transparent hiring and staff management procedures. • Employment requirements and vocational training plan to be agreed with local institutions, so that local people can be trained to meet the project's needs in a timely fashion. • Development of measures to manage the transition after construction is complete, including SME development, ongoing opportunities for the workforce in road management and maintenance, reskilling and alternative employment. • Procedures for sustainable local procurement, in consultation with local authorities and community leaders. • Local capacity building to foster community resilience. • Monitoring of local prices, and exploration of corrective measures (e.g. alternative sourcing to reduce local pressure) if appropriate.
<p>Cultural Heritage</p> <ul style="list-style-type: none"> • Displacement or damage to cultural heritage sites by construction activities, harm to the setting, amenity value, etc. of the site due to road construction or operation. 	<ul style="list-style-type: none"> • Careful route selection and siting of all project components, taking account of community consultation/specialist surveys. • Development of a Cultural Heritage Management Plan covering tangible and intangible (e.g. local traditions and practices) cultural heritage. • Implementation of a "Chance Finds" procedure during construction. • See also Guidance Note on Physical Cultural Heritage.
<p>Community Health, Safety and Security</p> <ul style="list-style-type: none"> • Poor construction management practices may lead to adverse effects on safety, human health and wellbeing. 	<ul style="list-style-type: none"> • Good construction site "housekeeping" and management procedures (including site access). • Disease control measures, e.g. no pools of standing water, rodent control, treatment of water. • Risk assessments and emergency response planning to consider impacts on local communities. • See also control of pollution under Physical Impacts heading.

Impacts	Mitigation
<ul style="list-style-type: none"> Interaction between workforce and local communities may increase occurrence of communicable diseases, including HIV/AIDS and sexually transmitted diseases (STDs). 	<ul style="list-style-type: none"> Implementation of a health management system for the construction workforce, to ensure it is fit for work and that it will not introduce disease into local communities. Training and awareness training for workforce and their dependents on HIV/AIDS and other STDs, and communicable diseases including malaria; health awareness raising campaigns for communities on similar topics.
<p>Workforce-Community Interactions</p> <ul style="list-style-type: none"> Real or perceived disruption to normal community life, through the physical presence of a construction workforce. 	<ul style="list-style-type: none"> Adoption of a Stakeholder Engagement Plan, as a framework for early and ongoing community consultation Implementation of a Grievance Procedure (see Grievance Procedure and Redress Mechanisms guidance note). Works procedures, defining a Code of Appropriate Conduct for all workers. Training for all staff in acceptable behaviour with respect to community interactions.
<p>In-migration</p> <p>Individuals are likely to migrate into the area which may cause conflict with resident communities, and put pressure on resources and infrastructure.</p>	<ul style="list-style-type: none"> Careful route selection and siting of all project components, after consultation with communities and local authorities. Preparation and implementation of an Influx/In-migration Management Plan, in consultation with local authorities. See also Economic Development and Employment, and Induced Access above.
<p>Workforce-Community Interactions</p> <ul style="list-style-type: none"> Real or perceived disruption to normal community life, through the physical presence of a construction workforce. 	<ul style="list-style-type: none"> Adoption of a Stakeholder Engagement Plan, as a framework for early and ongoing community consultation. Implementation of a Grievance Procedure (see Grievance Procedure and Redress Mechanisms guidance note). Works procedures, defining a Code of Appropriate Conduct for all workers. Training for all staff in acceptable behaviour with respect to community interactions.
<p>In-migration</p> <ul style="list-style-type: none"> Individuals are likely to migrate into the area which may cause conflict with resident communities, and put pressure on resources and infrastructure. 	<ul style="list-style-type: none"> Careful route selection and siting of all project components, after consultation with communities and local authorities. Preparation and implementation of an Influx/In-migration Management Plan, in consultation with local authorities. See also Economic Development and Employment, and Induced Access above.
<p>Labour and Working Conditions</p> <ul style="list-style-type: none"> Poor management of occupational health and safety could lead to accidents, injuries and illnesses among workers; mental health issues may arise due to remote or enclosed living. Differences in nationality, ethnicity, religion, etc. may lead to discrimination and harassment, and differences (perceived or real) in working conditions between workers may lead to resentments. 	<ul style="list-style-type: none"> Employment practices and working conditions should conform to International Labour Organisation (ILO) Standards and national regulations. Rest and recreational facilities and time should be provided, and rules on alcohol and drugs defined and clearly communicated to workers. The basis for differences in the standard of accommodation should be non-discriminatory; it should be documented and communicated transparently to the workforce. Clear and comprehensive health and safety reporting and grievance procedure system should be established, and be freely available to all of the workforce. See also Employment and Economic Development and Human Rights.

TRANSPORT SECTOR: CONSTRUCTION OF FLUVIAL AND MARITIME PORTS

Investment in ports facilitates the movement of people and goods, and contributes to economic development and quality of life through trade, enhanced transport links and tourism. However, the construction, rehabilitation and maintenance of ports can result in significant direct and indirect impacts on the environment, including disruption or contamination of water (including terrestrial and marine bodies of water) and physical disruption of coastal geomorphological processes, soil destabilization, habitat destruction, and loss or disturbance of fauna and flora. Port development may also be a source of adverse impacts on the human environment, particularly the displacement and resettlement of affected families and businesses, disruption of livelihoods, and health and safety.

Scope and structure

This keysheet provides a summary of the activities, typical environmental and social impacts, and potential mitigation and management measures relating to the development of ports. The types of port developments covered are construction or rehabilitation and major maintenance programmes for both fluvial and marine ports, supporting activities including shipping, loading / unloading and storage of cargo, ship refuelling and maintenance, commercial fishing, tourism and passenger transport.

This keysheet should be used specifically to help with drafting TORs for ESIA of port developments and with scoping and conducting ESIA and preparing ESMPs. It can also help in reviewing ESIA.

It should be used in conjunction with the Bank's Guidance Notes on ESIA (including coverage of cumulative impacts) and with the Guidance Notes on safeguard specific topics including transboundary projects.

The keysheet is organised under the following headings, with substantive information provided in table form:

- Project components and activities.
- Sources of impact and receptors/resources.
- Mitigation and management options.

The phases of port development projects considered are: design and planning, including site selection; construction; operation and maintenance; and where appropriate decommissioning (closure).

Project components and activities

The components of port developments are provided in Table 1, along with the activities involved in developing new or upgraded ports, and in operating ports, broken down by project phase.

Sources of impact, receptors/ resources, and mitigation

Table 2 summarizes the main aspects of port development activities that lead to typical impacts, the receptors and resources they affect, and options for mitigation. It considers impacts on the physical, biological and socioeconomic environment. The mitigation measures described assume that higher level design and site planning measures, as described in Table 1, have already been implemented.

The guidance on impacts and options for their mitigation can be used to help discussions with the borrower or client and improve their understanding of the Bank's requirements. They should also be used to assist preparation of ToRs for an ESIA so that they are tailored to the particular circumstances of the port development under consideration.

Table 1: Summary of Activities associated with Port Infrastructure Development

Components	
Port <ul style="list-style-type: none"> Port infrastructure: including quays, wharves for service/export/passengers, vessel berths, conveyors, administration and control rooms. Shipping and approach channels, canals, turning basins. Storage areas (for goods, fuel), e.g. stockyards, warehouses, surge bins; waiting areas for passengers. Drainage and erosion control structures Safety and security measures (e.g. barriers, fencing, navigation aids). Other elements (e.g. power supply, signage, lighting). 	Ancillary facilities <ul style="list-style-type: none"> Temporary construction facilities (e.g. workshops, laydown areas, workers' accommodation, quarries and borrow pits). Security posts and infrastructure. Access roads within and between temporary facilities and the port; permanent access roads/railways. Storm defence and coastal protection structures. Landscaping features, etc.
Activity (1)	
Design – Site Selection and Planning	Screening , Scoping and ESIA Preparation of ESMP Agreement of loan covenants
Strategic planning (options analysis, cost-benefit analysis, strategic site selection, initial design), and for major shipping network development, strategic environmental and social assessment (SESA), to establish: <ul style="list-style-type: none"> Major environmental and social constraints and alternatives (e.g. with respect to major settlements, watersheds and areas of biodiversity conservation importance, sensitive or vulnerable coastal, estuarine or riverine shorelines/banks). Design procedures such that environmental and social considerations are given equal weight to engineering and financial ones. 	
Site-specific planning (detailed design), taking account of environmental and social sensitivities and consultation with communities, drawing upon the following environmental and socioeconomic documentation, all of which should comply with national regulations and international good practice: <ul style="list-style-type: none"> Environmental and Social Impact Assessment (ESIA); Environmental and Social Management Plan (ESMP). Stakeholder Engagement Plan (SEP); Resettlement Action Plan (RAP). 	
Activity (2)	
Construction	Monitoring of ESMP performance Monitoring of compliance with loan covenants Monitoring of sub-contractor contract provisions
Construction activities will include: <ul style="list-style-type: none"> Establishing temporary access to work and ancillary areas, demarcating clearance zones, establishing access control. Clearance and levelling of the port footprint, and major earthworks where required. Dredging of the river or sea bed, and disposal of dredge spoil. Construction of port infrastructure, both on land and into and over the water (e.g. jetties). Location and development of borrow pits and possibly quarries, import of materials, e.g. aggregate/ballast. Sourcing and establishing a water supply from surface and/or groundwater. Improvement of existing drainage and introduction of new drainage, including culverts if required. Establishment or improvement of safety arrangements e.g. navigation aids, lighting. Landscaping, as required. 	
The equipment required will include heavy mobile plant (e.g. graders, bulldozers, excavators) and temporary fixed plant such as concrete batching plant and power generators.	
Operation and Maintenance	Project implementation: Compliance Monitoring
During operation activities at the site will include increased flow of river or marine traffic at the port and in surrounding waters; loading, unloading and storage of cargo, which may include hazardous materials; operation of equipment, e.g. shiploaders; transport of passengers; and provision of water and energy supply, sewerage treatment and disposal etc. to ships and to port facilities.	
These activities may contribute to direct and indirect impacts described in Table 2.	

Components	
Activity (2)	
Port maintenance will entail many of the activities described above for the construction phase, although in general they are likely to be smaller in scale and spatial extent. In particular, periodic/regular maintenance dredging will be required to maintain channels and basins.	
Decommissioning (Closure)	Project Completion: Compliance Report
Where temporary roads and facilities used in port construction are no longer required (if, for example, they are not required for maintenance) they should be decommissioned and rehabilitated in accordance with a site-specific closure plan developed in consideration of international good practice. The decommissioning process will include site clearance, removal of all equipment, appropriate disposal of waste materials, soil ripping and re-grading where necessary.	
Ports are normally intended to operate for a prolonged period, and so it would not be appropriate for closure or decommissioning plans to be prepared until a few years prior to this occurring.	

Table 2: Port Developments: Impacts and Mitigation

Impacts	Mitigation
Geology/Hydrogeology/Hydrology <ul style="list-style-type: none"> • Interruption of hydrogeology and groundwater flows from excavation and ground clearance; pollution of groundwater from discharges and accidental releases. 	<ul style="list-style-type: none"> • Site selection to take account of local hydrological conditions (e.g. avoid watercourses, springs, shallow water table). • Limit sealed or compacted areas as much as possible, to maintain natural recharge of the water table. • Avoid removing material below the water table. See Pollution of Soils and Water below.
<ul style="list-style-type: none"> • Increased turbidity from dredging and spoil disposal; water pollution from contaminated dredged material. 	<ul style="list-style-type: none"> • Development of a dredge management plan, including considerations as to local hydrology, sediment characteristics, timing of activity, and habitat/ecological sensitivities of potential disposal sites (consider e.g. tides, low flow periods). • Use of appropriate modern dredging techniques and equipment, including measures to contain sediment plumes.
<ul style="list-style-type: none"> • Disruption of coastal processes (e.g. wave, tidal and current regime, sediment transport, flood and storm protection). • Saline intrusion into groundwater. 	<ul style="list-style-type: none"> • Siting and design to take account of shore configuration, currents, groundwater flows, and existing habitats. • Design and construction of compensatory shore protection and other measures to maintain coastal processes. • Siting of shipping and approach lanes to avoid disturbance or damage to coasts, riverbanks or other sensitive features such as wetlands or mangroves. • Monitoring of groundwater salinity; where necessary further mitigation may include control/diversion structures for saltwater, installation of cut off wells, sourcing of alternative water supply.
Soils, Run-off and Flooding <ul style="list-style-type: none"> • Loss, damage or disruption of soil/sediments. • Introduction of sediments to watercourses or interruption of drainage patterns, as a result of ground clearance, earthworks and the introduction of drainage structures. 	<ul style="list-style-type: none"> • Minimisation of cleared areas and soil disturbance, with revegetation as soon as feasible, with native species. • Early installation and regular maintenance of drainage and diversion structures, silt traps, etc; drainage outlets to discharge into vegetated areas if possible; vegetation along watercourses and drainage lines to be retained if possible. • Avoidance of areas liable to flooding, slope instability, and water crossings where possible. • Retention of topsoil for restoration (including tilling and revegetation) as soon as practicable. • Careful design: e.g. site selection, minimal diversion, timing of works (overall duration and seasonality).
Pollution of Soils and Water <ul style="list-style-type: none"> • Discharge of sewage effluent from construction and operation workforce, and passengers, causing pollution watercourses. • Release of hazardous substances during construction, or operation (e.g. runoff during maintenance, accidental spills/leaks, especially large spills to aquatic environment) leading to soil, surface or groundwater contamination. 	<ul style="list-style-type: none"> • Implementation of standard good wastewater management procedures. • Installation of sewage treatment to meet required standards; hygiene training for workforce. • Materials handling and control procedures. • Control of construction vehicle movements and prohibition of vehicle washing in watercourses, and similar practices. • Development of emergency response plans during construction (contractors and local authorities) and operation (local authorities) to manage major incidents if they should occur.

Impacts	Mitigation
<p>Air Quality</p> <ul style="list-style-type: none"> Dust from construction activities, and from loading and off-loading of certain materials (e.g. minerals), could affect human health, vegetation and wildlife. 	<ul style="list-style-type: none"> Sensitive site selection and siting of construction facilities. Dust control and suppression measures, such as use of dampening and proper containment.
<ul style="list-style-type: none"> Emissions from construction and maintenance activities, use of vessels, and transport of certain materials (e.g. fuels, chemicals) affecting sensitive receptors (human, flora, fauna). 	<ul style="list-style-type: none"> Sensitive site selection and layout. Use of modern equipment meeting appropriate emissions standards, and regular preventative maintenance. Increasing fuel efficiency. No use of ozone depleting substances during construction. Transport volatile materials under appropriate storage conditions.
<p>Noise and Vibration</p> <ul style="list-style-type: none"> Noise and vibration from construction and maintenance equipment, traffic and activities, may disturb sensitive noise receptors (human, fauna). 	<ul style="list-style-type: none"> Sensitive local access route selection, and siting of construction facilities, accompanied where necessary by noise attenuation measures. Use of modern, well maintained equipment fitted with abatement devices (e.g. mufflers, noise enclosures). Strict controls of timing of activities, e.g. blasting and other high noise emissions; prohibition on night working if possible. Observance of seasonal sensitivities (e.g. breeding seasons), and alteration of activity to reduce noise levels at that time
<ul style="list-style-type: none"> Noise and vibration from vehicles and vessels during operation may disturb sensitive noise receptors (human and fauna). 	<ul style="list-style-type: none"> Sensitive local access route selection (e.g. avoiding proximity to communities), and siting of permanent facilities. Use of noise barriers to screen receptors, e.g. with berms or bunds.
<ul style="list-style-type: none"> Underwater noise, e.g. from piling, dredging or vessels may disturb sensitive aquatic and/or marine species (e.g. fish, marine mammals). 	<ul style="list-style-type: none"> Use of best practicable means to reduce noise and vibration impacts, e.g. "slow start"/"soft start" piling, effective equipment maintenance and the use of enclosures
<p>Resources and Waste</p> <ul style="list-style-type: none"> Construction and operation will require supply of water (surface or groundwater), which could affect existing supply for human communities and ecosystems. 	<ul style="list-style-type: none"> Water study prior to any abstraction, to inform a Sustainable Water Management Plan. No abstraction without prior approval of relevant authorities at all locations. Promotion of water efficiency (including leak detection, preventative maintenance of equipment) and water recycling.
<ul style="list-style-type: none"> Inefficient waste management during construction, operation and maintenance leading to excess consumption of materials, generation of wastes/emissions, pollution of soils and water. 	<ul style="list-style-type: none"> Preparation of Waste Management Plan following the waste hierarchy, supported by staff training. Inclusion of all ship wastes and discharge of ballast water within the Waste Management Plan. Earthworks to be designed to achieve a balance between cut and fill wherever possible. Use of authorised contractors for hazardous and any other wastes which the project cannot dispose of safely.
<p>Loss, fragmentation and degradation of habitat, and severance of animal migration routes and pathways</p> <ul style="list-style-type: none"> Land clearance and dredging during construction and maintenance causing loss or fragmentation of protected or ecologically sensitive areas and other areas of conservation interest (e.g. wetland habitats, mangroves, coral reefs), and degradation following poorly managed rehabilitation. 	<ul style="list-style-type: none"> Careful site selection and siting of all project components, with advice from biodiversity authorities/wildlife specialists. Wherever feasible, establishment of buffer zones around marine, aquatic or terrestrial conservation areas, watercourses, and other locations identified as ecologically sensitive and avoidance or minimisation of activity within these zones. Rehabilitation of cleared areas with native species, and ecosystem restoration in habitats of conservation value, using specialist advice and input, backed up by a long-term monitoring programme and corrective actions as necessary.
<ul style="list-style-type: none"> Severance of aquatic routes and watercourses used for migration or for access to feeding and breeding areas, and impedance of fish coastal migration routes by jetties, wharves, and other structures protruding from the coast. 	<ul style="list-style-type: none"> Sensitive site selection and design of in-water components. Use of fish passes etc. to avoid impacts on animal movement.

Impacts	Mitigation
<ul style="list-style-type: none"> Impacts on habitats and species from habitat alteration and degradation (e.g. from smothering by sediments disturbed or disposed of during dredging, changes in drainage, soil erosion, pollution of water, soils or air, introduction of invasive species). 	<p>Where development in sensitive areas cannot be avoided, mitigation may include:</p> <ul style="list-style-type: none"> Minimisation of area impacted, clear demarcation of remaining intact areas of habitat, and prohibition of activity into those areas for any purpose; maintenance of wildlife corridors between fragmented areas wherever possible. No ground clearance upstream of sensitive areas unless appropriately engineered drainage installed. Rigorous dredge disposal site selection within dredge management planning. Habitat rehabilitation and ecosystem restoration of areas no longer required after construction, as soon as possible. If loss of Critical Habitat is inevitable, development/implementation of an Offsets Programme. See relevant sections re: control of impacts relating to hydrology, pollution, invasive species, and induced access.
<ul style="list-style-type: none"> Disturbance and emissions from vehicles or vessels affecting the integrity and viability of areas of conservation interest. 	See also Air Quality and Noise /Vibration above.
<p>Impacts from Induced Access</p> <ul style="list-style-type: none"> Port developments served by new or improved transport links from remote areas will facilitate access to those areas, which could lead to land clearance for agriculture, and increased disturbance and pressure on natural resources. 	<ul style="list-style-type: none"> Careful site selection and siting of all project components, with advice from biodiversity authorities/wildlife specialists to avoid remote and previously inaccessible areas where possible. Development of a construction camp siting strategy to avoid attracting people towards more remote areas, where possible. Restrictions on access to all temporary access roads, and their removal after construction.
<p>Direct Impacts on Flora and Fauna</p> <ul style="list-style-type: none"> Clearance of vegetation and dredging of the sea/river bed may lead to loss of plant and animal species and habitat of conservation interest. Direct mortality to aquatic animals from collisions with vessels, entrainment during dredging, or smothering during dredge disposal. Port development could displace animals and disturb their habitats, by direct disturbance during construction and operation (e.g. from noise – including underwater noise, light disturbance at night, general human presence). 	<ul style="list-style-type: none"> Careful site selection and siting of all project components, with advice from biodiversity authorities/wildlife specialists. Siting of shipping and approach lanes to avoid areas that are ecologically sensitive or otherwise of conservation interest (e.g. coral reefs, fish breeding grounds, mangroves). Careful planning of phasing and timing of construction and maintenance activities, in particular dredging. Demarcation and avoidance of areas of conservation interest (high value species, feeding or breeding sites, migration routes, etc.) where possible, and wildlife rescue and translocation where appropriate, under expert supervision. Implementation of speed restrictions for vessels, and observation and avoidance procedures for sensitive marine/aquatic species. <p>Also see measures under Hydrology, Soils, Run-off and Flooding, Pollution of Soils and Water, and Induced Access above, and Invasive Species below.</p>
<p>Invasive Species</p> <ul style="list-style-type: none"> Movement of plant and workforce into areas, and of vessels during operation, could introduce invasive species which adversely impact fauna, flora, ecosystems, and crops. The introduction of invasive species via ballast water carried by vessels is a particular concern. 	<ul style="list-style-type: none"> Invasive Species Management Plan, which should be developed and implemented in consultation with authorities, including appropriate eradication measures for different species/groups of species; this must include appropriate management of ballast water. Staff training and awareness raising in communities. No introduction of exotic species (e.g. for site rehabilitation) without specialist vetting and government approval.
<p>Direct Impacts on Flora and Fauna</p> <ul style="list-style-type: none"> Clearance of vegetation and dredging of the sea/river bed may lead to loss of plant and animal species and habitat of conservation interest. Direct mortality to aquatic animals from collisions with vessels, entrainment during dredging, or smothering during dredge disposal. Port development could displace animals and disturb their habitats, by direct disturbance during construction and operation (e.g. from noise – including underwater noise, light disturbance at night, general human presence). 	<ul style="list-style-type: none"> Careful site selection and siting of all project components, with advice from biodiversity authorities/wildlife specialists. Siting of shipping and approach lanes to avoid areas that are ecologically sensitive or otherwise of conservation interest (e.g. coral reefs, fish breeding grounds, mangroves). Careful planning of phasing and timing of construction and maintenance activities, in particular dredging. Demarcation and avoidance of areas of conservation interest (high value species, feeding or breeding sites, migration routes, etc.) where possible, and wildlife rescue and translocation where appropriate, under expert supervision. Implementation of speed restrictions for vessels, and observation and avoidance procedures for sensitive marine/aquatic species. <p>Also see measures under Hydrology, Soils, Run-off and Flooding, Pollution of Soils and Water, and Induced Access above, and Invasive Species below.</p>

Impacts	Mitigation
<p>Invasive Species</p> <ul style="list-style-type: none"> • Movement of plant and workforce into areas, and of vessels during operation, could introduce invasive species which adversely impact fauna, flora, ecosystems, and crops. The introduction of invasive species via ballast water carried by vessels is a particular concern. 	<ul style="list-style-type: none"> • Invasive Species Management Plan, which should be developed and implemented in consultation with authorities, including appropriate eradication measures for different species/groups of species; this must include appropriate management of ballast water. • Staff training and awareness raising in communities. • No introduction of exotic species (e.g. for site rehabilitation) without specialist vetting and government approval.
<p>Physical and Economic Displacement of People, Property, Assets and Resources</p> <ul style="list-style-type: none"> • Development or upgrading of ports may physically displace people, or lead to the loss of assets or income, e.g. from fishing grounds, agricultural land. 	<ul style="list-style-type: none"> • Careful site selection and siting of all project components, and avoid occupation of areas which are inhabited or regarded as of high value by communities (e.g. fishing grounds, areas of high agricultural value) where possible. • Early development and sensitive implementation of resettlement planning, in accordance with national regulations and international good practice to compensate for any losses (both physical and economic).
<p>Economic Development and Employment</p> <ul style="list-style-type: none"> • Direct employment of local population in workforce, and stimulation of local economy through demand for goods and services will enhance livelihoods and economic activity in local communities, but potentially adverse effects if expectations not met and community relations are not well managed. 	<ul style="list-style-type: none"> • Development of an Employment Plan, with clear employment requirements and procedures for the construction and operational/maintenance workforce. • Transparent and culturally appropriate communication with communities regarding employment opportunities. • Fair and transparent hiring and staff management procedures. • Employment requirements and vocational training plan to be agreed with local institutions, so that local people can be trained to meet the project's needs in a timely fashion. • Development of measures to manage the transition after construction is complete, including SME development, ongoing opportunities for the workforce in port management and maintenance, reskilling and alternative employment.
<ul style="list-style-type: none"> • Procurement of local goods and services for the port development and workforce could deplete resources available for local communities 	<ul style="list-style-type: none"> • Procedures for sustainable local procurement, in consultation with local authorities and community leaders. • Local capacity building to foster community resilience. • Monitoring of local prices; exploration of corrective measures (e.g. alternative sourcing) if appropriate.
<p>Cultural Heritage</p> <ul style="list-style-type: none"> • Displacement or damage to cultural heritage sites (including marine archaeological sites) by construction activities, harm to the setting, amenity value, etc. of the site due to port construction or operation. • Change to intangible cultural heritage due to increased access, and interaction with workforce. 	<ul style="list-style-type: none"> • Careful site selection and siting of all project components, taking account of community consultation/specialist surveys. • Development of a Cultural Heritage Management Plan covering tangible and intangible (e.g. local traditions and practices) cultural heritage. • Implementation of a "Chance Finds" procedure during construction. <p>See also Guidance Note on Physical Cultural Heritage.</p>
<p>Community Health, Safety and Security</p> <ul style="list-style-type: none"> • Poor construction management practices may lead to adverse effects on safety, human health and wellbeing (e.g. disruption to drainage/flows creates stagnant waters). 	<ul style="list-style-type: none"> • Good construction site "housekeeping" and management procedures (including site access, disease control measures). • Risk assessments and emergency response planning to consider impacts on local communities • See also control of pollution under Physical Impacts heading.
<ul style="list-style-type: none"> • Interaction between workforce and local communities may increase occurrence of communicable diseases, including HIV/AIDS and sexually transmitted diseases (STDs). • Improved communications between centres of population and between rural and urban areas may increase transmission and incidence of communicable diseases. 	<ul style="list-style-type: none"> • Implementation of a health management system for the construction workforce, to ensure it is fit for work and that it will not introduce disease into local communities. • Training and awareness training for workforce and their dependents on HIV/AIDS and other STDs, and communicable diseases including malaria; health awareness raising campaigns for communities on similar topics.
<ul style="list-style-type: none"> • Risks to local fishermen, boats etc. from collisions with vessels, and from transport of dangerous goods. 	<ul style="list-style-type: none"> • Avoid incidents through implementation of a Safety Management Plan (e.g. establishment of exclusion/transit zones, use of patrol vessels, communication of risks to local communities, preparation of spill prevention and control procedures). • Implementation of an Emergency Response Plan to manage major incidents if they should occur.

Impacts	Mitigation
<ul style="list-style-type: none"> Potential safety risks associated with increased traffic in the area around the port, including project-related vehicles (e.g. mobile machinery; trucks transporting fuel, equipment, construction materials or cargo; buses for transport of the workforce or passengers within, and to and from the port) and other vehicles (e.g. private cars, buses, trucks transporting people and cargo to and from the site). 	<ul style="list-style-type: none"> Adoption of best transport safety practices for project vehicles, e.g. improving driver skills, limiting trip duration and vehicle speed. Regular maintenance of project vehicles to reduce risk of traffic accidents. Collaboration with local communities and authorities to improve road safety and increase traffic awareness. Implementation of an Emergency Response Plan to manage major road incidents if they should occur.
<p>Workforce-Community Interactions</p> <ul style="list-style-type: none"> Real or perceived disruption to normal community life, through the physical presence of a workforce. 	<ul style="list-style-type: none"> Adoption of a Stakeholder Engagement Plan, as a framework for early and ongoing community consultation. Implementation of a Grievance Procedure (see Grievance Procedure and Redress Mechanisms guidance note). Works procedures, defining a Code of Appropriate Conduct for all workers. Training for all staff in acceptable behaviour with respect to community interactions.
<p>In-migration</p> <ul style="list-style-type: none"> Individuals are likely to migrate into the area which may cause conflict with resident communities, and put pressure on resources and infrastructure. 	<ul style="list-style-type: none"> Careful site selection and siting of all project components, after consultation with communities and local authorities. Preparation and implementation of an Influx/In-migration Management Plan, in consultation with local authorities. <p>See also Economic Development and Employment, and Induced Access above.</p>
<p>Labour and Working Conditions</p> <ul style="list-style-type: none"> Poor management of occupational health and safety leading to accidents, injuries and illnesses among workers; mental health issues due to remote or enclosed living. Differences in nationality, ethnicity, religion, etc. may lead to discrimination and harassment, and differences (perceived or real) in working conditions between workers may lead to resentments. 	<ul style="list-style-type: none"> Employment practices and working conditions should conform to International Labour Organisation (ILO) Standards and national regulations. Rest and recreational facilities and time should be provided, and rules on alcohol and drugs defined and clearly communicated to workers. The basis for differences in the standard of accommodation should be non-discriminatory; it should be documented and communicated transparently to the workforce. Clear and comprehensive health and safety reporting and grievance procedure system should be established, and be freely available to all of the workforce. <p>See also Employment and Economic Development above.</p>



TRANSPORT SECTOR: AIRPORT SYSTEMS

Investment in airports facilitates the movement of people and goods, and contributes to economic development and quality of life through trade, enhanced transport links and tourism. However, their construction, rehabilitation and maintenance can result in significant direct and indirect impacts on the environment, including disruption or contamination of ground and surface waters, soil destabilization, habitat destruction, and loss or disturbance of fauna and flora. Airport development may also be a source of adverse impacts on the human environment, particularly the displacement and resettlement of affected families and businesses, and health and safety.

Scope and structure

This keysheet provides a summary of the activities, typical environmental and social impacts, and potential mitigation and management measures relating to the development of airports. The types of airport developments covered are construction or rehabilitation and major maintenance programmes for airports of a sufficient size to require man-made runways (i.e. not grass or dirt landing strips).

This keysheet should be used specifically to help with drafting ToRs for ESIs of airport developments and with scoping and conducting ESIs and preparing ESMPs. It can also help in reviewing ESIs. It should be used in conjunction with the Bank's Guidance Notes on ESIs (including coverage of cumulative impacts) and with the Guidance Notes on specific safeguard topics including transboundary projects.

The keysheet is organised under the following headings, with substantive information provided in table form:

- project components and activities.

- sources of impact and receptors/resources.
- mitigation and management options.

The phases of airport development projects considered are: design and planning, including site selection; construction; operation and maintenance; and where appropriate decommissioning (closure).

Project components and activities

The components of airport developments are provided in Table 1, along with the activities involved in developing new or upgraded airports, and in operating airports, broken down by project phase.

Sources of impact, receptors/resources, and mitigation

Table 2 summarizes the main aspects of airport development activities that lead to typical impacts, the receptors and resources they affect, and options for mitigation. It considers impacts on the physical, biological and socioeconomic environment. The mitigation measures described assume that higher level design and site planning measures, as described in Table 1, have already been implemented.

The guidance on impacts and options for their mitigation can be used to help discussions with the borrower or client and improve their understanding of the Bank's requirements. It should also be used to assist preparation of ToRs for an ESI so that they are tailored to the particular circumstances of the airport development under consideration.

Table 1: Summary of Activities associated with Airport Infrastructure Development

Components	
<p>Airport</p> <ul style="list-style-type: none"> Runway (various dimensions and materials). Terminal buildings. Ground facilities, e.g. air traffic control centre, onsite emergency services, maintenance and refuelling areas. Storage areas (for goods, fuel, vehicles, aircraft) Drainage and erosion control structures. Safety and security measures (e.g. barriers, fencing, navigation aids). Other elements (e.g. power supply, signage, lighting). 	<p>Ancillary facilities</p> <ul style="list-style-type: none"> Temporary construction facilities (e.g. workshops, laydown areas, workers' accommodation, quarries and borrow pits). Security posts and infrastructure. Access roads within and between temporary facilities and the airport, permanent access roads and other transport links. Landscaping features, etc.
Activity (1)	
Design – Site Selection and Planning	<p>Screening , Scoping and ESIA</p> <p>Preparation of ESMP</p> <p>Agreement of loan covenants</p>
<p>Strategic planning (options analysis, cost-benefit analysis, strategic site selection, initial design), and for major transport network development, strategic environmental and social assessment (SESA), to establish:</p> <ul style="list-style-type: none"> Major environmental and social constraints and alternatives (e.g. with respect to major settlements, watersheds and areas of biodiversity conservation importance). Design procedures such that environmental and social considerations are given equal weight to engineering and financial ones. 	
<p>Site-specific planning (detailed design), taking account of environmental and social sensitivities and consultation with communities, drawing upon the following environmental and socioeconomic documentation, all of which should comply with national regulations and international good practice:</p> <ul style="list-style-type: none"> Environmental and Social Impact Assessment (ESIA); Environmental and Social Management Plan (ESMP); Stakeholder Engagement Plan (SEP); and Resettlement Action Plan (RAP). 	
Activity (2)	
Construction	<p>Monitoring of ESMP performance</p> <p>Monitoring of compliance with loan covenants</p> <p>Monitoring of sub-contractor contract provisions</p>
<p>Construction activities will include:</p> <ul style="list-style-type: none"> Establishing temporary access to work and ancillary areas, demarcating clearance zones, establishing access control. Clearance and levelling of the airport footprint, and major earthworks where required. Construction of airport infrastructure. Location and development of borrow pits and possibly quarries, import of materials, e.g. aggregate/ballast. Sourcing and establishing a water supply from surface and/or groundwater. Improvement of existing drainage and introduction of new drainage, including culverts if required. Establishment or improvement of safety arrangements e.g. navigation aids, lighting. Landscaping, as required. 	
<p>The equipment required will include heavy mobile plant (e.g. graders, bulldozers, excavators) and temporary fixed plant such as concrete batching plant and power generators</p>	
Operation and Maintenance	Project implementation: Compliance Monitoring
<p>During operation activities will include arrival and departure of aircraft, increased flow of ground traffic at the airport and in the surrounding area; loading, unloading and storage of cargo, which may include hazardous materials; operation of equipment, e.g. transport of passengers; provision of water and energy supply, sewerage treatment and disposal etc. to aircraft and vehicles, and to airport facilities. These activities may contribute to direct and indirect impacts described in Table 2.</p>	
<p>Airport maintenance will entail many of the activities described above for the construction phase, although in general they are likely to be smaller in scale and spatial extent. It will include activities such as runway and road maintenance. Maintenance of aircraft will include mechanical repair and maintenance, and engine servicing.</p>	
Decommissioning (Closure)	Project Completion: Compliance Report
<p>Where temporary roads and facilities used in airport construction are no longer required (if, for example, they are not required for maintenance) they should be decommissioned and rehabilitated in accordance with a site-specific closure plan developed in consideration of international good practice. The decommissioning process will include site clearance, removal of all equipment, appropriate disposal of waste materials, soil ripping and re-grading where necessary.</p>	
<p>Airports are normally intended to operate for a prolonged period, and so it would not be appropriate for closure or decommissioning plans to be prepared until a few years prior to this occurring.</p>	

Table 2: Airport Developments: Impacts and Mitigation

Impacts	Mitigation
<p>Geology/Hydrogeology/Hydrology</p> <ul style="list-style-type: none"> • Interruption of hydrogeology and groundwater flows from excavation and ground clearance; pollution of groundwater from discharges and accidental releases. 	<ul style="list-style-type: none"> • Site selection to take account of local hydrological conditions (e.g. where possible avoid watercourses, springs, shallow water table). • Limit sealed or compacted areas as much as possible, to maintain natural recharge of the water table. • Avoid removing material below the water table. <p>See Pollution of Soils and Water below.</p>
<p>Soils, Run-off and Flooding</p> <ul style="list-style-type: none"> • Loss, damage or disruption of soil/sediments. 	<ul style="list-style-type: none"> • Minimisation of cleared areas and soil disturbance, with revegetation as soon as feasible, with native species. • Early installation and regular maintenance of drainage and diversion structures, silt traps, etc; drainage outlets to discharge into vegetated areas if possible; vegetation along watercourses and drainage lines to be retained if possible. • Avoidance of areas liable to flooding, slope instability, and water crossings where possible. • Retention of topsoil for restoration (including tilling and revegetation) as soon as practicable. • Careful design: e.g. site selection, minimal diversion, timing of works (overall duration and seasonality)
<ul style="list-style-type: none"> • Introduction of sediments to watercourses or interruption of drainage patterns, as a result of ground clearance, earthworks and the introduction of drainage structures. 	
<p>Pollution of Soils and Water</p> <ul style="list-style-type: none"> • Discharge of construction and operation workforce and passenger sewage effluent polluting watercourses. 	<ul style="list-style-type: none"> • Implementation of standard good wastewater management procedures. • Installation of sewage treatment to meet required standards; hygiene training for workforce.
<ul style="list-style-type: none"> • Release of hazardous substances during construction, or operation (e.g. runoff during maintenance, accidental spills/leaks) leading to soil, surface or groundwater contamination. 	<ul style="list-style-type: none"> • Materials handling and control procedures. • Control of construction vehicle movements and prohibition of vehicle washing in watercourses, and similar practices. • Development of emergency response plans during construction (contractors and local authorities) and operation (local authorities) to manage major incidents if they should occur.
<p>Air Quality</p> <ul style="list-style-type: none"> • Dust from construction activities could affect human health, vegetation and wildlife. 	<ul style="list-style-type: none"> • Sensitive site selection and siting of construction facilities. • Dust control and suppression measures, such as use of dampening.
<ul style="list-style-type: none"> • Emissions from construction and maintenance activities, exhausts from takeoff and landings by aircraft and ground operations affecting sensitive receptors (human, flora, fauna). 	<ul style="list-style-type: none"> • Sensitive site selection, taking account of locations of sensitive receptors under landing and take-off flight paths. • Use of modern equipment and ground vehicles meeting appropriate emissions standards, with regular preventative maintenance. • Increasing fuel efficiency of ground vehicles and equipment, and selection of fuel in order to minimise harmful emissions. • No use of ozone depleting substances during construction.
<p>Noise and Vibration</p> <ul style="list-style-type: none"> • Noise and vibration from construction and maintenance equipment, traffic and activities, may disturb sensitive noise receptors (human, fauna). 	<ul style="list-style-type: none"> • Sensitive local access route selection, and siting of construction facilities, accompanied where necessary by noise attenuation measures. • Use of modern, well maintained equipment fitted with abatement devices (e.g. mufflers, noise enclosures). • Strict controls of timing of activities, e.g. blasting and other high noise emissions; prohibition on night working if possible. • Observance of seasonal sensitivities (e.g. breeding seasons), and alteration of activity to reduce noise levels at that time.
<ul style="list-style-type: none"> • Noise and vibration from vehicles and aircraft during operation may disturb sensitive noise receptors (human and fauna). 	<ul style="list-style-type: none"> • Sensitive local access route selection (e.g. avoiding proximity to communities), and siting of permanent facilities. • Use of noise barriers to screen receptors, e.g. with berms or bunds. • Strict controls of timing of activities, e.g. air traffic minimised at night.
<p>Resources and Waste</p> <ul style="list-style-type: none"> • Construction and operation will require supply of water (surface or groundwater), which could affect existing supply for human communities and ecosystems 	<ul style="list-style-type: none"> • Water study prior to any abstraction, to inform a Sustainable Water Management Plan • No abstraction without prior approval of relevant authorities at all locations • Promotion of water efficiency (including leak detection, preventative maintenance of equipment) and water recycling

Impacts	Mitigation
<ul style="list-style-type: none"> Inefficient waste management during construction, operation and maintenance leading to excess consumption of materials, generation of wastes/emissions, pollution of soils and water 	<ul style="list-style-type: none"> Preparation of Waste Management Plan following the waste hierarchy, supported by staff training Earthworks to be designed to achieve a balance between cut and fill wherever possible Use of authorised contractors for hazardous and any other wastes which the project cannot dispose of safely
<p>Loss, fragmentation and degradation of habitat, and severance of animal migration routes and pathways</p> <ul style="list-style-type: none"> Land clearance during construction and maintenance causing loss or fragmentation of protected or ecologically sensitive areas and other areas of conservation interest, and degradation following poorly managed rehabilitation. 	<ul style="list-style-type: none"> Careful site selection and siting of all project components, with advice from biodiversity authorities/wildlife specialists. Wherever feasible, establishment of buffer zones around conservation areas, watercourses, and other locations identified as ecologically sensitive and avoidance or minimisation of activity within these zones. Rehabilitation of cleared areas with native species, and ecosystem restoration in habitats of conservation value, using specialist advice and input, backed up by a long-term monitoring programme and corrective actions as necessary.
<ul style="list-style-type: none"> Severance of terrestrial and aerial routes used for migration or for access to feeding and breeding areas. 	<ul style="list-style-type: none"> Sensitive site selection and siting of all project components. Observance of seasonal sensitivities (e.g. breeding seasons), and alteration of construction activity to reduce impacts at those times.
<ul style="list-style-type: none"> Impacts on habitats and species from habitat alteration and degradation (e.g. changes in drainage, soil erosion, pollution of water, soils or air, introduction of invasive species). 	<p>Where development in sensitive areas cannot be avoided, mitigation may include:</p> <ul style="list-style-type: none"> Minimisation of area impacted, clear demarcation of remaining intact areas of habitat, and prohibition of activity into those areas for any purpose; maintenance of wildlife corridors between fragmented areas wherever possible. No ground clearance upstream of sensitive areas unless appropriately engineered drainage installed. Habitat rehabilitation and ecosystem restoration of areas no longer required after construction, as soon as possible. If loss of Critical Habitat is inevitable, development/implementation of an Offsets Programme <p>See relevant sections re: control of impacts relating to hydrology, pollution, invasive species, and induced access.</p>
<ul style="list-style-type: none"> Disturbance and emissions from ground vehicles or aircraft affecting the integrity and viability of areas of conservation interest. 	<p>See control of air quality and noise / vibration impacts above</p>
<p>Impacts from Induced Access</p> <ul style="list-style-type: none"> Airport developments could facilitate access to areas not previously exploited, and so lead to land clearance for agriculture, and increased disturbance and pressure on natural resources. 	<ul style="list-style-type: none"> Careful site selection and siting of all project components, with advice from biodiversity authorities/wildlife specialists to avoid remote and previously inaccessible areas if possible. Siting of construction camp(s) to avoid attracting people towards more remote areas in the region of the airport development. Restrictions on access to all temporary access roads, and their removal after construction.
<p>Direct Impacts on Flora and Fauna</p> <ul style="list-style-type: none"> Clearance of vegetation may lead to loss of plant species and habitat of conservation interest. Direct mortality to birds / bats from collisions with aircraft, especially at takeoff and landing. Airport development could displace animals and disturb their habitats, by direct disturbance during construction and operation (e.g. from noise, light disturbance at night). 	<ul style="list-style-type: none"> Careful site selection and siting of all project components, with advice from biodiversity authorities/wildlife specialists. Careful planning of phasing and timing of construction activities. Demarcation and avoidance of areas of conservation interest (high value species, feeding or breeding sites, migration routes, etc.) where possible, and wildlife rescue and translocation where appropriate, under expert supervision Measures to control noise impacts (e.g. noise barriers) and light pollution (e.g. directional lighting and light shielding) Implementation of procedures to deter birds (e.g. "bird-scarers") <p>Also see measures under Hydrology, Soils, Run-off and Flooding, Pollution of Soils and Water, Noise and Vibration, and Induced Access above, and Invasive Species below</p>

Impacts	Mitigation
<p>Invasive Species</p> <ul style="list-style-type: none"> • Movement of plant and workforce into areas could introduce invasive species which adversely impact fauna, flora, ecosystems, and crops. • Invasive and exotic species could be introduced on aircraft, either accidentally or deliberately. 	<ul style="list-style-type: none"> • Invasive Species Management Plan, which should be developed and implemented in consultation with authorities, including appropriate eradication measures for different species/groups of species. • Staff training and awareness raising in communities. • No introduction of exotic species (e.g. for site rehabilitation) without specialist vetting and government approval. • Comprehensive operational invasive species control measures and staff training (e.g. border control and customs).
<p>Physical and Economic Displacement of People, Property, Assets and Resources</p> <ul style="list-style-type: none"> • Development or upgrading of airports may physically displace people, or lead to the loss of assets or income. 	<ul style="list-style-type: none"> • Careful site selection and siting of all project components, and avoid occupation of areas which are inhabited or regarded as of high value by communities (e.g. horticulture, community orchards) where possible. • Early development and sensitive implementation of resettlement planning, in accordance with national regulations and international good practice to compensate for any losses (both physical and economic).
<p>Economic Development and Employment</p> <ul style="list-style-type: none"> • Direct employment of local population in workforce, and stimulation of local economy through demand for goods and services will enhance livelihoods and economic activity in local communities, but potentially adverse effects if expectations not met and community relations are not well managed. 	<ul style="list-style-type: none"> • Development of an Employment Plan, with clear employment requirements and procedures for the construction and operational/maintenance workforce. • Transparent and culturally appropriate communication with communities regarding employment opportunities. • Fair and transparent hiring and staff management procedures. • Employment requirements and vocational training plan to be agreed with local institutions, so that local people can be trained to meet the project's needs in a timely fashion. • Development of measures to manage the transition after construction is complete, including SME development, ongoing opportunities for the workforce in airport management and maintenance, reskilling and alternative employment.
<ul style="list-style-type: none"> • Procurement of local goods and services for the airport development and workforce could deplete resources available for local communities. 	<ul style="list-style-type: none"> • Procedures for sustainable local procurement, in consultation with local authorities and community leaders • Local capacity building to foster community resilience. • Monitoring of local prices; exploration of corrective measures (e.g. alternative sourcing) if appropriate.
<p>Cultural Heritage</p> <ul style="list-style-type: none"> • Displacement or damage to cultural heritage sites by construction activities, harm to the setting, amenity value, etc. of the site due to airport construction or operation. • Change to intangible cultural heritage due to increased access, and interaction with workforce. 	<ul style="list-style-type: none"> • Careful site selection and siting of all project components, taking account of community consultation/specialist surveys. • Development of a Cultural Heritage Management Plan covering tangible and intangible (e.g. local traditions and practices) cultural heritage. • Implementation of a "Chance Finds" procedure during construction. See also Guidance Note on Physical Cultural Heritage.
<p>Community Health, Safety and Security</p> <ul style="list-style-type: none"> • Poor construction management practices may lead to adverse effects on safety, human health and wellbeing. 	<ul style="list-style-type: none"> • Good construction site "housekeeping" and management procedures (including site access, disease control measures). • Risk assessments and emergency response planning to consider impacts on local communities. See also control of pollution under Physical Impacts heading.
<ul style="list-style-type: none"> • Interaction between workforce and local communities may increase occurrence of communicable diseases, including HIV/AIDS and sexually transmitted diseases (STDs). • Improved communications between centres of population and between rural and urban areas may increase transmission and incidence of communicable diseases. 	<ul style="list-style-type: none"> • Implementation of a health management system for the construction workforce, to ensure it is fit for work and that it will not introduce disease into local communities. • Training and awareness training for workforce and their dependents on HIV/AIDS and other STDs, and communicable diseases including malaria; health awareness raising campaigns for communities on similar topics.
<ul style="list-style-type: none"> • Potential safety risks associated with increased traffic in the area around the airport, including project-related vehicles (e.g. mobile machinery; trucks transporting fuel, equipment, construction materials and cargo; buses for transport of personnel and passengers within, and to and from the site) and other vehicles (e.g. private cars, buses, trucks transporting people and cargo to and from the site). 	<ul style="list-style-type: none"> • Adoption of best transport safety practices for project vehicles, e.g. improving driver skills, limiting trip duration and vehicle speed. • Regular maintenance of project vehicles to reduce risk of traffic accidents. • Collaboration with local communities and authorities to improve road safety and increase traffic awareness. • Implementation of an Emergency Response Plan to manage major road incidents if they should occur.

Impacts	Mitigation
<ul style="list-style-type: none"> Major incidents with potential for considerable loss of life or injury to passengers, airport staff, and the public, e.g. after aircraft accidents. 	<ul style="list-style-type: none"> Implementation of an Emergency Response Plan to manage major aircraft incidents if they should occur. Good maintenance of air traffic control and all other systems, and emergency response vehicles and equipment. Deployment of "bird-scaring" measures to reduce the risk of bird strikes.
<p>Workforce-Community Interactions</p> <ul style="list-style-type: none"> Real or perceived disruption to normal community life, through the physical presence of a workforce; 	<ul style="list-style-type: none"> Adoption of a Stakeholder Engagement Plan, as a framework for early and ongoing community consultation. Implementation of a Grievance Procedure (see Grievance Procedure and Redress Mechanisms guidance note). Works procedures, defining a Code of Appropriate Conduct for all workers. Training for all staff in acceptable behaviour with respect to community interactions.
<p>In-migration</p> <ul style="list-style-type: none"> Individuals are likely to migrate into the area which may cause conflict with resident communities, and put pressure on resources and infrastructure 	<ul style="list-style-type: none"> Careful site selection and siting of all project components, after consultation with communities and local authorities. Preparation and implementation of an Influx/In-migration Management Plan, in consultation with local authorities. <p>See also Economic Development and Employment, and Induced Access above.</p>
<p>Labour and Working Conditions</p> <ul style="list-style-type: none"> Poor management of occupational health and safety leading to accidents, injuries and illnesses among workers; mental health issues due to remote or enclosed living Differences in nationality, ethnicity, religion, etc. may lead to discrimination and harassment, and differences (perceived or real) in working conditions between workers may lead to resentments 	<ul style="list-style-type: none"> Employment practices and working conditions should conform to International Labour Organisation (ILO) Standards and national regulations. Rest and recreational facilities and time should be provided, and rules on alcohol and drugs defined and clearly communicated to workers. The basis for differences in the standard of accommodation should be non-discriminatory; it should be documented and communicated transparently to the workforce. Clear and comprehensive health and safety reporting and grievance procedure system should be established, and be freely available to all of the workforce. <p>See also Employment and Economic Development and Human Rights.</p>

TRANSPORT SECTOR: RAILWAY CONSTRUCTION AND RAIL TRANSPORTATION

Investment in rail infrastructure facilitates the movement of people and goods contributing to economic development and enhancing the quality of life. However, their construction, rehabilitation, maintenance and operation have often caused widespread adverse impacts on natural and human environments. Damage may include disruption or contamination of water courses and drainage systems, soil destabilization, habitat destruction and barrier effects, disturbance and loss of fauna and flora, displacement of communities and opening up frontier areas containing pristine landscapes. Rail development may also be a source of adverse impacts on the human environment, particularly the displacement and resettlement of affected families and businesses, and health and safety.

Scope and structure

This keysheet provides a summary of the activities, typical environmental and social impacts, and potential mitigation and management measures relating to the development of railways and to rail transportation. The types of rail developments covered are construction or rehabilitation and major maintenance programmes for long-distance passenger and freight railways, and commuter rail networks. Locomotive and rolling stock maintenance and repair during operation of a railway are also covered.

This keysheet should be used specifically to help with drafting ToRs for ESIA's of rail developments and with scoping and conducting ESIA's and preparing ESMPs. It can also help in reviewing ESIA's. This keysheet should be used specifically to help with drafting ToRs for ESIA's of biofuel projects and with scoping and conducting ESIA's and preparing ESMPs. It can also help in reviewing ESIA's.

The keysheet is organised under the following headings, with substantive information provided in table form:

- Project components and activities.
- Sources of impact and receptors/resources.
- Mitigation and management options.

The phases of rail development projects considered are: design and planning, including route (alignment) selection; construction; operation and maintenance; and where appropriate decommissioning (closure).

Project components and activities

The components of rail developments are provided in Table 1, along with the activities involved in developing new or upgraded railways, and in operating railways, broken down by project phase.

Sources of impact, receptors/ resources, and mitigation

Table 2 summarizes the main aspects of rail development activities that lead to typical impacts, the receptors and resources they affect, and options for mitigation. It considers impacts on the physical, biological and socioeconomic environment. The mitigation measures described assume that higher level design and alignment planning measures, as described in Table 1, have already been implemented.

The guidance on impacts and options for their mitigation can be used to help discussions with the borrower or /client and improve their understanding of the Bank's requirements. They should also be used to assist preparation of ToRs for an ESIA so that they are Terms of Reference, which can be tailored to the particular circumstances of the railway project under consideration.

Table 1: Summary of Activities associated with Railway Infrastructure Development

Components	
Rail <ul style="list-style-type: none"> • Railway – track, working/operational corridor, and if appropriate passing loops. • Locomotives and rolling stock (e.g. carriages, wagons). • Power supply. • Signalling equipment. • Crossings (e.g. bridges, culverts) and tunnels. • Drainage and erosion control structures. • Safety and security measures (e.g. barriers and fencing). • Other elements (e.g. signage). 	Ancillary facilities <ul style="list-style-type: none"> • Rail marshalling yards and depots, track maintenance and train servicing facilities. • Fuelling stations (with storage tanks, filling equipment). • Temporary construction facilities (e.g. workshops, laydown areas, working corridor outside the track, workers' accommodation, quarries and borrow pits). • Security posts and infrastructure. • Access roads within and between temporary facilities and the rail being developed, permanent maintenance roads. • Landscaping features, e.g. cuttings.
Activity (1)	
Design – Alignment Selection and Planning	Screening, Scoping and ESIA Preparation of ESMP Agreement of loan covenants
Strategic planning (transport options analysis, cost-benefit analysis, strategic alignment selection, initial design), and for major rail or rail network development, strategic environmental and social assessment (SESA), to establish: <ul style="list-style-type: none"> • Major environmental and social constraints and alternatives (e.g. with respect to major settlements, watersheds and areas of biodiversity conservation importance). • Design procedures such that environmental and social considerations are given equal weight to engineering and financial ones. 	
Site-specific planning (detailed design), taking account of environmental and social sensitivities and consultation with communities, drawing upon the following environmental and socioeconomic documentation, all of which should comply with national regulations and international good practice: <ul style="list-style-type: none"> • Environmental and Social Impact Assessment (ESIA). Environmental and Social Management Plan (ESMP). • Stakeholder Engagement Plan (SEP). Resettlement Action Plan (RAP). 	
Activity (2)	
Construction	Monitoring of ESMP performance Monitoring of compliance with loan covenants Monitoring of sub-contractor contract provisions
Construction activities will include: <ul style="list-style-type: none"> • Establishing temporary access to work and ancillary areas, demarcating clearance zones, establishing access control. • Clearance and levelling of the rail corridor, major earthworks (e.g. cuttings, embankments) and tunnels where required. • Location and development of borrow pits (and possibly quarries), import of materials, e.g. aggregate/ballast for trackbeds. • Construction of track, including laying sleepers and rails, connecting power supply. • Sourcing and establishing of a water supply from surface and/or groundwater. • Improvement of existing drainage and introduction of new drainage, including culverts if required. • Water crossings, e.g. construction or upgrading of bridges and culverts, including concrete batching for structures. • Establishment or improvement of safety arrangements e.g. level crossings, barriers. • Landscaping, as required. 	
The equipment required will include heavy mobile plant (e.g. graders, bulldozers, excavators) and temporary fixed plant such as concrete batching plant and power generators.	
Operation and Maintenance	Project implementation: Compliance Monitoring
During operation railway infrastructure will support rolling stock, including locomotives and rail cars, which will transport a range of materials (eg fuels, minerals, food, chemicals) in a variety of states (eg. loose/packaged, dry/wet). These activities may contribute to direct and indirect impacts described in Table 2.	
Railway maintenance will entail many of the activities described above for the construction phase, although in general they are likely to be smaller in scale and spatial extent. It will include activities such as trackbed maintenance and right-of-way maintenance. Maintenance of locomotives and rolling stock will include mechanical repair and maintenance and engine servicing.	
Decommissioning (Closure)	Project Completion: Compliance Report

Components	
Activity (2)	
<p>Where temporary roads and facilities used in rail construction are no longer required (if, for example, they are not required for maintenance) they should be decommissioned and rehabilitated in accordance with a site-specific closure plan developed in consideration of international good practice. The decommissioning process will include site clearance, removal of all equipment, appropriate disposal of waste materials, soil ripping and re-grading where necessary.</p> <p>Railways are normally intended to operate for a prolonged period, and so it would not be appropriate for closure or decommissioning plans to be prepared until a few years prior to this occurring.</p>	

Table 2: Railway Developments: Impacts and Mitigation

Impacts	Mitigation
<p>Geology/Hydrogeology</p> <ul style="list-style-type: none"> • Interruption or disruption of surface and groundwater flows from construction, excavation and ground clearance. 	<ul style="list-style-type: none"> • Alignment to take account of local hydrological conditions (e.g. avoid watercourses, springs, shallow water table). • Limit sealed or compacted areas as much as possible, to maintain natural recharge of the water table. • Avoid removing material below the water table.
<ul style="list-style-type: none"> • Pollution of groundwater from discharges and accidental releases. 	See Pollution of Soils and Water below
<p>Soils, Run-off and Flooding</p> <ul style="list-style-type: none"> • Loss, damage or disruption of soil/sediments. 	<ul style="list-style-type: none"> • Minimisation of cleared areas and soil disturbance, with revegetation as soon as feasible (with native species). • Early installation and regular maintenance of drainage and diversion structures, silt traps, etc; drainage outlets to discharge into vegetated areas if possible; vegetation along watercourses and drainage lines to be retained if possible. • Avoidance of areas liable to flooding, slope instability, and water crossings where possible. • Retention of topsoil for restoration (including tilling and revegetation) as soon as practicable. • Restrictions on work and other activities around waterbodies, or minimisation measures around water crossings. • Careful design: e.g. alignment, minimal diversion, timing of works (overall duration and seasonality).
<p>Pollution of Soils and Water</p> <ul style="list-style-type: none"> • Discharge of construction workforce and passenger sewage effluent polluting watercourses. 	<ul style="list-style-type: none"> • Implementation of standard good wastewater management procedures. • Installation of sewage treatment to meet required standards; hygiene training for workforce.
<ul style="list-style-type: none"> • Release of hazardous substances during construction or operation (e.g. accidental spills and leaks, runoff during maintenance) leading to soil, surface or groundwater contamination. 	<ul style="list-style-type: none"> • Materials handling and control procedures, use of storage and containment equipment meeting international standards. • Control of construction vehicle movements and prohibition of vehicle washing in watercourses, and similar practices. • Emergency response plans during construction (contractors and local authorities) and operation (local authorities).
<p>Air Quality</p> <ul style="list-style-type: none"> • Dust from construction activities, and from transport of certain materials (e.g. minerals), could affect human health, vegetation and wildlife. 	<ul style="list-style-type: none"> • Sensitive local alignment selection and siting of construction facilities. • Dust control and suppression measures, such as use of enclosed vehicles.
<ul style="list-style-type: none"> • Emissions from construction and maintenance activities, use of rolling stock, and transport of certain materials (e.g. fuels, chemicals) affecting sensitive receptors (human, flora, fauna). 	<ul style="list-style-type: none"> • Selected alignment to avoid excessive gradients which will require more power to pull loads up them. • Use of modern equipment meeting appropriate emissions standards, and regular preventative maintenance. • Increasing fuel efficiency, through rolling stock design and selection, driver training, fuel selection. • No use of ozone depleting substances during construction. • Transport volatile materials under appropriate storage conditions.

Impacts	Mitigation
<p>Noise and Vibration</p> <ul style="list-style-type: none"> Noise and vibration from construction and maintenance equipment, traffic and activities, may disturb sensitive noise receptors (human, fauna). 	<ul style="list-style-type: none"> Sensitive local access road route selection and siting of construction facilities, accompanied where necessary by noise attenuation measures. Use of modern, well maintained equipment fitted with abatement devices (e.g. mufflers, noise enclosures). Strict controls of timing of activities, e.g. blasting and other high noise emissions; prohibition on night working. Observance of seasonal sensitivities (e.g. breeding seasons), and alteration of activity to reduce noise levels at that time.
<ul style="list-style-type: none"> Noise and vibration from rolling stock during operation may disturb sensitive noise receptors (human, fauna). 	<ul style="list-style-type: none"> Sensitive local alignment selection (e.g. avoiding proximity to communities), and siting of permanent facilities. Use of noise barriers to screen receptors, e.g. with berms or bunds.
<p>Resources and Waste</p> <ul style="list-style-type: none"> Construction will require a supply of water (surface or groundwater) and of other resources (e.g. timber), which may affect supply for human communities and ecosystems. 	<ul style="list-style-type: none"> Water study prior to any abstraction, to inform a Sustainable Water Management Plan No abstraction without prior approval of relevant authorities at all locations. Promotion of water efficiency (including leak detection, preventative maintenance of equipment) and water recycling. Implementation of a procurement plan to ensure that resources are not obtained from unsustainable sources.
<ul style="list-style-type: none"> Inefficient waste management during construction, operation and maintenance leading to excess consumption of materials, generation of wastes/emissions, pollution of soils and water. 	<ul style="list-style-type: none"> Preparation of Waste Management Plan following the waste hierarchy, supported by staff training. Earthworks to be designed to achieve a balance between cut and fill wherever possible. Use of authorised contractors for hazardous and any other wastes which the project cannot dispose of safely.
<p>Loss, fragmentation and degradation of habitat, and severance of animal migration routes and pathways</p> <ul style="list-style-type: none"> Land clearance during construction or maintenance causing loss or fragmentation of protected or ecologically sensitive areas, and other areas of conservation interest, and degradation following poorly managed rehabilitation. 	<ul style="list-style-type: none"> Careful route alignment and siting of all project components, with advice from biodiversity authorities/wildlife specialists. Wherever feasible, establishment of buffer zones around conservation areas, watercourses, and other locations identified as ecologically sensitive and avoidance or minimisation of activity within these zones. Rehabilitation of cleared areas with native species, and ecosystem restoration in habitats of conservation value, using specialist advice and input so as to maintain the integrity of the habitat, backed up by a long-term monitoring programme and corrective actions as necessary.
<ul style="list-style-type: none"> Severance of terrestrial routes and watercourses used for migration or for access to feeding and breeding areas. 	<ul style="list-style-type: none"> Careful alignment selection and siting of all project components, with advice from biodiversity authorities/wildlife specialists. Maintenance of wildlife corridors between fragmented areas wherever possible. Wildlife crossings for terrestrial animals, and design of culverts/crossing structures to avoid impacts on animal movement.
<ul style="list-style-type: none"> Impacts on habitats and species from habitat alteration and degradation (e.g. from changes in drainage, soil erosion, pollution of water, soils or air, introduction of invasive species). 	<p>Where development in sensitive areas cannot be avoided, mitigation may include:</p> <ul style="list-style-type: none"> Minimisation of area impacted, clear demarcation of remaining intact areas of habitat, and prohibition of activity into those areas for any purpose; prohibit or minimise activities in vicinity of sensitive areas, e.g. upstream. Habitat rehabilitation and ecosystem restoration of areas no longer required to occur as soon as possible after construction. If loss of Critical Habitat is inevitable, development/implementation of an Offsets Programme. <p>See relevant sections re: control of impacts from pollution, invasive species, and induced access.</p>
<ul style="list-style-type: none"> Disturbance and emissions from trains affecting the integrity and viability of areas of conservation interest. 	<p>See control of air quality and noise / vibration impacts above.</p>

Impacts	Mitigation
<p>Impacts from Induced Access</p> <ul style="list-style-type: none"> Rail development into remote areas will facilitate human access, which can lead to land clearance for agriculture, and increased disturbance and pressure on natural resources through bushmeat hunting, logging, fire, etc. 	<ul style="list-style-type: none"> Careful alignment selection and siting of all project components, with advice from biodiversity authorities/wildlife specialists to avoid remote and previously inaccessible areas where possible. Siting strategy for construction camps to avoid attracting people towards more remote areas, where possible. Restrictions on access to all temporary access roads, and their removal after construction. Access controls on permanent access roads required for maintenance. See also Bushmeat Hunting below.
<p>Bushmeat Hunting</p> <ul style="list-style-type: none"> Construction activities and access to remote areas could lead to greater demand for bushmeat (from workforce and wider community), stimulate the wildlife trade and facilitate access to hunting areas 	<ul style="list-style-type: none"> Preparation of a Bushmeat Hunting and Wildlife Trade Management Plan, agreed with government authorities and implemented jointly. Prohibition on workforce hunting, selling, or purchasing bushmeat, and training to support this requirement. Prohibition on workforce (except security personnel) having guns in work areas or accommodation. Sensitisation and public awareness campaigns against hunting and bushmeat the trade amongst local communities.
<p>Direct Impacts on Flora and Fauna.</p> <ul style="list-style-type: none"> Clearance of vegetation may lead to loss of plant species and habitats of conservation interest. Direct mortality to animals from collisions with vehicles or rolling stock, or contact with electrified elements. Rail development could displace animals and disturb their habitats, by direct disturbance during construction and operation (e.g. from noise, light disturbance at night, general human presence). 	<ul style="list-style-type: none"> Careful alignment selection and siting of all project components, with advice from biodiversity authorities/ wildlife specialists. Careful planning of phasing and timing of construction activities. Demarcation and avoidance of areas of conservation interest (high value species, feeding or breeding sites, migration routes, etc.) where possible, and wildlife rescue and translocation where appropriate, under expert supervision. Use of barriers and fencing to limit animal movement within railway alignment. <p>Also see measures under soils, run-off and flooding, pollution of soils and water, noise / vibration and induced access above, and invasive species below.</p>
<p>Invasive Species</p> <ul style="list-style-type: none"> Movement of plant and workforce into areas, and of trains during operation, could introduce invasive species which adversely impact fauna, flora, ecosystems, and crops. 	<ul style="list-style-type: none"> Invasive Species Management Plan, which should be developed and implemented in consultation with authorities, including appropriate eradication measures for different species/groups of species. Staff training and awareness raising in communities. No introduction of exotic species (e.g. for site rehabilitation) without specialist vetting and government approval. Where possible, clearance of invasive species during routine maintenance of track and operational corridor.
<p>Physical and Economic Displacement of People, Property, Assets and Resources</p> <ul style="list-style-type: none"> Development or upgrading of railways may physically displace people, or lead to loss of assets. 	<ul style="list-style-type: none"> Careful alignment selection and siting of all project components, avoid occupation of areas which are inhabited or regarded as of high value by communities (e.g. horticulture, community orchards) where possible. Early development and sensitive implementation of resettlement planning, in accordance with national regulations and international good practice to compensate for any losses (both physical and economic).
<p>Economic Development and Employment</p> <ul style="list-style-type: none"> Direct employment of local population in workforce, and stimulation of local economy through demand for goods and services will enhance livelihoods and economic activity in local communities; potential for adverse effects if expectations not met and community relations are not well managed. 	<ul style="list-style-type: none"> Development of an Employment Plan, with clear employment requirements and procedures for the construction and operational/ maintenance workforce. Transparent and culturally appropriate communication with communities regarding employment opportunities. Fair and transparent hiring and staff management procedures. Employment requirements and vocational training plan to be agreed with local institutions, so that local people can be trained to meet the project's needs in a timely fashion. Development of measures to manage post-construction transition (e.g. SME development, ongoing opportunities for the workforce in railway management and maintenance, reskilling and alternative employment).

Impacts	Mitigation
<ul style="list-style-type: none"> Procurement of local goods and services for rail development and workforce could deplete resources available for local communities. 	<ul style="list-style-type: none"> Procedures for sustainable local procurement, in consultation with local authorities and community leaders. Local capacity building to foster community resilience. Monitoring of local prices; exploration of corrective measures (e.g. alternative sourcing) if appropriate.
<p>Cultural Heritage</p> <ul style="list-style-type: none"> Displacement or damage to cultural heritage sites by construction activities, harm to the setting, amenity value, etc. of the site due to railway construction or operation. Change to intangible cultural heritage due to increased access, and interaction with workforce. 	<ul style="list-style-type: none"> Careful alignment selection and siting of all project components, taking account of community consultation/specialist surveys. Development of a Cultural Heritage Management Plan covering tangible and intangible (e.g. local traditions and practices) cultural heritage. Implementation of a "Chance Finds" procedure during construction. See also Guidance Note on Physical Cultural Heritage.
<p>Community Health, Safety and Security</p> <ul style="list-style-type: none"> Poor construction management practices may lead to adverse effects on safety, human health and wellbeing. 	<ul style="list-style-type: none"> Good construction site "housekeeping" and management procedures (including site access, disease control measures). Risk assessments and emergency response planning to consider impacts on local communities. <p>See also control of pollution under Physical Impacts heading.</p>
<ul style="list-style-type: none"> Interaction between workforce and local communities may increase occurrence of communicable diseases, including HIV/AIDS and sexually transmitted diseases (STDs). Improved communications between centres of population and between rural and urban areas may increase transmission and incidence of communicable diseases. 	<ul style="list-style-type: none"> Implementation of a health management system for the construction workforce, to ensure it is fit for work and that it will not introduce disease into local communities. Training and awareness raising for workforce and their dependents on HIV/AIDS and other STDs, and communicable diseases including malaria; health awareness raising campaigns for communities on similar topics.
<ul style="list-style-type: none"> Risks to local communities from rail accidents (including as pedestrians), and transport of dangerous goods 	<ul style="list-style-type: none"> Avoid incidents through implementation of a Safety Management Plan (e.g. good maintenance of track and rolling stock, use of barriers and signage, preparation of spill prevention and control procedures) Implementation of an Emergency Response Plan to manage major incidents if they should occur
<p>Workforce-Community Interactions</p> <ul style="list-style-type: none"> Real or perceived disruption to normal community life, through the physical presence of a workforce 	<ul style="list-style-type: none"> Adoption of a Stakeholder Engagement Plan, as a framework for early and ongoing community consultation Implementation of a Grievance Procedure (see Grievance Procedure and Redress Mechanisms guidance note) Works procedures, defining a Code of Appropriate Conduct for all workers, including acceptable behaviour with respect to community interactions
<p>In-migration</p> <ul style="list-style-type: none"> Individuals are likely to migrate into the area which may cause conflict with resident communities, and put pressure on resources and infrastructure 	<ul style="list-style-type: none"> Careful alignment selection and siting of all project components, after consultation with communities and local authorities Preparation and implementation of an Influx/In-migration Management Plan, in consultation with local authorities <p>See also Economic Development and Employment, and Induced Access above</p>
<p>Labour and Working Conditions</p> <ul style="list-style-type: none"> Poor management of occupational health and safety leading to accidents, injuries and illnesses among workers; mental health issues due to remote or enclosed living Differences in nationality, ethnicity, religion, etc. may lead to discrimination and harassment, and differences (perceived or real) in working conditions between workers may lead to resentment 	<ul style="list-style-type: none"> Employment practices and working conditions should conform to International Labour Organisation (ILO) Standards and national regulations Rest and recreational facilities and time should be provided, and rules on alcohol and drugs defined and clearly communicated to workers The basis for differences in the standard of accommodation should be non-discriminatory; it should be documented and communicated transparently to the workforce. Clear and comprehensive health and safety reporting and grievance procedure system should be established, and be freely available to all of the workforce <p>See also Employment and Economic Development</p>

TRANSPORT SECTOR: ICT PROJECTS: INCLUDING MARINE / TERRESTRIAL CABLES AND COMMUNICATIONS NETWORKS

Information and communications technology (ICT) projects include the development of networks for two-way communications such as fixed line and wireless voice and data transmission, and one-way communication such as television and radio broadcasting. The development of these networks facilitates the sharing of information, and so contributes to economic development and enhanced the quality of life. Key infrastructure includes terrestrial and submarine cables, and transmission towers.

The key impacts associated with the development of ICT projects occur during construction, particularly during the construction of submarine and terrestrial cables, which can extend over long distances. These are similar in nature to other linear construction projects, namely land take causing severance of habitat / migration routes and habitat loss, excavation affecting soils, watercourses and archaeological sites, and the presence of workers. During operation, key impacts are limited to the physical presence of transmission towers and impacts from maintenance.

Scope and structure

This keysheet provides a summary of the activities, typical environmental and social impacts, and potential mitigation and management measures relating to the development of ICT projects. Fixed line and wireless voice and data transmission infrastructure includes long distance terrestrial and submarine cables (e.g. fibre optic cables), as well as radio and television broadcasting, and associated telecommunications and broadcasting installations and equipment.

This keysheet should be used specifically to help with drafting ToRs for ESIs of ICT projects and with scoping and conducting ESIs and preparing ESMPs. It can also help in reviewing ESIs. It should be used in conjunction

with the Bank's Guidance Notes on ESIs (including coverage of cumulative impacts), with Guidance Notes on specific safeguard topics including transboundary projects.

The keysheet is organised under the following headings, with substantive information provided in table form:

- Project components and activities.
- Sources of impact and receptors/resources.
- Mitigation and management options.

The phases of ICT projects considered are: design and planning, including route and site selection; construction; operation and maintenance; and where appropriate decommissioning (closure).

Project components and activities

The components of ICT projects are provided in Table 1, along with the activities involved in developing these networks, broken down by project phase.

Sources of impact, receptors/ resources, and mitigation

Table 2 summarizes the main aspects of ICT development activities that lead to typical impacts, the receptors and resources they affect, and options for mitigation. It considers impacts on the physical, biological and socioeconomic environment. The mitigation measures described assume that higher level design and network

planning measures, as described in Table 1, have already been implemented. The guidance on impacts and options for their mitigation can be used to help discussions with the borrower or client and improve their understanding

of the Bank's requirements. They should also be used to assist preparation of ToRs for an ESIA so that they are tailored to the particular circumstances of the HEP development under consideration.

Table 1: Summary of Activities associated with ICT Infrastructure Development

Components	
<p>Wire Line Systems</p> <ul style="list-style-type: none"> • Base station and switches. • Ground-based cables installed in trenches. • Submarine cables on the seabed. • Interconnection facility where submarine cables make landfall. • Above ground cables and associated towers. <p>Wireless Systems</p> <ul style="list-style-type: none"> • Antennas mounted on buildings (on poles or tripods on roof). • Antennas mounted on masts or towers (generally galvanised steel towers or guyed steel masts). 	<p>Ancillary facilities</p> <ul style="list-style-type: none"> • Equipment room, where antenna is mounted within a building. • Equipment building, placed on concrete foundation (where antenna mounted on a tower / mast). • Backup batteries, and auxiliary power units (generators). • Access roads to communications masts / towers. • Temporary construction facilities (e.g. workshops, laydown areas, working corridors along the cable route, workers' accommodation, borrow pits etc). • Temporary access roads within and between construction areas / temporary facilities.
Activity	
Design – Network planning, including cable route selection	<p>Screening , Scoping and ESIA</p> <p>Preparation of ESMP</p> <p>Agreement of loan covenants</p>
<p>Strategic planning (communications options analysis, cost-benefit analysis, strategic network layout selection, initial design) to establish:</p> <ul style="list-style-type: none"> • Major constraints and alternatives (e.g. with respect to major settlements, and terrestrial and/or marine areas of biodiversity conservation importance). • Design procedures such that environmental and social considerations are given equal weight to engineering and financial ones. 	
<p>Site-specific planning (detailed design), taking account of environmental and social sensitivities and consultation with communities, draw upon the following environmental and socioeconomic documentation, all of which should comply with national regulations and international good practice:</p> <ul style="list-style-type: none"> • Environmental and Social Impact Assessment (ESIA). • Environmental and Social Management Plan (ESMP). • Stakeholder Engagement Plan (SEP). • Resettlement Action Plan (RAP). 	
Construction	<p>Monitoring of ESMP performance</p> <p>Monitoring of compliance with loan covenants</p> <p>Monitoring of sub-contractor contract provisions</p>
<p>Construction activities will include:</p> <ul style="list-style-type: none"> • Establishing temporary access to work and ancillary areas, demarcating clearance zones, establishing access control. • Clearance and levelling of the cable route. • Location and development of borrow pits if required. • Trenching and laying of underground cables, including watercourse crossings. • Backfilling and reinstatement of underground cable route. • Laying of submarine cables. • Construction of equipment room where submarine cable makes landfall. • Construction of masts / towers and installation of overhead power lines. 	
<p>The equipment required will include heavy mobile plant (e.g. excavators) and temporary fixed plant such as power generators. For marine cables, equipment will include cable-laying ships, tenders and other small supply vessels.</p>	
Operation and Maintenance	Project implementation: Compliance Monitoring
<p>During operation impacts will be minimal and limited to visual and electromagnetic impacts. These may contribute to direct and indirect impacts described in Table 2.</p>	
<p>ICT infrastructure maintenance will entail many of the activities described above for the construction phase, although they are likely to be smaller in scale and spatial extent.</p>	
Decommissioning (Closure)	Project Completion: Compliance Report

Components	
Activity	
Where temporary access roads are developed during construction they should be decommissioned and rehabilitated in accordance with a site-specific closure plan developed in consideration of international good practice.	
The closure process will include site clearance, removal of all equipment including underground cables, appropriate disposal of waste materials and reinstatement / revegetation as appropriate.	

Table 2: ICT Developments: Impacts and Mitigation

Impacts	Mitigation
Geology/Hydrogeology <ul style="list-style-type: none"> • Interruption of hydrogeology and groundwater flows from excavation and ground clearance. 	<ul style="list-style-type: none"> • Detailed cable alignment to take account of local groundwater conditions, e.g. by avoiding areas with springs or where the water table is shallow. • Limit sealed or compacted areas as much as possible, to maintain natural recharge of the water table. • Avoid removing material below the water table.
<ul style="list-style-type: none"> • Pollution of groundwater during construction 	See Pollution of Soils and Water below
Soils, Run-off and Flooding <ul style="list-style-type: none"> • Loss of soil / sediments and pollution of watercourses, and interruption of drainage patterns, as a result of ground clearance and earthworks. 	<ul style="list-style-type: none"> • Minimisation of cleared areas and soil disturbance, with revegetation as soon as feasible, with native species. • No vehicle use to be used outside designated areas. • Early installation and regular maintenance of drainage and diversion structures, silt traps, etc; drainage outlets to discharge into vegetated areas if possible; vegetation along watercourses and drainage lines to be retained if possible. • Avoidance of areas liable to flooding, slope instability, and water crossings where possible. • Retention of topsoil for restoration (including tilling and revegetation) as soon as practicable. • Restrictions on work and other activities around waterbodies (e.g. vehicle washing), and minimisation measures around water crossings where this not possible. • Careful design: e.g. alignment, minimal diversion of watercourses, timing of works (overall duration and seasonality).
Pollution of Soils and Water <ul style="list-style-type: none"> • Discharge of construction site/camp sewage effluent polluting watercourses. 	<ul style="list-style-type: none"> • Installation of sewage treatment to meet required standards; hygiene training for workforce.
<ul style="list-style-type: none"> • Release of hazardous substances during construction (e.g. vehicle or vessel spills) leading to soil, surface water, marine or groundwater contamination. 	<ul style="list-style-type: none"> • Materials handling and control procedures. • Control of construction vehicle movements and prohibition of vehicle washing in watercourses, and similar practices. • Emergency response plans during construction (contractors and local authorities) and operation (local authorities). • Measures to avoid release of hazardous materials from vessels, and spill response plans in place.
Air Quality <ul style="list-style-type: none"> • Dust from construction, and other emissions during construction and operation, could affect human health, vegetation (including crops) and wildlife. 	<ul style="list-style-type: none"> • Sensitive siting of construction facilities. • Dust control and suppression measures. • Modern equipment and vehicles meeting appropriate emissions standards, and regular preventative maintenance. • No use of ozone depleting substances during construction.
Noise and Vibration <ul style="list-style-type: none"> • Noise and vibration from equipment including backup power generators may disturb sensitive noise receptors (human and fauna). 	<ul style="list-style-type: none"> • Sensitive siting of all facilities, including temporary construction facilities. • Use of modern equipment fitted with abatement devices (e.g. mufflers, noise enclosures); good maintenance regime.
<ul style="list-style-type: none"> • Noise and vibration from cable laying vessels may disturb marine fauna. 	<ul style="list-style-type: none"> • Sensitive timing of cable-laying and location of cable route.
Resources and Waste <ul style="list-style-type: none"> • Construction may require supply of water from surface or groundwater, which could affect existing supply for human communities and ecosystems. 	<ul style="list-style-type: none"> • Water study prior to any abstraction. • No abstraction without prior approval of relevant authorities at all locations. • Promotion of water efficiency (including leak detection, preventative maintenance of equipment) and water recycling.

Impacts	Mitigation
<ul style="list-style-type: none"> Inefficient waste management during construction and maintenance leading to excess materials consumption, generation of wastes/emissions, soils and water pollution. 	<ul style="list-style-type: none"> Preparation of Waste Management Plan following the waste hierarchy, supported by staff training. Ensuring that new support equipment does not contain polychlorinated biphenyls (PCBs) or ozone depleting substances, and meets international phase out requirements for hazardous materials. Use of authorised contractors for hazardous and any other wastes which the project cannot dispose of safely. Collection, storage, and transfer and / or treatment services of vessel waste, in accordance with MARPOL.
<p>Visual Impacts</p> <ul style="list-style-type: none"> Visual impacts from tower and antennae. 	<ul style="list-style-type: none"> Minimise the construction of additional towers through co-location of antennae in existing towers or other structures. Use of tower and antennae camouflaging or disguising alternatives. Careful site selection including consultation with local communities.
<p>Loss, fragmentation and degradation of terrestrial and marine habitat, and severance of animal migration routes and pathways</p> <ul style="list-style-type: none"> Land clearance for cabling and equipment may cause loss or fragmentation of protected areas and other areas of conservation interest, and degradation following poorly managed rehabilitation. 	<ul style="list-style-type: none"> Careful siting of all project components to avoid potentially valuable terrestrial and marine habitat, with advice from biodiversity authorities/wildlife specialists and use of existing utility / transport corridors where possible. Burying submarine cables when traversing sensitive intertidal habitat. Wherever feasible, establishment of buffer zones around conservation areas, watercourses, and other locations identified as ecologically sensitive and avoidance or minimisation of activity within these zones. Rehabilitation of cleared areas of terrestrial habitat with native species, and ecosystem restoration in habitats of conservation value, using specialist advice and input, backed up by a long-term monitoring programme and corrective actions as necessary.
<ul style="list-style-type: none"> Disturbance to the seabed from anchoring of cable lay vessels, and presence of cable on seabed. 	<ul style="list-style-type: none"> Selection of cable route to avoid sensitive marine habitat of potentially high biodiversity value.
<ul style="list-style-type: none"> Severance of animal migration pathways. 	<ul style="list-style-type: none"> Where cable routes and access roads cross watercourses, design culverts/crossing structures to avoid impacts on fish movement. Careful siting of overhead power lines to avoid bird migration routes.
<ul style="list-style-type: none"> Construction impacts on habitats and species (e.g. from changes in drainage, soil erosion, pollution of water, soils or air, introduction of invasive species, and general human disturbance). 	<p>Where development in sensitive areas cannot be avoided, mitigation may include:</p> <ul style="list-style-type: none"> Minimisation of area impacted, clear demarcation of remaining intact areas of habitat, and prohibition of activity into those areas for any purpose; maintenance of wildlife corridors between fragmented areas wherever possible. Avoidance of construction activities (including submarine cable laying) during sensitive seasons or times of day. No ground clearance upstream of sensitive areas unless appropriately engineered drainage installed. Habitat rehabilitation and ecosystem restoration of areas no longer required after construction, as soon as possible. If loss of Critical Habitat is inevitable, development/implementation of an Offsets Programme. Monitoring cable laying path for presence of marine mammals. <p>See relevant sections re. control of impacts from pollution, and invasive species.</p>
<ul style="list-style-type: none"> Disturbance and emissions from vehicles and vessels during construction affecting the integrity and viability of areas of conservation interest. 	<p>See control of air quality and noise / vibration impacts above</p>
<p>Impacts from Induced Access</p> <ul style="list-style-type: none"> Development of ICT facilities in remote or undeveloped areas, especially construction of access roads, may lead to further development, increased disturbance and pressure on natural resources through bushmeat hunting, logging, fire, etc. 	<ul style="list-style-type: none"> Careful site and alignment/route selection, with advice from biodiversity authorities/wildlife specialists to avoid remote and previously inaccessible areas where possible. Where possible, instate access controls on roads leading to project facilities in otherwise undeveloped or remote areas. See also Bushmeat Hunting below.

Impacts	Mitigation
<p>Bushmeat Hunting</p> <ul style="list-style-type: none"> Construction activities in remote areas could lead to greater demand for bushmeat, stimulate the wildlife trade and facilitate access to hunting areas. 	<ul style="list-style-type: none"> Measures to minimise bushmeat hunting by construction workforce, if significant risk is identified.
<p>Direct Impacts on Flora and Fauna</p> <ul style="list-style-type: none"> Clearance of vegetation may lead to loss of plant species and habitat of conservation interest, and displacement of fauna. 	<ul style="list-style-type: none"> Careful route selection and siting of all project components, with advice from biodiversity authorities/wildlife specialists. Careful planning of phasing and timing of construction activities. Demarcation and avoidance of areas of conservation interest (high value species, feeding or breeding sites including fish spawning sites for marine cables, migration routes, etc.) where possible, and wildlife rescue and translocation where appropriate, under expert supervision. <p>Also see measures under Soils, Run-off and Flooding, Pollution of Soils and Water, above, and Invasive Species below.</p>
<ul style="list-style-type: none"> Potential for bird collisions with communications towers and above ground cables. 	<ul style="list-style-type: none"> Siting towers and above ground cable routes to avoid important areas of habitat and migration routes. Avoid cumulative impacts by limiting the number of towers (eg through co-location, removing disused towers). Careful design to limit the impact of towers, eg limiting tower height, use of designs with lower collision risk, limiting tower lighting where practical.
<p>Invasive Species</p> <ul style="list-style-type: none"> Movement of plant and workforce (including cable laying vessel movements) into areas could introduce invasive species which adversely impact fauna, flora, ecosystems, and crops. 	<ul style="list-style-type: none"> Invasive Species Management Plan, which should be developed and implemented in consultation with authorities, including appropriate eradication measures for different species/groups of species. Staff training and awareness raising in communities. No introduction of exotic species (e.g. for site rehabilitation) without specialist vetting and government approval.
<p>Economic Development and Employment</p> <ul style="list-style-type: none"> Direct employment of local population in workforce, and stimulation of local economy through demand for goods and services will enhance livelihoods and economic activity in local communities, but potentially adverse effects if community relations are not well managed. 	<ul style="list-style-type: none"> Development of an Employment Plan, with clear employment requirements and procedures for the construction workforce. Transparent and culturally appropriate communication with communities regarding employment opportunities. Fair and transparent hiring and staff management procedures.
<ul style="list-style-type: none"> Workforce and procurement of local goods and services for the construction of ICT infrastructure could deplete resources available for local communities. 	<ul style="list-style-type: none"> Procedures for sustainable local procurement, in consultation with local authorities and community leaders.
<p>Cultural Heritage</p> <ul style="list-style-type: none"> Displacement or damage to cultural heritage sites by construction activities, harm to the setting, amenity value, etc. of the site due to construction or operation. 	<ul style="list-style-type: none"> Careful route selection and siting of all project components, taking account of community consultation/specialist surveys. Development of a Cultural Heritage Management Plan covering tangible and intangible (e.g. local traditions and practices) cultural heritage. Implementation of a "Chance Finds" procedure during construction. <p>See also Guidance Note on Physical Cultural Heritage.</p>
<p>Community Health, Safety and Security</p> <ul style="list-style-type: none"> Poor construction management practices may lead to adverse effects on safety, human health and wellbeing. 	<ul style="list-style-type: none"> Good construction site "housekeeping" and management procedures (including site access). Disease control measures, e.g. no pools of standing water, rodent control, treatment of water. Risk assessments and emergency response planning to consider impacts on local communities. <p>See also control of pollution under Physical Impacts heading.</p>
<ul style="list-style-type: none"> Interaction between workforce and local communities may increase occurrence of communicable diseases, including HIV/AIDS and sexually transmitted diseases (STDs). 	<ul style="list-style-type: none"> Implementation of a health management system for the construction workforce, to ensure it is fit for work and that it will not introduce disease into local communities. Training and awareness training for workforce and their dependents on HIV/AIDS and other STDs, and communicable diseases including malaria; health awareness raising campaigns for communities on similar topics.

Impacts	Mitigation
<ul style="list-style-type: none"> Potential safety risks associated with the presence of communications towers. 	<ul style="list-style-type: none"> Measures to avoid unauthorised climbing of towers, eg fencing, guards and anti-climbing devices. Measures to avoid aircraft collision with towers, eg lighting and consultation with air traffic authorities.
<p>Social Structures and Community Life</p> <ul style="list-style-type: none"> Real or perceived disruption to normal community life, through the physical presence of a construction workforce. 	<ul style="list-style-type: none"> Adoption of a Stakeholder Engagement Plan, as a framework for early and ongoing community consultation. Implementation of a Grievance Procedure (see Grievance Procedure and Redress Mechanisms guidance note). Works procedures, defining a Code of Appropriate Conduct for all workers. Training for all staff in acceptable behaviour with respect to community interactions.
<p>Labour and Working Conditions</p> <ul style="list-style-type: none"> Poor management of occupational health and safety could lead to accidents, injuries and illnesses among workers; mental health issues may arise due to remote or enclosed living. Differences in nationality, ethnicity, religion, etc. may lead to discrimination and harassment, and differences (perceived or real) in working conditions between workers may lead to resentments. 	<ul style="list-style-type: none"> Employment practices and working conditions should conform to International Labour Organisation (ILO) Standards and national regulations. Rest and recreational facilities and time should be provided, and rules on alcohol and drugs defined and clearly communicated to workers. The basis for differences in the standard of accommodation should be non-discriminatory; it should be documented and communicated transparently to the workforce. Clear and comprehensive health and safety reporting and grievance procedure system should be established, and be freely available to all of the workforce. <p>See also Employment and Economic Development.</p>

ENERGY / ELECTRICITY SECTOR: HYDROELECTRIC POWER PROJECTS

Hydroelectric projects (HEPs) generate electricity by harnessing the energy of water, providing renewable power that promotes economic development and enhances quality of life with, at least during operation, minimal carbon emissions. HEPs can vary from very small scale (“micro-hydro”, with output of a few kW, and “mini-hydro”, normally generating in the range of 1-5 MW) up to a very large scale, using major dams and lakes, generating 10GW of power or more.

The key impacts caused by the development of hydroelectric power projects are associated with the flooding of the area upstream of a dam to provide a constant water supply for the powerhouse. The loss of this area may result in resettlement of people, loss of critical habitats or agricultural areas, changes to the hydrology of watercourses downstream, emissions of pollutants from decomposition of flooded vegetation, and disrupt movement of aquatic and terrestrial fauna. Whilst hydropower projects can result in significant benefits to communities, the presence of the reservoir can also cause social impacts, particularly if resettlement is required, as well as altering access to resources such as artisanal fisheries and influx of construction workers.

Scope and structure

This keysheet provides a summary of the activities, typical environmental and social impacts, and potential mitigation and management measures relating to the development of hydroelectric power projects, including construction and operation of powerhouses, substations, dams, reservoirs and associated infrastructure, such as access roads. The impacts of transmission lines exporting the power generated by HEPs to the distribution network are covered in a separate keysheet. This keysheet should be used specifically to help with drafting ToRs for ESIs of hydroelectric power projects and with scoping and conducting ESIs and preparing ESMPs. It can also help in reviewing ESIs.

It should be used in conjunction with the Bank’s Guidance Notes on ESIs (including coverage of cumulative impacts), with the Guidance Notes on specific safeguard topics

including transboundary projects and the keysheet on transmission lines.

The keysheet is organised under the following headings, with substantive information provided in table form:

- Project components and activities.
- Sources of impact and receptors/resources.
- Mitigation and management options.

The phases of hydroelectric power projects considered are: design and planning, including route and site selection; construction; operation and maintenance; and where appropriate decommissioning (closure).

Project components and activities

The components of hydroelectric power projects are provided in Table 1, along with the activities involved in developing these networks, broken down by project phase.

Sources of impact, receptors/ resources, and mitigation

Table 2 summarizes the main aspects of hydroelectric power development activities that lead to typical impacts, the receptors and resources they affect, and options for mitigation. It considers impacts on the physical, biological and socioeconomic environment. The mitigation measures described assume that higher level design and network planning measures, as described in Table 1, have already been implemented.

The guidance on impacts and options for their mitigation can be used to help discussions with the borrower or client and improve their understanding of the Bank’s requirements. They should also be used to assist preparation of ToRs for an ESI so that they are tailored to the particular circumstances of the HEP development under consideration.

Table 1: Summary of Activities associated with Hydroelectric Power Projects

Components	
<p>HEP</p> <p>The design of hydroelectric power projects depends on local characteristics and energy needs, but may include most of the following general components:</p> <ul style="list-style-type: none"> • Dam. • Reservoir (except in “run-of-river” schemes). • Regulating structures to control release of water back into the watercourse. • One or more saddle dams, if topography requires, at low points around the reservoir margin to increase the storage volume and therefore the generation potential. • Water intake structures. • Powerhouse and control room. • Switchyard. • Water outlet structures and tailrace. 	<p>Associated infrastructure</p> <ul style="list-style-type: none"> • Access roads (temporary and permanent). • Permanent offices and staff accommodation. • Security posts and fencing, etc. • Coffor dams and diversion channel to divert water flows during construction. • Quarries and borrow pits. • Construction workshops, offices and laydown areas. • Accommodation for construction workforce (e.g. construction worker camp).
Activity	
Design – System planning, including site selection	<p>Screening , Scoping and ESIA</p> <p>Preparation of ESMP</p> <p>Agreement of loan covenants</p>
<p>Strategic planning (options analysis, cost-benefit analysis, initial design etc), and for major development, strategic environmental and social assessment (SESA), to establish:</p> <ul style="list-style-type: none"> • Major constraints and alternatives (e.g. with respect to settlements, flow regimes and generation potential, watersheds and areas of biodiversity conservation importance). • Site selection and design procedures such that environmental and social considerations are given equal weight to engineering and financial ones. 	
<p>Site-specific planning (detailed design), taking account of environmental and social sensitivities and consultation with communities, draw upon the following environmental and socioeconomic documentation, all of which should comply with national regulations and international good practice:</p> <ul style="list-style-type: none"> • Environmental and Social Impact Assessment (ESIA). • Environmental and Social Management Plan (ESMP). • Stakeholder Engagement Plan (SEP). • Resettlement Action Plan (RAP). 	
Construction	<p>Monitoring of ESMP performance</p> <p>Monitoring of compliance with loan covenants</p> <p>Monitoring of sub-contractor contract provisions</p>
<p>Construction activities may include:</p> <ul style="list-style-type: none"> • Establishing temporary access to work and ancillary areas, demarcating clearance zones, establishing access control, constructing temporary labour camps. • Location and development of quarries and borrow pits. • Constructing river diversion coffer dams and diversion channels. • Land clearance and relocation of infrastructure on site, including vegetation clearance from reservoir area. • Resettlement, if required. • Construction of dam (constructed of concrete and/or a combination of rock and earth fill). • Construction of powerhouse and installation of turbines and other electrical components. • Impoundment to create reservoir (which may take up to several years to fill). 	
<p>The equipment required will include heavy mobile plant (e.g. bulldozers, graders, excavators; and possibly tunnelling equipment) and temporary fixed plant such as power generators and concrete batching plant.</p>	
Operation and Maintenance	Project implementation: Compliance Monitoring
<p>During operation impacts may result from changes to the hydrology of the watercourse used in the HEP. These may contribute to direct and indirect impacts described in Table 2.</p>	
<p>Operational maintenance will for the most part maintenance of electrical and mechanical components, and regular inspection and if necessary repair of the dam and other physical structures.</p>	
<p>Reservoir management (including maintenance of the reservoir margins) will also be required, and catchment protection and maintenance is also a standard part of good practice for environmental management of HEPs.</p>	

Components	
Activity	
Decommissioning (Closure)	Project Completion: Compliance Report
<p>Where temporary facilities such as access roads, quarries, worker accommodation and laydown areas are developed during construction, they should be decommissioned and rehabilitated in accordance with a site-specific closure plan developed in consideration of international good practice. Whilst temporary facilities within the inundation area will not require rehabilitation, they should be decommissioned and the closure process should still include site clearance, removal of all equipment, and appropriate disposal of waste materials.</p> <p>HEPs are long-term developments, which may be developed for other purposes (e.g. water supply, irrigation) either during or after power generation. Closure planning should be carried out only when the end of useful life can be foreseen.</p>	

Table 2: Hydroelectric Power Projects: Impacts and Mitigation

Impacts	Mitigation
<p>Geology/Hydrogeology</p> <ul style="list-style-type: none"> Changes to hydrogeology and groundwater flows from impoundment of water, including salt water intrusion which may then cause salinization of soils. 	<ul style="list-style-type: none"> Detailed site selection to take account of local groundwater conditions, e.g. by avoiding areas with springs or where the water table is shallow. Limit sealed or compacted areas as much as possible, to maintain natural recharge of the water table. Maintain a minimum flow in watercourses to prevent salt-water intrusion.
<ul style="list-style-type: none"> Potential for seismic events caused by the pressure of the water body on underlying strata. 	<ul style="list-style-type: none"> Detailed site selection to take account of geological conditions, avoiding areas with unsuitable geological conditions.
<ul style="list-style-type: none"> Pollution of groundwater from discharges and accidental releases during construction. 	<ul style="list-style-type: none"> Minimisation of cleared areas and soil disturbance, with revegetation as soon as feasible, with native species. Avoidance of areas liable to flooding, slope instability, and water crossings where possible. Restrictions on work and other activities around waterbodies (e.g. vehicle washing), and minimisation measures around water crossings where this not possible. Limit unnecessary movements of heavy machinery. Stabilise the soils in order to reduce potential erosion. Careful design: e.g. minimal diversion of watercourses, timing of works (overall duration and seasonality).
<ul style="list-style-type: none"> Changes to surface water flows, as a result of impoundment of water. 	<ul style="list-style-type: none"> Environmental flow assessment, to avoid operational releases significantly altering flow regimes and so preventing water resources from fulfilling their important functions and services; and to ensure that environmental flows are designed to maintain downstream river ecosystems in a desired state while balancing social and ecological water-related needs. <p>See Guidance Note on Environmental Flows</p>
<ul style="list-style-type: none"> Entrapment of sediment in reservoir can cause a reduction in sediment content downstream. In turn this may result in scouring of riverbed downstream of the dam due to the low content of sediments in water, and a loss of nutrients to floodplains. 	<ul style="list-style-type: none"> Design the works in order to release sediments (hydraulic release). Dredge accumulated sediments.
<ul style="list-style-type: none"> Soil erosion due to water level changes in the reservoir and run-off erosion. 	<ul style="list-style-type: none"> Prevent land clearing in watershed and facilitate the reforestation of cleared areas. Avoid areas sensitive to erosion, where possible. Implement integrated watershed management in order to control soil erosion.
<p>Pollution of Soils and Water</p> <ul style="list-style-type: none"> Discharge of construction site/camp sewage effluent polluting watercourses. 	<ul style="list-style-type: none"> Installation of sewage treatment to meet required standards; hygiene training for workforce.
<ul style="list-style-type: none"> Release of hazardous substances during construction (e.g. vehicle or vessel spills) leading to soil, surface water, marine or groundwater contamination. 	<ul style="list-style-type: none"> Materials handling and control procedures. Control of construction vehicle movements and prohibition of vehicle washing in watercourses, and similar practices. Emergency response plans during construction (contractors and local authorities) and operation (local authorities).

Impacts	Mitigation
<ul style="list-style-type: none"> Decomposition of flooded vegetation may cause nutrient rich conditions in reservoir, reduction in oxygen levels and releases of hydrogen sulphide which is toxic to aquatic organisms, release of methane (a greenhouse gas), and degradation of water quality in the reservoir. 	<ul style="list-style-type: none"> Limit retention time of water in reservoir; consider periodic "flushing". Implement design measures such as stratified water offtakes at different depths. Consider clearing vegetation from area of impoundment before filling the reservoir. Watershed management plan, developed in collaboration with relevant authorities to control clearance of vegetation in watershed (to prevent erosion and sedimentation) and limit run-off of agro-chemicals, fertilisers, etc. into the reservoir.
<p>Air Quality</p> <ul style="list-style-type: none"> Dust from construction could affect human health, vegetation (including crops) and wildlife. 	<ul style="list-style-type: none"> Sensitive siting of construction facilities. Dust control and suppression measures. Modern equipment and vehicles meeting appropriate emissions standards, and regular preventative maintenance.
<ul style="list-style-type: none"> Decomposition of flooded vegetation may cause release of methane (a powerful greenhouse gas). 	<ul style="list-style-type: none"> Consider clearing the vegetation before flooding the reservoir.
<p>Noise and Vibration</p> <ul style="list-style-type: none"> Noise and vibration from equipment during construction may disturb sensitive noise receptors (human and fauna). 	<ul style="list-style-type: none"> Sensitive siting of construction facilities. Use of modern equipment fitted with abatement devices (e.g. mufflers, noise enclosures); good maintenance regime.
<p>Resources and Waste</p> <ul style="list-style-type: none"> Potential loss of productive soils and watercourses used for artisanal fishing and transport of nutrients to floodplains. 	<ul style="list-style-type: none"> Water study prior to construction, to inform a Sustainable Water Management Plan. Careful siting to avoid areas of productive soils and watercourses.
<ul style="list-style-type: none"> Inefficient waste management during construction and maintenance leading to excess materials consumption, generation of wastes/emissions, soils and water pollution. 	<ul style="list-style-type: none"> Preparation of Waste Management Plan following the waste hierarchy, supported by staff training.
<p>Visual Impacts</p> <ul style="list-style-type: none"> Visual impacts from reservoir and dam. 	<ul style="list-style-type: none"> Careful site selection including consultation with local communities.
<p>Loss, fragmentation and degradation of habitat, and severance of animal migration routes and pathways</p> <ul style="list-style-type: none"> Land clearance for power house, dam, reservoir and associated infrastructure may cause loss or fragmentation of protected areas and other areas of conservation interest. 	<ul style="list-style-type: none"> Careful siting of all project components to avoid critical habitat, with advice from biodiversity authorities/wildlife specialists. Minimise area of land clearance and inundation to the extent possible. Wherever feasible, establishment of buffer zones around conservation areas, watercourses, and other locations identified as ecologically sensitive and avoidance or minimisation of activity within these zones. If loss of Critical Habitat is inevitable, development/implementation of an Offsets Programme.
<ul style="list-style-type: none"> Severance of animal migration pathways, for both terrestrial and aquatic species, including fish 	<ul style="list-style-type: none"> Careful siting of all project components to avoid severing migration corridors where possible, with advice from biodiversity authorities/wildlife specialists. Maintain a minimum water flow for fish. Provide appropriate means of passage for fishes, where feasible.
<ul style="list-style-type: none"> Construction impacts on habitats and species (e.g. from changes in drainage, soil erosion, pollution of water, soils or air, introduction of invasive species, noise and general human disturbance). 	<p>Where development in sensitive areas cannot be avoided, mitigation may include:</p> <ul style="list-style-type: none"> Minimisation of area impacted, clear demarcation of remaining intact areas of habitat, and prohibition of activity into those areas for any purpose; maintenance of wildlife corridors between fragmented areas wherever possible. Avoidance of construction activities during sensitive seasons or times of day. Habitat rehabilitation and ecosystem restoration of areas no longer required after construction, as soon as possible. If loss of Critical Habitat is inevitable, development/implementation of an Offsets Programme. <p>See relevant sections re: control of impacts from pollution, and invasive species.</p>

Impacts	Mitigation
<p>Direct Impacts on Terrestrial and Marine Flora and Fauna</p> <ul style="list-style-type: none"> • Clearance or flooding of vegetation may lead to loss of plant species and habitat of conservation interest, and displacement of fauna. 	<ul style="list-style-type: none"> • Careful site selection, with advice from biodiversity authorities/wildlife specialists. • Careful planning of phasing and timing of construction activities. • Demarcation and avoidance of areas of conservation interest (high value species, feeding or breeding sites, migration routes, etc.) where possible. • Consider translocation of both flora and fauna before the reservoir floods, if appropriate, under expert supervision. <p>Also see measures under Soils, Run-off and Flooding, Pollution of Soils and Water, and Induced Access above, and Invasive Species below</p>
<ul style="list-style-type: none"> • Adverse impact on fishes due to changes in water flow and limnology, disruption of fish migrations, and degradation of water quality. 	<ul style="list-style-type: none"> • Minimise sedimentation in spawning grounds downstream. • Maintain a minimum water flow for fish, in accordance with the environmental flow assessment. • Provide appropriate means of passage for fish. • Identify and where possible conserve spawning grounds. <p>See Guidance Note on Environmental Flows</p>
<ul style="list-style-type: none"> • Bio-accumulation of methyl mercury in the tissues of fish-eating wildlife species, affecting their vital organs and central nervous system, especially in acid and anaerobic conditions. 	<ul style="list-style-type: none"> • In regions where conditions can favour mercury methylation, remove as much as possible the vegetation and organic matter on the ground before flooding, and manage the reservoir to minimise methyl mercury production (e.g. gradual flooding, reduced water retention time, etc.).
<ul style="list-style-type: none"> • Creation of a new fish habitat in the reservoir facilitating fisheries development. 	<ul style="list-style-type: none"> • Facilitate the development of culture fisheries in reservoir as an alternative livelihood and source of protein for surrounding communities.
<p>Impacts from Induced Access</p> <p>Development of HEPs in remote or undeveloped areas, especially construction of roads into undisturbed habitat, may lead to further development, increased disturbance and pressure on natural resources through bushmeat hunting, logging, fire, etc.</p>	<ul style="list-style-type: none"> • Careful site selection, with advice from biodiversity authorities/wildlife specialists to avoid remote and previously inaccessible areas where possible. • Where possible, instate access controls on roads leading to project facilities in otherwise undeveloped or remote areas. • Remove temporary access roads after construction, and return land to alternative beneficial use <p>See also Bushmeat Hunting below.</p>
<p>Bushmeat Hunting</p> <ul style="list-style-type: none"> • Construction activities in remote areas could lead to greater demand for bushmeat (from workforce and wider community) and illegal fishing, stimulate the wildlife trade and facilitate access to hunting areas. 	<ul style="list-style-type: none"> • Bushmeat Hunting and Wildlife Trade Management Plan, agreed with government authorities and implemented jointly. • Prohibition on workforce hunting, selling, or purchasing bushmeat, and training to support this requirement. • Prohibition on workforce (except security personnel) having guns in work areas or accommodation. • Sensitisation and public awareness campaigns against hunting and bushmeat the trade amongst local communities. • Control illegal fishing.
<p>Invasive Species</p> <ul style="list-style-type: none"> • Movement of plant and workforce into areas could introduce invasive species which adversely impact fauna, flora, ecosystems, and crops. 	<ul style="list-style-type: none"> • Invasive Species Management Plan, which should be developed and implemented in consultation with authorities, including appropriate eradication measures for different species/groups of species. • Staff training and awareness raising in communities. • No introduction of exotic species (e.g. for site rehabilitation) without specialist vetting and government approval.
<p>Economic Development and Employment</p> <ul style="list-style-type: none"> • Direct employment of local population in workforce, and stimulation of local economy through demand for goods and services will enhance livelihoods and economic activity in local communities, but potentially adverse effects if community relations are not well managed. 	<ul style="list-style-type: none"> • Development of an Employment Plan, with clear employment requirements and procedures for the construction workforce. • Transparent and culturally appropriate communication with communities regarding employment opportunities. • Fair and transparent hiring and staff management procedures. • Employment requirements and vocational training plan to be agreed with local institutions, so that local people can be trained to meet the project's needs in a timely fashion. • Development of measures to manage the transition after construction is complete, including SME development, ongoing (limited) opportunities for the workforce in operations e.g. equipment maintenance, reskilling and alternative employment.

Impacts	Mitigation
<ul style="list-style-type: none"> Procurement of local goods and services for the hydropower project and workforce could deplete resources available for local communities. 	<ul style="list-style-type: none"> Ensure adequate social services, including drinking water supplies, for addressing the basic needs of the local populations, non-resident workers and migrants. Procedures for sustainable local procurement, in consultation with local authorities and community leaders Local capacity building to foster community resilience. Monitoring of local prices, and exploration of corrective measures (e.g. alternative sourcing to reduce local pressure) if appropriate.
<ul style="list-style-type: none"> Potential diversification of income generating activities due to a better access to energy and access to fisheries, or SOCIOECONOMIC dissatisfaction if benefits are not available to all. 	<ul style="list-style-type: none"> Whenever possible, facilitate access to energy amongst local populations, particularly those adversely affected by the project.
<p>Physical and Economic Displacement of People, Property, Assets and Resources</p> <ul style="list-style-type: none"> Development of HEP, in particular creation of reservoir, may physically displace people, or lead to loss of assets. 	<ul style="list-style-type: none"> Careful site selection and siting of all project components, avoid occupation of areas which are inhabited or regarded as of high value by communities (e.g. horticulture, community orchards) where possible. Early development and sensitive implementation of resettlement planning, in accordance with national regulations and international good practice to compensate for any losses (both physical and economic).
<ul style="list-style-type: none"> Loss of forest products from flooding of reservoir (fuel wood, timber, medicinal plants etc). 	<ul style="list-style-type: none"> Recover the forest products extracted from land clearing and identify mechanisms to distribute the products to the local population. Careful site selection to avoid where possible areas that are critical for supplying ecosystem services, in consultation with the local community. Consider appropriate compensation for affected people in resettlement plan.
<ul style="list-style-type: none"> Disruption of downstream economic activities and livelihoods, particularly flood-plain agriculture and fisheries. 	<ul style="list-style-type: none"> Consider appropriate compensation or alternative income opportunities to men and women having a reduced access to or losing productive means, in resettlement plan. Ensure that other vulnerable groups can safely satisfy their basic needs and where necessary have access to alternative livelihoods.
<p>Cultural Heritage</p> <ul style="list-style-type: none"> Displacement or damage to cultural heritage sites by construction activities, harm to the setting, amenity value, etc. of the site due to construction or operation, particularly flooding of the reservoir. 	<ul style="list-style-type: none"> Careful siting of all project components, taking account of community consultation/specialist surveys. Development of a Cultural Heritage Management Plan covering tangible and intangible (e.g. local traditions and practices) cultural heritage. Implementation of a "Chance Finds" procedure during construction. <p>See also Guidance Note on Physical Cultural Heritage</p>
<p>Community Health, Safety and Security</p> <ul style="list-style-type: none"> Poor construction management practices may lead to adverse effects on safety, human health and wellbeing. 	<ul style="list-style-type: none"> Good construction site "housekeeping" and management procedures (including site access). Disease control measures, e.g. no pools of standing water, rodent control, treatment of water. Risk assessments and emergency response planning to consider impacts on local communities. <p>See also Pollution of Soils and Water above</p>
<ul style="list-style-type: none"> Interaction between workforce and local communities may increase occurrence of communicable diseases, including HIV/AIDS and sexually transmitted diseases (STDs). 	<ul style="list-style-type: none"> Implementation of a health management system for the construction workforce, to ensure it is fit for work and that it will not introduce disease into local communities. Training and awareness training for workforce and their dependents on HIV/AIDS and other STDs, and communicable diseases including malaria; health awareness raising campaigns for communities on similar topics.
<ul style="list-style-type: none"> Potential safety risks associated with the presence of reservoir. 	<ul style="list-style-type: none"> Plan lifesaving equipment and measures. Ensure that downstream villages are informed in advance of water fluctuations.

Impacts	Mitigation
<ul style="list-style-type: none"> Potential health risks associated with water-borne diseases and water-related diseases (eg. schistosomiasis, onchocerciasis, malaria). 	<ul style="list-style-type: none"> Information, education and communication about safe uses of reservoir water. Vector control and management programs (eg spraying, use of molluscicides, management of fluctuations in water levels); strengthening medical services to enhance diagnostic skills and ensure rapid identification and treatment of disease
<ul style="list-style-type: none"> Contamination of domestic water supplies due to the poor water quality of water released from reservoir. 	<ul style="list-style-type: none"> Establish quality control for water supplies. <p>See also Pollution of Soils and Water above.</p>
<p>Social Structures and Community Life</p> <ul style="list-style-type: none"> Real or perceived disruption to normal community life, through the physical presence of a construction workforce. 	<ul style="list-style-type: none"> Adoption of a Stakeholder Engagement Plan, as a framework for early and ongoing community consultation. Implementation of a Grievance Procedure (see Grievance Procedure and Redress Mechanisms guidance note). Works procedures, defining a Code of Appropriate Conduct for all workers. Training for all staff in acceptable behaviour with respect to community interactions.
<p>Labour and Working Conditions, and Human Rights</p> <ul style="list-style-type: none"> Poor management of occupational health and safety could lead to accidents, injuries and illnesses among workers; mental health issues may arise due to remote or enclosed living. Differences in nationality, ethnicity, religion, etc. may lead to discrimination and harassment, and differences (perceived or real) in working conditions between workers may lead to resentments. 	<ul style="list-style-type: none"> Employment practices and working conditions should conform to International Labour Organisation (ILO) Standards and national regulations. Rest and recreational facilities and time should be provided, and rules on alcohol and drugs defined and clearly communicated to workers. The basis for differences in the standard of accommodation should be non-discriminatory; it should be documented and communicated transparently to the workforce. . Clear and comprehensive health and safety reporting and grievance procedure system should be established, and be freely available to all of the workforce. <p>See also Employment and Economic Development.</p>



ENERGY / ELECTRICITY SECTOR: TRANSMISSION LINES AND INTERCONNECTION SYSTEMS

Transmission lines and interconnection systems include infrastructure for the transmission of power between a generation facility and a substation located within an electricity grid, in addition to power distribution from a substation to consumers located in residential, commercial, and industrial areas. Transmission lines distribute electrical energy to urban and rural areas to increase productivity and improve the quality life for many communities.

Transmission lines can range from several kilometers to hundreds of kilometers in length and route corridors are generally between 20 and 500m in width, depending on considerations such as the surrounding environment and the voltage being transmitted. They are generally constructed over land but can cross watercourses, wetlands and bays, either on pylons/poles, or buried in a trench. Submarine power cables are also used to transmit power between land masses (see also keysheet on ICT Infrastructure, which discusses impacts of marine cable laying, and mitigation).

The major impacts associated with the development of transmission lines mostly occur during construction, namely land take causing severance of habitat / migration routes and habitat loss, excavation affecting soils, watercourses and archaeological sites, and the presence of workers. During operation, impacts are limited to those associated with maintenance, including chemical or mechanical control of vegetation in the right of way (RoW) and occasional line repair. Visual impacts and disruption of bird migratory routes and bird or bat foraging pathways can also be of concern.

Scope and structure

This keysheet provides a summary of the activities, typical environmental and social impacts, and potential mitigation and management measures relating to the development of transmission lines and interconnection systems.

This keysheet should be used specifically to help with drafting ToRs for ESIA of transmission line developments

and with scoping and conducting ESIA and preparing ESMPs. It can also help in reviewing ESIA.

It should be used in conjunction with the Bank's Guidance Notes on ESIA (including coverage of cumulative impacts) and with the Guidance Notes on specific safeguard topics including transboundary projects.

The keysheet is organised under the following headings, with substantive information provided in table form:

- Project components and activities.
- Sources of impact and receptors/resources.
- Mitigation and management options.

The phases of transmission line projects considered are: design and planning, including route and site selection; construction; operation and maintenance; and where appropriate decommissioning (closure).

Project components and activities

The components of transmission line projects are provided in Table 1, along with the activities involved in developing these networks, broken down by project phase.

Sources of impact, receptors/ resources, and mitigation

Table 2 summarizes the main aspects of transmission line development activities that lead to typical impacts, the receptors and resources they affect, and options for mitigation. It considers impacts on the physical, biological and socioeconomic environment. The mitigation measures described assume that higher level design and network

planning measures, as described in Table 1, have already been implemented.

The guidance on impacts and options for their mitigation can be used to help discussions with the borrower or client

and improve their understanding of the Bank's requirements. They should also be used to assist preparation of ToRs for an ESIA so that they are tailored to the particular circumstances of the transmission line or interconnection project under consideration.

Table 1: Summary of Activities associated with Hydroelectric Power Projects

Components	
Transmission lines <ul style="list-style-type: none"> • Above ground power transmission lines • Transmission lines buried in underground conduits. • Submarine cables to islands and other inaccessible locations. Transmission Towers <ul style="list-style-type: none"> • Steel, wood or aluminium towers and pylons. • Power Distribution Lines • Lower voltage lines with power distribution poles (generally wood). 	Substations <ul style="list-style-type: none"> • One or more transformers, as well as switching, control, and protection equipment. • Substations can be located in fenced enclosures, underground, or inside buildings. Temporary construction components <ul style="list-style-type: none"> • Temporary construction facilities (e.g. workshops, laydown areas, working corridors along the RoW, workers' accommodation, etc.). • Temporary access roads within and between construction areas / temporary facilities.
Activity	
Design – System planning, including route selection.	Screening , Scoping and ESIA Preparation of ESMP Agreement of loan covenants
Strategic planning (communications options analysis, cost-benefit analysis, strategic network layout selection, initial design), and for major (national or international) transmission line development, strategic environmental and social assessment (SESA), to establish: <ul style="list-style-type: none"> • Major constraints and alternatives (e.g. with respect to major settlements, watersheds and areas of biodiversity conservation importance). • Design procedures such that environmental and social considerations are given equal weight to engineering and financial ones. 	
Site-specific planning (detailed design), taking account of environmental and social sensitivities and consultation with communities, draw upon the following environmental and socioeconomic documentation, all of which should comply with national regulations and international good practice: <ul style="list-style-type: none"> • Environmental and Social Impact Assessment (ESIA). • Environmental and Social Management Plan (ESMP). • Stakeholder Engagement Plan (SEP). • Resettlement Action Plan (RAP). 	
Construction	Monitoring of ESMP performance. Monitoring of compliance with loan covenants. Monitoring of sub-contractor contract provisions.
Construction activities will include: <ul style="list-style-type: none"> • Establishing temporary access to work and ancillary areas, demarcating clearance zones, establishing access control. • Clearance and levelling of the transmission line route. • Location and development of borrow pits if required. • Trenching and laying of underground powerline, including watercourse crossings. • Backfilling and reinstatement of underground powerline route. • Laying of submarine cables. • Construction of pylons / towers and installation of overhead power lines. • Construction of substations. 	
The equipment required will include heavy mobile plant (e.g. excavators) and temporary fixed plant such as power generators.	
Operation and Maintenance	Project implementation: Compliance Monitoring
During operation impacts will generally be small, related to visual and electromagnetic impacts, and to disruption of aerial routes used by birds and bats. These and others are described in Table 2.	
RoW maintenance is required to protect the system from windfall, and contact with trees and other vegetation. This involves mowing with heavy-duty equipment, use of herbicides, trimming and pruning. Maintenance of power lines and substations will entail many of the activities described above for the construction phase, although they are likely to be smaller in scale and spatial extent.	

Components	
Activity	
Decommissioning (Closure)	Project Completion: Compliance Report
Where temporary access roads are developed during construction they should be decommissioned and rehabilitated in accordance with a site-specific closure plan developed in consideration of international good practice.	
Both for temporary facilities and ultimately the transmission line and associated facilities, the closure process will include site clearance, removal of all equipment including underground power lines, appropriate disposal of waste materials and reinstatement / revegetation as appropriate.	

Table 2: Transmission Line Development Developments: Impacts and Mitigation

Impacts	Mitigation
Geology/Hydrogeology <ul style="list-style-type: none"> • Interruption of hydrogeology and groundwater flows from construction and ground clearance. 	<ul style="list-style-type: none"> • Detailed alignment to take account of local groundwater conditions, e.g. by avoiding areas with springs or where the water table is shallow. • Limit sealed or compacted areas as much as possible, to maintain natural recharge of the water table.
Soils, Run-off and Flooding <ul style="list-style-type: none"> • Loss of soil / sediments and pollution of watercourses, and interruption of drainage patterns, as a result of ground clearance access roads. 	<ul style="list-style-type: none"> • Good construction site management practices to avoid runoff, erosion and sedimentation. • Careful design: e.g. alignment, minimal diversion of watercourses, timing of works (overall duration and seasonality).
Pollution of Soils and Water <ul style="list-style-type: none"> • Release of hazardous substances during construction and operation (e.g. insulating oils / gases, fuels and chemicals for wood preservation) leading to soil, surface water, marine or groundwater contamination. 	<ul style="list-style-type: none"> • Materials handling and control procedures. • Control of construction vehicle movements and prohibition of vehicle washing in watercourses, and similar practices • Replace existing transformers and other electrical equipment containing PCB, and ensure appropriate storage, decontamination, and disposal of contaminated units. Remediation of soil if required. • Ensure that chemically preserved poles are pretreated at an appropriate facility to ensure chemical fixation and prevent leaching of wood preservatives. • Measures to minimise the use of oil-based wood preservatives, and appropriate disposal of poles.
<ul style="list-style-type: none"> • Discharge of construction site/camp sewage effluent polluting watercourses 	<ul style="list-style-type: none"> • Installation of sewage treatment to meet required standards; hygiene training for workforce
<ul style="list-style-type: none"> • Contamination of soils, surface water and groundwater from herbicides used in RoW management. 	<ul style="list-style-type: none"> • Implement an RoW maintenance plan which considers alternative vegetation control strategies, with use of herbicides as a last resort. Alternatives may include mechanical weed control or use of grazing animals. • If herbicide use is required, implement measures to avoid uncontrolled and excessive use, with only those which are less harmful to the environment being deployed (e.g. avoiding systemic or persistent herbicides that are injurious to animals and humans). • Measures to prevent leaks and spills during storage and handling, eg spill containment measures, training and correct labelling.
Air Quality <ul style="list-style-type: none"> • Dust from construction, and other emissions during construction and operation, could affect human health, vegetation (including crops) and wildlife. 	<ul style="list-style-type: none"> • Sensitive siting of construction facilities, including access roads and laydown areas • Dust control and suppression measures as required. • Modern equipment and vehicles meeting appropriate emissions standards, and regular preventative maintenance.
Noise and Vibration <ul style="list-style-type: none"> • Noise and vibration from equipment including backup power generators and vehicles may disturb sensitive noise receptors (human and fauna). 	<ul style="list-style-type: none"> • Sensitive siting of construction facilities. • Use of modern equipment fitted with abatement devices (e.g. mufflers, noise enclosures); good maintenance regime.
<ul style="list-style-type: none"> • For submarine power cables, noise and vibration from vessels may disturb marine fauna. 	<ul style="list-style-type: none"> • Sensitive timing of laying, and location, of submarine power cables.

Impacts	Mitigation
<p>Electric and electromagnetic fields</p> <ul style="list-style-type: none"> Potential adverse human health impacts and impacts to fauna from power transmission lines and equipment. 	<ul style="list-style-type: none"> Evaluate potential exposure to the public, and any potential engineering techniques to reduce EMF produced. Consider siting facilities to limit public exposure, especially near the most sensitive receptors, e.g. avoiding high voltage lines and equipment close to schools and hospitals, and also close to animal breeding sites
<p>Resources and Waste</p> <ul style="list-style-type: none"> Construction may require supply of water from surface or groundwater. 	<ul style="list-style-type: none"> Measures to ensure sustainable water use, as required.
<ul style="list-style-type: none"> Inefficient waste management during construction and maintenance leading to excess materials consumption, generation of wastes/ emissions, soils and water pollution. 	<ul style="list-style-type: none"> Preparation of Waste Management Plan following the waste hierarchy, supported by staff training Use of authorised contractors for hazardous and any other wastes which the project cannot dispose of safely <p>See Pollution of Soils and Water above</p>
<p>Visual Impacts</p> <ul style="list-style-type: none"> Visual impacts from transmission lines and towers. 	<ul style="list-style-type: none"> Careful choice of alignment considering the landscape, important environmental and community features, siting high voltage lines away from highly populated areas, and burying lines in dense residential / commercial areas. Public consultation along the alignment, to take community views into account.
<p>Loss, fragmentation and degradation of terrestrial and marine habitat, and severance of animal migration routes and pathways</p> <ul style="list-style-type: none"> Land clearance may cause loss or fragmentation of protected areas and other areas of conservation interest, and degradation following poorly managed rehabilitation. Aerial power lines and pylons may disrupt bird migratory routes and bird and bat flight paths. 	<ul style="list-style-type: none"> Careful siting of all project components to avoid critical terrestrial and marine habitat, with advice from biodiversity authorities/wildlife specialists, and use of existing utility corridors where possible. Burying submarine cables when traversing sensitive intertidal habitat. Wherever feasible, establishment of buffer zones around conservation areas, watercourses, and other locations identified as ecologically sensitive and avoidance or minimisation of activity within these zones. Where possible, installation of transmission lines above existing vegetation to avoid clearing. Rehabilitation of cleared areas with native species, and ecosystem restoration in habitats of conservation value, using specialist advice and input, backed up by a long-term monitoring programme and corrective actions as necessary.
<ul style="list-style-type: none"> Loss of vegetation due to right of way maintenance. 	<ul style="list-style-type: none"> Implement an integrated vegetation management approach to minimise impacts to non-target, endangered and threatened species. Removal of invasive plant species and where necessary planting of native plant species. Schedule vegetation management to avoid important periods for sensitive fauna species (e.g. breeding season). Good maintenance practices such as avoiding clearance in riparian areas, avoiding use of machinery close to watercourses and measures to avoid noise / dust / spill impacts.
<ul style="list-style-type: none"> Impacts from forest fires resulting from right of way maintenance activities. 	<ul style="list-style-type: none"> Reduce risk of forest fires, eg by monitoring fire risk, removal of high hazard fuel and appropriate disposal, timing maintenance to avoid high risk seasons, fire breaks and planting of fire resistant species.
<ul style="list-style-type: none"> Disturbance to the seabed from anchoring of cable laying vessels, and presence of cable on seabed. 	<ul style="list-style-type: none"> Sensitive siting of powerline to avoid critical marine habitat.
<ul style="list-style-type: none"> Severance of animal migration pathways and flyways, and bird / bat collisions with pylons and power lines. 	<ul style="list-style-type: none"> Where power lines and access roads cross watercourses, design culverts/crossing structures to avoid impacts on fish movement. Avoid critical habitats such as bird migration corridors, bat foraging corridors and nesting areas. Design transmission line project to minimise the risk of collision and electrocution, such as burying power lines in critical areas, install visibility enhancement objects, maintaining space between energised parts and pylon structures/hardware.

Impacts	Mitigation
<ul style="list-style-type: none"> Construction impacts on habitats and species (e.g. from changes in drainage, soil erosion, pollution of water, soils or air, and general human disturbance). 	<p>Where development in sensitive areas cannot be avoided, mitigation may include:</p> <ul style="list-style-type: none"> Minimisation of area impacted, clear demarcation of remaining intact areas of habitat, and prohibition of activity into those areas for any purpose; maintenance of wildlife corridors between fragmented areas wherever possible. Avoidance of construction activities during sensitive seasons or times of day. Habitat rehabilitation and ecosystem restoration of areas no longer required after construction, as soon as possible. Monitoring power cable alignment for presence of marine mammals prior to cable laying. <p>See also Pollution of Soils and Water above and Induced Access below.</p>
<ul style="list-style-type: none"> Disturbance and emissions from vehicles and vessels during construction affecting the integrity and viability of areas of conservation interest. 	<p>See Air quality and Noise / Vibration above.</p>
<p>Impacts from Induced Access</p> <ul style="list-style-type: none"> Development of transmission lines in remote or undeveloped areas, especially construction of access roads for construction and maintenance, may lead to further development, increased disturbance and pressure on natural resources through bushmeat hunting, logging, fire, etc. 	<ul style="list-style-type: none"> Careful alignment selection, with advice from biodiversity authorities/wildlife specialists to avoid remote and previously inaccessible areas where possible. Where possible, instate access controls on roads leading to transmission line and other project facilities (e.g. substations) in otherwise undeveloped or remote areas. <p>See also Bushmeat Hunting below.</p>
<p>Bushmeat Hunting</p> <ul style="list-style-type: none"> Construction activities in remote areas could lead to greater demand for bushmeat, stimulate the wildlife trade and facilitate access to hunting areas. 	<ul style="list-style-type: none"> Bushmeat Hunting and Wildlife Trade Management Plan, agreed with government authorities and implemented jointly. Measures to minimise bushmeat hunting by construction workforce, if significant risk is identified. Sensitisation and public awareness campaigns against hunting and bushmeat the trade amongst local communities.
<p>Direct Impacts on Terrestrial and Marine Flora and Fauna</p> <ul style="list-style-type: none"> Clearance of vegetation may lead to loss of plant species and habitat of conservation interest, and displacement of fauna. Submarine cable laying may disturb sensitive habitats and important areas for species (e.g. fish spawning areas). 	<ul style="list-style-type: none"> Careful route selection and siting of all project components, with advice from biodiversity authorities/wildlife specialists. Careful planning of phasing and timing of construction activities. Demarcation and avoidance of areas of conservation interest (high value species, feeding or breeding sites, migration routes, etc.) where possible, and wildlife rescue and translocation where appropriate, under expert supervision. <p>Also see measures under Soils, Run-off and Flooding, Pollution of Soils and Water, and Induced Access above, and Invasive Species below.</p>
<ul style="list-style-type: none"> Potential for bird collisions with communications towers and above ground cables. 	<ul style="list-style-type: none"> Siting towers and above ground cable routes to avoid critical habitats and migration routes. Avoid cumulative impacts by limiting the number of towers (eg through co-location, removing disused towers). Careful design to limit the impact of towers, eg limiting tower height, use of designs with lower collision risk, limiting tower lighting where practical.
<p>Invasive Species</p> <ul style="list-style-type: none"> Movement of plant and workforce (including cable laying vessel movements) into areas could introduce invasive species which adversely impact fauna, flora, ecosystems, and crops. 	<ul style="list-style-type: none"> Invasive Species Management Plan, which should be developed and implemented in consultation with authorities, including appropriate eradication measures for different species/groups of species. Staff training and awareness raising in communities. No introduction of exotic species (e.g. for site rehabilitation) without specialist vetting and government approval. Removal of invasive plant species during routine vegetation management.
<p>Economic Development and Employment</p> <ul style="list-style-type: none"> Direct employment of local population in workforce, and stimulation of local economy through demand for goods and services will enhance livelihoods and economic activity in local communities, but potentially adverse effects if community relations are not well managed. 	<ul style="list-style-type: none"> Development of an Employment Plan, with clear employment requirements and procedures for the construction workforce. Transparent and culturally appropriate communication with communities regarding employment opportunities. Fair and transparent hiring and staff management procedures.

Impacts	Mitigation
<p>Cultural Heritage</p> <ul style="list-style-type: none"> Displacement or damage to cultural heritage sites by construction activities, harm to the setting, amenity value, etc. of the site due to construction or operation. 	<ul style="list-style-type: none"> Careful route selection and siting of all project components, taking account of community consultation/specialist surveys. Development of a Cultural Heritage Management Plan covering tangible and intangible (e.g. local traditions and practices) cultural heritage. Implementation of a "Chance Finds" procedure during construction. <p>See also Guidance Note on Physical Cultural Heritage.</p>
<p>Community Health, Safety and Security</p> <ul style="list-style-type: none"> Poor construction management practices may lead to adverse effects on safety, human health and wellbeing. 	<ul style="list-style-type: none"> Good construction site "housekeeping" and management procedures (including site access). Disease control measures, e.g. no pools of standing water, rodent control, treatment of water. Risk assessments and emergency response planning to consider impacts on local communities. <p>See also control of pollution under Physical Impacts heading.</p>
<ul style="list-style-type: none"> Interaction between workforce and local communities may increase occurrence of communicable diseases, including HIV/AIDS and sexually transmitted diseases (STDs). 	<ul style="list-style-type: none"> Implementation of a health management system for the construction workforce, to ensure it is fit for work and that it will not introduce disease into local communities. Training and awareness training for workforce and their dependents on HIV/AIDS and other STDs, and communicable diseases including malaria; health awareness raising campaigns for communities on similar topics.
<ul style="list-style-type: none"> Potential safety risks associated with the presence of transmission lines. 	<ul style="list-style-type: none"> Measures to avoid electrocution, such as signs, fencing and other barriers, and grounding objects. Measures to avoid aircraft collision with transmission lines, eg lighting and consultation with air traffic authorities.
<p>Social Structures and Community Life</p> <ul style="list-style-type: none"> Real or perceived disruption to normal community life, through the physical presence of a construction workforce. 	<ul style="list-style-type: none"> Adoption of a Stakeholder Engagement Plan, as a framework for early and ongoing community consultation. Implementation of a Grievance Procedure (see Grievance Procedure and Redress Mechanisms guidance note). Works procedures, defining a Code of Appropriate Conduct for all workers. Training for all staff in acceptable behaviour with respect to community interactions.
<p>Labour and Working Conditions</p> <ul style="list-style-type: none"> Poor management of occupational health and safety could lead to accidents, injuries and illnesses among workers; mental health issues may arise due to remote or enclosed living Differences in nationality, ethnicity, religion, etc. may lead to discrimination and harassment, and differences (perceived or real) in working conditions between workers may lead to resentments. 	<ul style="list-style-type: none"> Employment practices and working conditions should conform to International Labour Organisation (ILO) Standards and national regulations. Rest and recreational facilities and time should be provided, and rules on alcohol and drugs defined and clearly communicated to workers. The basis for differences in the standard of accommodation should be non-discriminatory; it should be documented and communicated transparently to the workforce. Clear and comprehensive health and safety reporting and grievance procedure system should be established, and be freely available to all of the workforce. <p>See also Employment and Economic Development.</p>

ENERGY / ELECTRICITY SECTOR: THERMAL POWER PROJECTS

Thermal power projects include all combustion processes fuelled by fossil fuels (solid, liquid and gas) and biomass, which deliver electrical or mechanical power, heat or steam. The transmission lines to deliver electricity to consumers are covered in a separate keysheet (See keysheet on Transmission Lines and Interconnection Systems).

The impacts associated with the construction of thermal power projects are similar to other industrial developments, eg land take and presence of workers. The operation of thermal power projects can cause a variety of significant environmental impacts, including gaseous and liquid emissions, fuel and water consumption, solid waste, hazardous waste and noise emissions.

Scope and structure

This keysheet provides a summary of the activities, typical environmental and social impacts, and potential mitigation and management measures relating to the development of thermal power projects.

This keysheet should be used specifically to help with drafting ToRs for ESIs of thermal power developments and with scoping and conducting ESIs and preparing ESMPs. It can also help in reviewing ESIs.

It should be used in conjunction with the Bank's Guidance Notes on ESIs (including coverage of cumulative impacts) and with the Guidance Notes on specific safeguard topics including transboundary projects.

The keysheet is organised under the following headings, with substantive information provided in table form:

- Project components and activities.

- Sources of impact and receptors/resources.
- Mitigation and management options.

The phases of thermal power projects considered are: design and planning, including route and site selection; construction; operation and maintenance; and where appropriate decommissioning (closure).

Project components and activities

The components of thermal power projects are provided in Table 1, along with the activities involved in developing these networks, broken down by project phase.

Sources of impact, receptors/ resources, and mitigation

Table 2 summarizes the main aspects of thermal power development activities that lead to typical impacts, the receptors and resources they affect, and options for mitigation. It considers impacts on the physical, biological and socioeconomic environment. The mitigation measures described assume that higher level design and network planning measures, as described in Table 1, have already been implemented.

The guidance on impacts and options for their mitigation can be used to help discussions with the borrower or client and improve their understanding of the Bank's requirements. They should also be used to assist preparation of ToRs for an ESI so that they are tailored to the particular circumstances of the thermal power project under consideration.

Table 1: Summary of Activities associated with Thermal Power Projects

Components	
<p>Power plant</p> <p>The components of a thermal power plant vary according to the technology and fuel used, but generally include the following:</p> <ul style="list-style-type: none"> Fuel reception and storage. This depends on the fuel and may include: <ul style="list-style-type: none"> Coal heaps. Tanks for oil or diesel. Pipelines for gas or liquid fuel. Conveyors for coal, if close to coal mine. Rail, ship or truck terminals and associated infrastructure. Fuel processing (for coal-fired power plants) Electricity generation, of which common systems are: <ul style="list-style-type: none"> Steam turbines. Reciprocating engines. Combustion turbines. Combined cycle generators. Co-generation systems. 	<ul style="list-style-type: none"> Electricity generation equipment, eg turbine – generators. Structures for condensation and cooling of steam / water, which may include large cooling towers. Flue gas desulphurisation (FGD) plant (if appropriate). Systems for disposal of boiler ash and other waste streams. Electricity transformers and connection to grid Cooling water outlets to water bodies (river, lake or sea). <p>Ancillary facilities</p> <ul style="list-style-type: none"> Security fencing and guard posts. Offices, workshops, and staff quarters. Car parks, etc. Access roads and other transport infrastructure (e.g. railway line) if appropriate.
Activity	
Design – System planning, including route selection	<p>Screening , Scoping and ESIA</p> <p>Preparation of ESMP</p> <p>Agreement of loan covenants</p>
<p>Strategic planning (options analysis, cost-benefit analysis, initial design), to establish:</p> <ul style="list-style-type: none"> Major constraints and alternatives (e.g. with respect to major settlements, watersheds and areas of biodiversity conservation importance). Design procedures such that environmental and social considerations are given equal weight to engineering and financial ones. 	
<p>Site-specific planning (detailed design), taking account of environmental and social sensitivities and consultation with communities, draw upon the following environmental and socioeconomic documentation, all of which should comply with national regulations and international good practice:</p> <ul style="list-style-type: none"> Environmental and Social Impact Assessment (ESIA). Environmental and Social Management Plan (ESMP). Stakeholder Engagement Plan (SEP). Resettlement Action Plan (RAP). 	
Construction	<p>Monitoring of ESMP performance</p> <p>Monitoring of compliance with loan covenants</p> <p>Monitoring of sub-contractor contract provisions</p>
<p>Construction activities will include:</p> <ul style="list-style-type: none"> Establishing temporary access to work and ancillary areas, demarcating clearance zones, establishing access control. Clearance and levelling of the site. Location and development of borrow pits if required. Construction of power plant and facilities. Construction of fuel transport infrastructure as required (eg access roads, railway line and terminals). Construction of electricity transformers and interconnection to grid. 	
<p>The equipment required will include heavy mobile plant (e.g. excavators) and temporary fixed plant such as power generators.</p>	
Operation and Maintenance	Project implementation: Compliance Monitoring
<p>During operation, one of the most significant impacts will be emissions to air of local air pollutants and greenhouse gases. Normal operations will also give rise to liquid effluent, solid wastes, hazardous waste, noise emissions. The processes also require inputs of fuel and water, which need to be transported to the plant.</p>	
<p>Maintenance of thermal power plants will entail many of the activities described above for the construction phase, although they are likely to be smaller in scale and time.</p>	

Components	
Activity	
Decommissioning (Closure)	Project Completion: Compliance Report
Where temporary access roads are developed during construction they should be decommissioned and rehabilitated in accordance with a site-specific closure plan developed in consideration of international good practice.	
The closure process will include site clearance, removal of all equipment, appropriate disposal of waste materials and reinstatement / revegetation as appropriate.	

Table 2: Transmission Line Development Developments: Impacts and Mitigation

Impacts	Mitigation
Geology/Hydrogeology <ul style="list-style-type: none"> • Interruption of hydrogeology and groundwater flows from excavation and ground clearance. 	<ul style="list-style-type: none"> • Sensitive site selection to take account of local groundwater conditions, e.g. by avoiding areas with springs or where the water table is shallow. • Limit sealed or compacted areas as much as possible, to maintain natural recharge of the water table.
<ul style="list-style-type: none"> • Pollution of groundwater from discharges and accidental releases during construction and operation. 	See Pollution of Soils and Water below
Soils, Run-off and Flooding <ul style="list-style-type: none"> • Loss of soil / sediments and pollution of watercourses, and interruption of drainage patterns, as a result of ground clearance and earthworks during construction. 	<ul style="list-style-type: none"> • Minimisation of cleared areas and soil disturbance, with revegetation as soon as feasible, with native species. • Avoidance of areas liable to flooding, slope instability, and water crossings where possible. • Careful design: e.g. alignment, minimal diversion of watercourses, timing of works (overall duration and seasonality).
Pollution of Soils and Water <ul style="list-style-type: none"> • Discharge of cooling water with elevated temperature and chemical additives. 	<ul style="list-style-type: none"> • Reducing the volume of water required, for example through re-use of water in the cooling water system, or air cooled systems. • Use of multi-port diffusers to minimise the impact of thermal discharges. • Minimise impacts through outfall design, outfall location and changes to effluent flow and temperature.
<ul style="list-style-type: none"> • Discharge of waste water from power generation processes, which may contain fuel oils, contaminants from fuel, chlorine, biocides and other contaminants, depending on the wastewater stream and type of technology used. 	<ul style="list-style-type: none"> • Water treatment prior to discharge. • Reuse of water in coal-fired plants, for use as FGD make-up. • Reduce volume of water used in process, eg by minimising volume used as fireside wash or choosing SOx removal technologies that use less water. • Minimise runoff from coal piles; manage coal piles to reduce contamination in runoff. • Use less environmentally harmful additives or reduced quantities to control scaling, corrosion or as biocides.
<ul style="list-style-type: none"> • Accidental release of hazardous substances during construction and operation, such as fuels and other chemicals (e.g. vehicle or vessel spills) leading to soil, surface water or groundwater contamination. 	<ul style="list-style-type: none"> • Materials handling and control procedures. • Control of construction vehicle movements and prohibition of vehicle washing in watercourses, and similar practices. • Emergency response plans during construction (contractors and local authorities) and operation (local authorities).
<ul style="list-style-type: none"> • Release of sewage and grey-water 	<ul style="list-style-type: none"> • Installation of sewage treatment to meet required standards.

Impacts	Mitigation
<p>Air Quality</p> <ul style="list-style-type: none"> Emissions from the combustion of fossil fuels/ biomass, including sulphur dioxide (SO_x), nitrogen oxides (NO_x), carbon monoxide (CO), methane (CH₄) and particulate matter (PM) which cause local and long range air pollution. Emissions of other toxic or persistent substances to air, such as heavy metals, unburned hydrocarbons and volatile organic compounds, depending on the fuel used. Dust from construction could affect human health, vegetation (including crops) and wildlife. 	<ul style="list-style-type: none"> Use of the cleanest fuel economically available, where natural gas is preferable to oil, which is preferable to coal. If burning coal, use of high-heat-content, low ash and low-sulphur coal. Consider beneficiation to reduce ash content, particularly for high ash coal. Balance economic and environmental impacts by choosing the best power generation technology for the fuel chosen, including consideration of combined heat and power. Design stack heights to minimise impacts of air pollution. Consider cumulative impacts from other sources of air emissions in area, and engineer mitigation or site the plant so as to reduce the cumulative impact to within applicable standards. Dependent on the pollutant concentration emissions from the power plant, pollutant specific mitigation measures should be considered, for example flue gas desulphurisation where high SO₂ concentrations are predicted, and filters or selective catalytic reduction (SCR) to reduce metals. Use of technology such as low NO_x burners or SCR to reduce NO_x emissions. Particulate matter emissions can be reduced through the use of filters, electrostatic precipitators and wet scrubbers within the power generation process, and use of dust suppression techniques such as water spray systems, minimising the height of fuel drop, and designing fuel transport systems to reduce dust. Dust control and suppression measures during construction. Emissions of methane and carbon monoxide can be reduced through efficient boiler design and operation, eg pure fuel and high combustion temperatures. Modern equipment and vehicles meeting appropriate emissions standards, and regular preventative maintenance to ensure efficient operation and reduce leaks (eg of methane).
<p>Energy efficiency & greenhouse gas emissions</p> <ul style="list-style-type: none"> Use of fossil fuels (a finite resource) and emissions of carbon dioxide and methane which contribute to global climate change. 	<ul style="list-style-type: none"> Use a less carbon intensive fossil fuel (eg natural gas instead of coal) or if feasible using biomass (a carbon neutral fuel). Use of combined heat and power generation technology. Use of energy efficient technology, eg combined cycle gas turbine technology. Ensure that the combustion process works efficiently, through management and monitoring measures. Consider improving efficiency through reducing transmission losses, and peak load management.
<p>Noise and Vibration</p> <ul style="list-style-type: none"> Noise and vibration from power plant during operation, and construction activities may disturb sensitive noise receptors (human and fauna). 	<ul style="list-style-type: none"> Sensitive siting of construction facilities. Use of modern equipment fitted with abatement devices (e.g. mufflers, noise enclosures) if required. Good maintenance regime of construction and operational machinery.
<p>Resources and Waste</p> <ul style="list-style-type: none"> Extraction of water for cooling water system may affect existing supply for human communities and ecosystems. 	<ul style="list-style-type: none"> Water study prior to any abstraction, to inform a Sustainable Water Management Plan. No abstraction without prior approval of relevant authorities at all locations. Promotion of water efficiency (including leak detection, preventative maintenance of equipment) and water recycling. Reducing the volume of water required, for example through re-use of water in the cooling water system, or air cooled systems. Reducing intake flow to maintain hydrology of watercourse.
<ul style="list-style-type: none"> Inefficient waste management during construction and maintenance leading to excess materials consumption, generation of wastes/ emissions, soils and water pollution. 	<ul style="list-style-type: none"> Preparation of Waste Management Plan following the waste hierarchy, supported by staff training. Use of authorised contractors for hazardous and any other wastes which the project cannot dispose of safely.

Impacts	Mitigation
<ul style="list-style-type: none"> Significant quantities of solid wastes are produced by coal and biomass fired power stations, including fly ash (which may contain heavy metals), FDG waste and sludge. 	<ul style="list-style-type: none"> Dry handling of coal construction waste to minimise pathways for contaminants to enter the environment. Recycling of wastes as construction material and reusing sludge if appropriate. Appropriate management of handling, transport and disposal of wastes.
<p>Visual Impacts</p> <ul style="list-style-type: none"> Visual impacts from project, particularly cooling towers. 	<ul style="list-style-type: none"> Careful site selection including consultation with local communities.
<p>Loss, fragmentation and degradation of habitat, and severance of animal migration routes and pathways</p> <ul style="list-style-type: none"> Land clearance for plant and associated infrastructure eg access roads, railways, may cause loss or fragmentation of protected areas and other areas of conservation interest. 	<ul style="list-style-type: none"> Careful siting of all project components to avoid critical habitat, with advice from biodiversity authorities/wildlife specialists and use of existing transport corridors where possible. Wherever feasible, establishment of buffer zones around conservation areas, watercourses, and other locations identified as ecologically sensitive and avoidance or minimisation of activity within these zones. Rehabilitation of cleared areas with native species, and ecosystem restoration in habitats of conservation value, using specialist advice and input, backed up by a long-term monitoring programme and corrective actions as necessary.
<ul style="list-style-type: none"> Construction impacts on habitats and species (e.g. from changes in drainage, soil erosion, pollution of water, soils or air, introduction of invasive species, and general human disturbance). Disturbance and emissions from increased traffic and emissions from power plant affecting the integrity and viability of areas of conservation interest 	<p>Where development in sensitive areas cannot be avoided, mitigation may include:</p> <ul style="list-style-type: none"> Minimisation of area impacted, clear demarcation of remaining intact areas of habitat, and prohibition of activity into those areas for any purpose; maintenance of wildlife corridors between fragmented areas wherever possible. Avoidance of construction activities during sensitive seasons or times of day. No ground clearance upstream of sensitive areas unless appropriately engineered drainage installed. Habitat rehabilitation and ecosystem restoration of areas no longer required after construction, as soon as possible. If loss of Critical Habitat is inevitable, development/implementation of an Offsets Programme. <p>See also Pollution of Soils and Water, Air Quality, Noise / Vibration and Invasive Species.</p>
<p>Direct Impacts on Terrestrial and Marine Flora and Fauna</p> <ul style="list-style-type: none"> Clearance of vegetation may lead to loss of plant species and habitat of conservation interest, and displacement of fauna. 	<ul style="list-style-type: none"> Careful site selection and siting of all project components, with advice from biodiversity authorities/wildlife specialists. Careful planning of phasing and timing of construction activities. Demarcation and avoidance of areas of conservation interest (high value species, feeding or breeding sites, migration routes, etc.) where possible, and wildlife rescue and translocation where appropriate, under expert supervision. <p>Also see measures under Soils, Run-off and Flooding, Pollution of Soils and Water, and Induced Access above, and Invasive Species below.</p>
<ul style="list-style-type: none"> Extraction of water for cooling water system may affect aquatic habitats, and entrainment of aquatic fauna. Higher temperature of returning waters can affect marine and aquatic species. 	<ul style="list-style-type: none"> Screens and reducing intake velocity to prevent entrainment of aquatic fauna. Where appropriate (in the vicinity of fisheries or protected species) use operational measures and technology such as barrier nets to further reduce the risk of impingement or entrainment of fauna. Sensitive siting of cooling water outfalls, based if appropriate on hydrodynamic modelling of cooling water dispersion. Reducing the volume of water required, for example through re-use of water in the cooling water system, for example by using cooling towers or cooling ponds, or air cooled systems. Reducing intake flow to maintain resource use.
<p>Invasive Species</p> <ul style="list-style-type: none"> Movement of plant and workforce into areas could introduce invasive species which adversely impact fauna, flora, ecosystems, and crops. 	<ul style="list-style-type: none"> developed and implemented in consultation with authorities, including appropriate eradication measures for different species/groups of species. Staff training and awareness raising in communities. No introduction of exotic species (e.g. for site rehabilitation) without specialist vetting and government approval.

Impacts	Mitigation
<p>Economic Development and Employment</p> <ul style="list-style-type: none"> Direct employment of local population in workforce, and stimulation of local economy through demand for goods and services will enhance livelihoods and economic activity in local communities, but potentially adverse effects if community relations are not well managed. 	<ul style="list-style-type: none"> Development of an Employment Plan, with clear employment requirements and procedures for the construction workforce. Transparent and culturally appropriate communication with communities regarding employment opportunities. Fair and transparent hiring and staff management procedures. Employment requirements and vocational training plan to be agreed with local institutions, so that local people can be trained to meet the project's needs in a timely fashion. Development of measures to manage the transition after construction is complete, including SME development, ongoing opportunities for the workforce in equipment management and maintenance, reskilling and alternative employment.
<ul style="list-style-type: none"> Procurement of local goods and services project and workforce could deplete resources available for local communities. 	<ul style="list-style-type: none"> Procedures for sustainable local procurement, in consultation with local authorities and community leaders Local capacity building to foster community resilience Monitoring of local prices, and exploration of corrective measures (e.g. alternative sourcing to reduce local pressure) if appropriate
<p>Cultural Heritage</p> <ul style="list-style-type: none"> Displacement or damage to cultural heritage sites by construction activities, harm to the setting, amenity value, etc. of the site due to construction or operation. 	<ul style="list-style-type: none"> Careful site selection and siting of all project components, taking account of community consultation/specialist surveys. Development of a Cultural Heritage Management Plan covering tangible and intangible (e.g. local traditions and practices) cultural heritage. Implementation of a "Chance Finds" procedure during construction <p>See also Guidance Note on Physical Cultural Heritage.</p>
<p>Community Health, Safety and Security</p> <ul style="list-style-type: none"> Poor construction management practices may lead to adverse effects on safety, human health and wellbeing. 	<ul style="list-style-type: none"> Good construction site "housekeeping" and management procedures (including site access). Disease control measures, e.g. no pools of standing water, rodent control, treatment of water. Risk assessments and emergency response planning to consider impacts on local communities. <p>See also control of pollution under Physical Impacts heading.</p>
<ul style="list-style-type: none"> Interaction between workforce and local communities may increase occurrence of communicable diseases, including HIV/AIDS and sexually transmitted diseases (STDs). 	<ul style="list-style-type: none"> Implementation of a health management system for the construction workforce, to ensure it is fit for work and that it will not introduce disease into local communities Training and awareness training for workforce and their dependents on HIV/AIDS and other STDs, and communicable diseases including malaria; health awareness raising campaigns for communities on similar topics
<ul style="list-style-type: none"> Extraction of water for cooling water system may compete with other water uses such as drinking water supplies. 	See Resources and Waste above
<ul style="list-style-type: none"> Potential safety risks associated with the increased traffic if fuel is delivered by truck or railway. 	<ul style="list-style-type: none"> Adoption of best transport safety practices for delivery of fuels by truck, eg improving driver skills, limiting trip duration and vehicle speed. Regular maintenance of vehicles to reduce risk of traffic accidents. Collaboration with local communities and authorities to improve road safety and increase traffic awareness. Avoid rail incidents through implementation of a Safety Management Plan (e.g. good maintenance of track and rolling stock, use of barriers and signage, preparation of spill prevention and control procedures). Implementation of an Emergency Response Plan to manage major road or rail incidents if they should occur.
<p>Social Structures and Community Life</p> <ul style="list-style-type: none"> Real or perceived disruption to normal community life, through the physical presence of a construction workforce. 	<ul style="list-style-type: none"> Adoption of a Stakeholder Engagement Plan, as a framework for early and ongoing community consultation. Implementation of a Grievance Procedure (see Grievance Procedure and Redress Mechanisms guidance note). Works procedures, defining a Code of Appropriate Conduct for all workers. Training for all staff in acceptable behaviour with respect to community interactions.

Impacts	Mitigation
<p>Labor and Working Conditions</p> <ul style="list-style-type: none"> • Poor management of occupational health and safety could lead to accidents, injuries and illnesses among workers; mental health issues may arise due to remote or enclosed living. • Differences in nationality, ethnicity, religion, etc. may lead to discrimination and harassment, and differences (perceived or real) in working conditions between workers may lead to resentments. 	<ul style="list-style-type: none"> • Employment practices and working conditions should conform to International Labour Organisation (ILO) Standards and national regulations • Rest and recreational facilities and time should be provided, and rules on alcohol and drugs defined and clearly communicated to workers. • The basis for differences in the standard of accommodation should be non-discriminatory; it should be documented and communicated transparently to the workforce. • Clear and comprehensive health and safety reporting and grievance procedure system should be established, and be freely available to all of the workforce. <p>See also Employment and Economic Development.</p>



ENERGY / ELECTRICITY SECTOR: SOLAR POWER

Investment in solar power stations allows African countries to take advantage of a domestic, abundant and “green” energy source, and to enhance energy generation capacity needed to fuel economic growth and social progress. Using solar radiation as a renewable energy source is environmentally desirable and consistent with the “green and inclusive growth” path to which Bank borrowers and clients should commit. However, the construction, rehabilitation and maintenance of solar power stations has the potential to cause unintended adverse impacts on the natural and human environment.

The key environmental and social impacts from solar power developments are associated with land take during construction and operation. This can include loss of habitats, agricultural land, cultural heritage sites and displacement of population and fauna. Impacts may also be associated with the presence of construction workers in remote areas.

Scope and structure

This keysheet provides a summary of the activities, typical environmental and social impacts, and potential mitigation and management measures relating to the development of solar power stations. The types of solar power developments covered are: large solar power stations (photovoltaics and/or high temperature solar thermal) and decentralised photovoltaic schemes. More severe environmental and social impacts may be expected from large solar power stations, which therefore form the central focus of this keysheet.

This keysheet should be used specifically to help with drafting TORs for ESIs of solar power operations and with scoping and conducting ESIs and preparing ESMPs. It can also help in reviewing ESIs.

It should be used in conjunction with the Bank’s Guidance Notes on ESIs (including coverage of cumulative impacts) and with the Guidance Notes on specific safeguard topics.

The keysheet is organised under the following headings, with substantive information provided in table form:

- Project components and activities.
- Sources of impact and receptors/resources.
- Mitigation and management options.

The phases of solar power projects considered are: site identification / selection / acquisition; design/ engineering of networks and site development; construction of the solar power plant and infrastructure; operation / maintenance and, where appropriate decommissioning (closure).

Project components and activities

The components of solar power stations are provided in Table 1, along with the activities involved in developing new or expanded solar power stations, broken down by project phase.

Sources of impact, receptors/ resources, and mitigation

Table 2 summarizes the main aspects of solar power activities that lead to typical impacts, the receptors and resources they affect, and options for mitigation. It considers the potentially major impacts on the physical, biological and socioeconomic environment. The mitigation measures described assume that higher level power planning measures, as described in Table 1, have already been implemented.

The guidance on impacts and options for their mitigation can be used to help discussions with the borrower or client and improve their understanding of the Bank’s requirements. They should also be used to assist preparation of TORs for an ESI so that they are tailored to the particular circumstances of the solar power development under consideration.

Table 1: Summary of Activities associated with Solar Power Development

Components	
Photovoltaic system <ul style="list-style-type: none"> • Photovoltaic cells. • Ondulator (to turn DC into AC for compatibility with the grid). • Transformer (to take the voltage from the Ondulator and raise it to the required grid transmission level). • Meters. Solar Thermal system <ul style="list-style-type: none"> • Concentration/tracking mirrors. • Boiler tower. • Transformer. • Meters. 	Ancillary facilities <ul style="list-style-type: none"> • Fencing and security gates/posts. • Electric cables. • Housing (mostly temporary, during construction) and temporary and permanent storage facilities. • Access roads and tracks.
Activity (1)	
Site exploration/selection/acquisition	Strategic Planning, Option Screening , Scoping, SESA for large projects, ESIA Terms of Reference
<ul style="list-style-type: none"> • Strategic planning (demand side management, power options analysis, cost-benefit analysis, strategic site selection, initial design), and for major solar power development, strategic environmental and social assessment (SESA), to establish: • Major constraints and alternatives (e.g. with respect to major settlements, watersheds and areas of biodiversity conservation importance). • Design procedures such that environmental and social considerations are given equal weight to engineering and financial ones. 	
<ul style="list-style-type: none"> • Site-specific planning (detailed design), taking account of environmental and social sensitivities and consultation with communities, drawing upon the Environmental and Social Impact Assessment (ESIA) Terms of Reference, which should comply with national regulations and international good practice. 	
Activity (2)	
Design/ engineering of networks and site development	ESIA Preparation of ESMP Agreement of loan covenants
Design, detailed engineering and financial planning are done just before project approval; at that stage, the borrower or client should prepare an ESIA on the basis of the Terms of Reference prepared during the previous phase and integrate into the ESIA: <ul style="list-style-type: none"> • Environmental and Social Management Plan (ESMP). • Stakeholder Engagement Plan (SEP). • Resettlement Action Plan (RAP) as appropriate. 	
Construction	Monitoring of ESMP performance Monitoring of compliance with loan covenants Monitoring of sub-contractor contract provisions
Construction activities will include: <ul style="list-style-type: none"> • Establishing temporary access to work and ancillary areas, demarcating clearance zones, establishing access control. • Clearance and levelling of the site. • Location and development of borrow pits for construction materials; import of materials, e.g. gravel, clay, bitumen. • Sourcing and establishing of a water supply from surface and/or groundwater. • Improvement of existing drainage and creation of appropriate drainage channels as required. • Installation the solar devices (rows of photovoltaic panels in the simplest design, concentration devices for the more sophisticated solar power plants). • Connecting the solar power production system to the grid. • Landscaping, as required. 	
Operation and Maintenance	Project implementation: Compliance Monitoring
During operation, the principal activities will relate to the maintenance and repair of the photovoltaic cells, including cleaning of the solar ray receiving surfaces, repair of any damage to panels (eg due to severe weather conditions). These activities may contribute to direct and indirect impacts described in Table 2.	
Decommissioning (Closure)	Project Completion: Compliance Report

Components
Activity (2)
<p>At the end of the useful life of the solar plant, the plant itself and all ancillary components and facilities should be decommissioned and rehabilitated in accordance with a site-specific closure plan developed in consideration of international good practice.</p> <p>The closure process will include site clearance, removal of all equipment, appropriate disposal of waste materials, soil ripping and re-grading, and re-vegetation where necessary. Any access roads which are not public roads should be returned to an appropriate alternative land use (e.g. farmland, or natural vegetation cover).</p>

Table 2: Solar Power Developments: Impacts and Mitigation

Impacts	Mitigation
<p>Land use</p> <ul style="list-style-type: none"> Loss of agricultural/livestock/other productive use land. 	<ul style="list-style-type: none"> Assessment of the initial value of the land and compensation/support to resettlement.
<ul style="list-style-type: none"> Pollution of groundwater from discharges and accidental releases during construction and operation. 	See Pollution of Soils and Water below
<p>Soils, Run-off and Flooding</p> <ul style="list-style-type: none"> Interruption of drainage patterns and lack of water table replenishment, as a result of ground clearance and earthworks. 	<ul style="list-style-type: none"> Minimisation of cleared areas and soil disturbance, with revegetation as soon as feasible, with native species. Early installation and regular maintenance of drainage and diversion structures, silt traps, etc; drainage outlets to discharge into vegetated areas if possible; vegetation along watercourses and drainage lines to be retained if possible. Avoidance of areas liable to flooding, slope instability, and water crossings where possible. Retention of topsoil for restoration (including tilling and re-vegetation) as soon as practicable.
<p>Pollution of Soils and Water</p> <ul style="list-style-type: none"> Discharge of construction site/camp sewage effluent polluting watercourses. 	<ul style="list-style-type: none"> Installation of sewage treatment to meet required standards; hygiene training for workforce.
<ul style="list-style-type: none"> Release of hazardous substances during construction, or operation (e.g. vehicle spills) leading to soil, surface or groundwater contamination. 	<ul style="list-style-type: none"> Materials handling and control procedures. Control of construction vehicle movements and prohibition of vehicle washing in watercourses, and similar practices. Emergency response plans during construction (contractors and local authorities) and operation (local authorities).
<p>Air Quality</p> <ul style="list-style-type: none"> Dust from construction, and other emissions during construction and operation (e.g. wildfires), could affect human health, crops and wildlife. 	<ul style="list-style-type: none"> Sensitive siting of construction facilities. Dust control and suppression measures. Modern equipment with meeting appropriate emissions standards, and regular preventative maintenance. No use of ozone depleting substances during construction.
<p>Noise and Vibration</p> <ul style="list-style-type: none"> Noise and vibration from equipment, traffic and activities during construction (and maintenance) at sites and associated facilities, may disturb sensitive noise receptors (human and fauna). 	<ul style="list-style-type: none"> Sensitive siting of construction facilities. Use of modern equipment fitted with abatement devices (e.g. mufflers, noise enclosures); good maintenance regime. Strict controls of timing of activities, e.g. any activities with high noise emissions; prohibition on night working. Observance of seasonal sensitivities (e.g. breeding seasons), and alteration of activity to reduce noise levels at that time. Speed controls and other traffic calming measures to prevent excessive speed around settlements/ sensitive receptors.
<p>Resources and Waste</p> <ul style="list-style-type: none"> Construction and operation will require supply of water from surface or groundwater, which could affect existing supply for human communities and ecosystems. 	<ul style="list-style-type: none"> Water study prior to any abstraction, to inform a Sustainable Water Management Plan. No abstraction without prior approval of relevant authorities at all locations. Promotion of water efficiency (including leak detection, preventative maintenance of equipment) and water recycling.
<ul style="list-style-type: none"> Water requirements may be high for large/concentration solar power plants (cooling water is required for solar concentration devices). 	<ul style="list-style-type: none"> The use of a dry cooling system instead of a wet cooling system for concentrated solar power plants will reduce water requirements. Promotion of water efficiency (including leak detection, preventative maintenance of equipment) and water recycling.

Impacts	Mitigation
<ul style="list-style-type: none"> Inefficient waste management during construction and maintenance leading to excess materials consumption, generation of wastes/emissions, soils and water pollution. 	<ul style="list-style-type: none"> Preparation of Waste Management Plan following the waste hierarchy, supported by staff training Use of authorised contractors for hazardous and any other wastes which the project cannot dispose of safely.
<p>Loss, fragmentation and degradation of habitat, and severance of animal migration routes and pathways</p> <ul style="list-style-type: none"> Land clearance for the solar power plant and upgrading/expansion of existing plants may cause loss or fragmentation of protected areas and other areas of conservation interest, and degradation following poorly managed rehabilitation. 	<ul style="list-style-type: none"> Careful siting of all project components, with advice from biodiversity authorities/wildlife specialists. Wherever feasible, establishment of buffer zones around conservation areas, watercourses, and other locations identified as ecologically sensitive and avoidance or minimisation of activity within these zones. Rehabilitation of cleared areas with native species, and ecosystem restoration in habitats of conservation value, using specialist advice and input, backed up by a long-term monitoring programme and corrective actions as necessary.
<ul style="list-style-type: none"> Severance of terrestrial routes and watercourses used for migration or for access to feeding and breeding areas (e.g. by access roads). 	<ul style="list-style-type: none"> Sensitive siting, based on good understanding of physical and biological baseline conditions. Wildlife crossings for terrestrial animals, and design of culverts/crossing structures to avoid impacts on aquatic animal movement.
<ul style="list-style-type: none"> Construction (and to a lesser extent operational impacts) on habitats and species from habitat alteration and degradation (e.g. from changes in drainage, soil erosion, pollution of water, soils or air, introduction of invasive species and general human disturbance). 	<p>Where development in sensitive areas cannot be avoided, mitigation may include:</p> <ul style="list-style-type: none"> Minimisation of area impacted, clear demarcation of remaining intact areas of habitat, and prohibition of activity into those areas for any purpose. No ground clearance upstream of sensitive areas unless appropriately engineered drainage installed. Habitat rehabilitation and ecosystem restoration of areas no longer required after construction, as soon as possible. If loss of Critical Habitat is inevitable, development/implementation of an Offsets Programme. <p>Also see measures under Soils, Run-off and Flooding, and Pollution of Soils and Water above, and Invasive Species below.</p>
<p>Direct Impacts on Flora and Fauna</p> <ul style="list-style-type: none"> Clearance of vegetation may lead to loss of plant species and habitat of conservation interest. 	<ul style="list-style-type: none"> Careful site selection and siting of all project components, with advice from biodiversity authorities/wildlife specialists. Demarcation and avoidance of species of conservation interest in work areas where possible, otherwise transfer to other suitable locations if possible, under expert supervision. <p>Also see measures under Soils, Run-off and Flooding, and Pollution of Soils and Water above, and Invasive Species below.</p>
<ul style="list-style-type: none"> Solar power plants could displace animals and disturb their habitats, by direct disturbance during construction and operation (e.g. from noise, light disturbance at night, general human presence). 	<ul style="list-style-type: none"> Careful siting of all project components, with advice from biodiversity authorities/wildlife specialists. Careful planning of phasing and timing of construction activities. Demarcation and avoidance of areas of conservation interest (high value species, feeding or breeding sites, migration routes, etc.).
<p>Invasive Species</p> <ul style="list-style-type: none"> Movement of plant from the arrival of workforce into areas could introduce invasive species which adversely impact fauna, flora, ecosystems, and crops. 	<ul style="list-style-type: none"> Invasive Species Management Plan, which should be developed and implemented in consultation with authorities, including appropriate eradication measures for different species/groups of species. Staff training and awareness raising in communities. No introduction of exotic species (e.g. for site rehabilitation) without specialist vetting and government approval.
<p>Physical and Economic Displacement of People, Property, Assets and Resources</p> <ul style="list-style-type: none"> Development of solar power plants, especially large ones, may physically displace people, or lead to the loss of assets, e.g. land of agricultural or other beneficial use. 	<ul style="list-style-type: none"> Initial site selection taking into account original land use, preferentially selecting land of minimal value. Comparison of alternative locations. Careful siting of all project components, and avoid occupation of areas which are inhabited or regarded as of high value by communities (e.g. horticulture, community orchards) where possible. Early development and sensitive implementation of resettlement planning, in accordance with national regulations and international good practice to compensate for any losses (both physical and economic).

Impacts	Mitigation
<p>Economic Development and Employment</p> <ul style="list-style-type: none"> • Direct employment of the local population in the construction workforce, and temporary stimulation of local economy through demand for goods and services will enhance livelihoods and economic activity in local communities, but have potentially adverse effects if community relations are not well managed and/or if prices of staple food is artificially increased. 	<ul style="list-style-type: none"> • Development of an Employment Plan, with clear employment requirements and procedures for the construction workforce. • Transparent and culturally appropriate communication with communities regarding employment opportunities. • Fair and transparent hiring and staff management procedures. • Development of measures to manage the transition after construction is complete, including SME development, ongoing opportunities for the workforce in road management and maintenance, reskilling and alternative employment.
<ul style="list-style-type: none"> • Few if any employment opportunities during operation, risk of “Boom and Bust” in local economy. 	<ul style="list-style-type: none"> • Procedures for sustainable local procurement, in consultation with local authorities and community leaders. • Local capacity building to foster community resilience.
<p>Cultural Heritage</p> <ul style="list-style-type: none"> • Displacement or damage to cultural heritage sites by construction activities, harm to the setting, amenity value, etc. of the site. 	<ul style="list-style-type: none"> • Careful siting, taking account of community consultation and if appropriate specialist surveys. • Implementation of a “Chance Finds” procedure during construction. <p>See also Guidance Note on Physical Cultural Heritage.</p>
<p>Community Health, Safety and Security</p> <ul style="list-style-type: none"> • Poor construction management practices may lead to adverse effects on safety, human health and wellbeing. 	<ul style="list-style-type: none"> • Good construction site “housekeeping” and management procedures (including site access). • Disease control measures, e.g. no pools of standing water, rodent control, treatment of water. • Risk assessments and emergency response planning to consider impacts on local communities. <p>Also see measures under Soils, Run-off and Flooding, and Pollution of Soils and Water above.</p>
<ul style="list-style-type: none"> • Interaction between in-migrant construction workers and local communities may increase occurrence of communicable diseases, including HIV/AIDS and sexually transmitted diseases (STDs). 	<ul style="list-style-type: none"> • Implementation of a health management system for the construction workforce, to ensure it is fit for work and that it will not introduce disease into local communities. • Training and awareness training for workforce and their dependents on HIV/AIDS and other STDs, and communicable diseases including malaria; health awareness raising campaigns for communities on similar topics.
<p>Landscape and visual impacts</p> <ul style="list-style-type: none"> • The solar power plant, especially if large, could generate negative landscape impacts. 	<ul style="list-style-type: none"> • Careful siting. • Landscaping design by qualified personnel (e.g. a landscape architect) working closely with the local communities and other relevant parts of government, e.g. Department of Tourism.
<p>Workforce-Community Interactions</p> <ul style="list-style-type: none"> • Real or perceived disruption to normal community life, through the physical presence of a construction workforce. 	<ul style="list-style-type: none"> • Adoption of a Stakeholder Engagement Plan, as a framework for early and ongoing community consultation. • Implementation of a Grievance Procedure (see Grievance Procedure and Redress Mechanisms guidance note). • Works procedures, defining a Code of Appropriate Conduct for all workers. • Training for all of construction workforce, and subsequently of permanent staff, in acceptable behaviour with respect to community interactions.

ENERGY / ELECTRICITY SECTOR: WIND POWER

Wind power projects include infrastructure for the generation of electricity from the wind, either offshore or onshore. The transmission of power between a wind farm and consumers is covered in the transmission lines keysheet.

Wind power projects can vary from a single turbine providing power to a single building, to several hundred turbines in a wind farm which provide electricity to national electricity grids. The key elements of a wind power project includes turbines, transformers, underground collector transmission cables between the wind turbines, substations, and aboveground transmission lines to connect to an existing power grid and access roads. The location of wind farms is largely driven by the availability of the wind resource, and turbines have to carefully sited to ensure that one turbine does not interfere with the capture of wind by another turbine. Therefore, wind farms can cover large areas although the actual footprint will be much less.

The key impacts associated with the operation of wind power projects are visual impacts, noise, and disturbance / mortality of birds and bats. Construction impacts are similar to other infrastructure projects, namely land take causing severance of habitat / migration routes and habitat loss, excavation affecting soils, watercourses and archaeological sites, and the presence of workers.

Scope and structure

This keysheet provides a summary of the activities, typical environmental and social impacts, and potential mitigation and management measures relating to the development of onshore wind power projects. Offshore wind power is not considered in this keysheet.

This keysheet should be used specifically to help with drafting TORs for ESIs of transmission line developments and with scoping and conducting ESIs and preparing ESMPs. It can also help in reviewing ESIs.

It should be used in conjunction with the Bank's Guidance Notes on ESIs (including coverage of cumulative impacts) and with the Guidance Notes on specific

safeguard topics on transmission lines in a separate keysheet.

The keysheet is organised under the following headings, with substantive information provided in table form:

- Project components and activities.
- Sources of impact and receptors/resources.
- Mitigation and management options.

The phases of wind power projects considered are: design and planning, including route and site selection; construction; operation and maintenance; and where appropriate decommissioning (closure).

Project components and activities

The components of wind power projects are provided in Table 1, along with the activities involved in developing this infrastructure, broken down by project phase.

Sources of impact, receptors/ resources, and mitigation

Table 2 summarizes the main aspects of wind power development activities that lead to typical impacts, the receptors and resources they affect, and options for mitigation. It considers impacts on the physical, biological and socioeconomic environment. The mitigation measures described assume that higher level design and network planning measures, as described in Table 1, have already been implemented.

The guidance on impacts and options for their mitigation can be used to help discussions with the borrower or client and improve their understanding of the Bank's requirements. They should also be used to assist preparation of TORs for an ESI so that they are tailored to the particular circumstances of the wind power project under consideration.

Table 1: Summary of Activities Associated with Wind Power Projects

Components	
<p>Wind turbine structure(s), which comprise:</p> <ul style="list-style-type: none"> • Foundation. • Tower (height varies from 25m to over 100m). • Nacelle, which contains the generator. • Rotor blades and hub, (generally three blades of approx. 60-80m, longer when offshore). • Lights. 	<p>Ancillary facilities</p> <ul style="list-style-type: none"> • Transformers. • Transmission cables between the wind turbines and substation. • Substations. • Aboveground transmission lines to connect to an existing power grid. • Construction laydown areas, workshops, site offices etc, and if necessary, worker accommodation. • Access roads.
Activity	
Design – System planning, including route selection	Screening, Scoping and ESIA; Preparation of ESMP; Agreement of loan covenants
<p>Strategic planning (options analysis, cost-benefit analysis, strategic power network selection, initial design), to establish:</p> <ul style="list-style-type: none"> • Major constraints and alternatives (e.g. with respect to major settlements, watersheds and areas of biodiversity conservation importance). • Design procedures such that environmental and social considerations are given equal weight to engineering and financial ones. 	
<p>Site-specific planning (detailed design), taking account of environmental and social sensitivities and consultation with communities, draw upon the following environmental and socioeconomic documentation, all of which should comply with national regulations and international good practice:</p> <ul style="list-style-type: none"> • Environmental and Social Impact Assessment (ESIA). • Environmental and Social Management Plan (ESMP). • Stakeholder Engagement Plan (SEP). • Resettlement Action Plan (RAP). 	
Construction	Monitoring of ESMP performance; Monitoring of compliance with loan covenants; Monitoring of sub-contractor contract provisions
<p>Construction activities will include:</p> <ul style="list-style-type: none"> • Establishing temporary access to work and ancillary areas, demarcating clearance zones, establishing access control. • Clearance and levelling of the site. • Location and development of borrow pits if required. • Trenching and laying of underground transmission cables, including watercourse crossings. • Backfilling and reinstatement of underground transmission cable route. • Construction of substations. • Establishing of the turbine foundation. • Tower construction (usually from prefabricated parts). • Lifting of the nacelle and rotors onto the wind tower. • Rotor/ nacelle assembly. 	
<p>The equipment required for construction will include heavy mobile plant (e.g. excavators, bulldozers) and temporary fixed plant such as concrete batching plant and power generators.</p>	
Operation and Maintenance	Project implementation: Compliance Monitoring
<p>During operation key impacts will be due to the presence of the tower and rotors (visual impacts, noise and impacts to birds and bats). These may contribute to direct and indirect impacts described in Table 2.</p>	
<p>Maintenance activities are likely to include turbine and rotor maintenance, lubrication of parts, full generator overhaul, and maintenance of electrical components as necessary.</p>	
Decommissioning (Closure)	Project Completion: Compliance Report
<p>Where temporary access roads are developed during construction they should be decommissioned and rehabilitated in accordance with a site-specific closure plan developed in consideration of international good practice.</p>	
<p>The closure process will include site clearance, removal of all equipment including underground power lines, appropriate disposal of waste materials and reinstatement / revegetation as appropriate.</p>	

Table 2: Wind Power Developments: Impacts and Mitigation

Impacts	Mitigation
<p>Geology/Hydrogeology</p> <ul style="list-style-type: none"> • Interruption of hydrogeology and groundwater flows from construction, underground cable laying and ground clearance. 	<ul style="list-style-type: none"> • Detailed alignment to take account of local groundwater conditions, e.g. by avoiding areas with springs or where the water table is shallow. • Limit sealed or compacted areas as much as possible, to maintain natural recharge of the water table.
<p>Soils, Run-off and Flooding</p> <ul style="list-style-type: none"> • Loss of soil / sediments and pollution of watercourses, and interruption of drainage patterns, as a result of underground cable laying and ground clearance. 	<ul style="list-style-type: none"> • Good construction site management practices to avoid runoff, erosion and sedimentation. • Careful design: e.g. alignment, minimal diversion of watercourses, timing of works (overall duration and seasonality).
<p>Pollution of Soils and Water</p> <ul style="list-style-type: none"> • Release of hazardous substances during construction and maintenance (e.g. insulating oils / gases, fuels) leading to soil, surface water or groundwater contamination. 	<ul style="list-style-type: none"> • Materials handling and control procedures. • Control of construction vehicle movements and prohibition of vehicle washing in watercourses, and similar practices. • Emergency response plans during construction and maintenance (contractors and local authorities).
<p>Air Quality</p> <ul style="list-style-type: none"> • Discharge of construction site/camp sewage effluent polluting watercourses. 	<ul style="list-style-type: none"> • Installation of sewage treatment to meet required standards; hygiene training for workforce.
<p>Air Quality</p> <ul style="list-style-type: none"> • Dust and other emissions during construction, could affect human health, vegetation (including crops) and wildlife. 	<ul style="list-style-type: none"> • Sensitive siting of construction facilities. • Dust control and suppression measures as required. • Modern equipment and vehicles meeting appropriate emissions standards, and regular preventative maintenance.
<p>Noise and Vibration</p> <ul style="list-style-type: none"> • Mechanical and aerodynamic noise from operation of wind turbines may disturb sensitive noise receptors (human and fauna). 	<ul style="list-style-type: none"> • Appropriate design of turbines to minimise noise, including adherence to relevant national and international acoustic design standards. • Careful siting of wind farms to avoid sensitive receptors (eg schools, hospitals, places of worship, breeding areas and noise sensitive species in general).
<p>Noise and Vibration</p> <ul style="list-style-type: none"> • Noise during construction of wind farms may disturb sensitive noise receptors (human and fauna). 	<ul style="list-style-type: none"> • Sensitive siting of construction facilities. • Use of modern equipment fitted with abatement devices (e.g. mufflers, noise enclosures); good maintenance regime. • Sensitive timing and location of offshore foundation construction.
<p>Resources and Waste</p> <ul style="list-style-type: none"> • Construction may require supply of water from surface or groundwater. 	<ul style="list-style-type: none"> • Measures to ensure sustainable water use, as required.
<p>Resources and Waste</p> <ul style="list-style-type: none"> • Inefficient waste management during construction and maintenance leading to excess materials consumption, generation of wastes/ emissions, soils and water pollution. 	<ul style="list-style-type: none"> • Preparation of Waste Management Plan following the waste hierarchy, supported by staff training. • Use of authorised contractors for hazardous and any other wastes which the project cannot dispose of safely. <p>See Pollution of Soils and Water above.</p>
<p>Visual Impacts</p> <ul style="list-style-type: none"> • Visual impacts from towers and rotor blades. 	<ul style="list-style-type: none"> • Careful site selection considering the landscape, important environmental and community features. • Public consultation in all communities within the zone of visual impact (ZVI). • Consideration of visual impacts from all angles and for all users of the area. • Careful design to minimise the visual impact, eg maintaining uniform size and design of turbines, painting turbines a uniform colour (matching the sky while also considering navigation regulations), avoiding advertising, text or graphics on turbines. • Minimising the visual impact of other aspects of the project, such as avoiding erosion, restricting fencing to where essential for safety and security purposes, removing non-operational turbines.

Impacts	Mitigation
<p>Loss, fragmentation and degradation of habitat, and severance of animal migration routes and pathways</p> <ul style="list-style-type: none"> Land clearance may cause loss or fragmentation of protected areas and other areas of conservation interest, and degradation following poorly managed rehabilitation. 	<ul style="list-style-type: none"> Careful siting of all project components to avoid sensitive habitat, with advice from biodiversity authorities/wildlife specialists, and use of existing utility corridors where possible. Wherever feasible, establishment of buffer zones around conservation areas, watercourses, and other locations identified as ecologically sensitive and avoidance or minimisation of activity within these zones. Rehabilitation of cleared areas with native species (including the areas around turbines), and ecosystem restoration in habitats of conservation value, using specialist advice and input, backed up by a long-term monitoring programme and corrective actions as necessary.
<ul style="list-style-type: none"> Construction impacts on habitats and species (e.g. from changes in drainage, soil erosion, pollution of water, soils or air, introduction of invasive species, and general human disturbance). 	<p>Where development in sensitive areas cannot be avoided, mitigation may include:</p> <ul style="list-style-type: none"> Minimisation of area impacted, clear demarcation of remaining intact areas of habitat, and prohibition of activity into those areas for any purpose; maintenance of wildlife corridors between fragmented areas wherever possible. Avoidance of construction activities during sensitive seasons or times of day. No ground clearance upstream of sensitive areas unless appropriately engineered drainage installed. Habitat rehabilitation and ecosystem restoration of areas no longer required after construction, as soon as possible. If loss of Critical Habitat is inevitable, development/implementation of an Offsets Programme. <p>See also Pollution of Soils and Water and invasive species.</p>
<ul style="list-style-type: none"> Severance of animal migration pathways and flyways. 	<ul style="list-style-type: none"> Where underground cables and access roads cross watercourses, design culverts/crossing structures to avoid impacts on fish movement. Avoid sensitive habitats such as migration corridors, bat foraging corridors and nesting areas.
<ul style="list-style-type: none"> Disturbance and emissions from vehicles and vessels during construction affecting the integrity and viability of areas of conservation interest. 	<p>See Air Quality and Noise /Vibration above.</p>
<p>Direct Impacts on Flora and Fauna</p> <ul style="list-style-type: none"> Clearance of vegetation may lead to loss of plant species and habitat of conservation interest, and displacement of fauna. 	<ul style="list-style-type: none"> Careful route selection and siting of all project components, with advice from biodiversity authorities/wildlife specialists. Careful planning of phasing and timing of construction activities. Demarcation and avoidance of areas of conservation interest (high value species, feeding or breeding sites, migration routes, etc.) where possible, and wildlife rescue and translocation where appropriate, under expert supervision. <p>Also see measures under Soils, Run-off and Flooding, Pollution of Soils and Water, and Induced Access above, and Invasive Species below.</p>
<ul style="list-style-type: none"> Potential for bird collisions with towers and rotor blades. 	<ul style="list-style-type: none"> Careful siting of turbines to avoid high-density bird and bat areas and migration routes. Maintain turbine tower heights below typical elevations of migratory bird pathways. Maintain rotor blades a suitable distance from the ocean surface to avoid strikes with seabird activity close to the ocean surface. Employ slower-turning rotor blades to make them more visible. Configure turbine arrays to avoid potential avian mortality (e.g. group turbines rather than spread them widely or orient rows of turbines parallel to known bird movements). Implement appropriate stormwater management measures to avoid creating attractions such as small ponds which can attract birds and bats for feeding or nesting near the wind power development.

Impacts	Mitigation
<p>Impacts from Induced Access</p> <ul style="list-style-type: none"> Development of wind power projects in remote or undeveloped areas, especially construction of access roads, may lead to further development, increased disturbance and pressure on natural resources through bushmeat hunting, logging, fire, etc. 	<ul style="list-style-type: none"> Careful site selection, with advice from biodiversity authorities/wildlife specialists to avoid remote and previously inaccessible areas where possible. Where possible, install access controls on roads in otherwise undeveloped or remote areas. See also Bushmeat Hunting below.
<p>Invasive Species</p> <ul style="list-style-type: none"> Movement of plant and workforce into areas could introduce invasive species which adversely impact fauna, flora, ecosystems, and crops. 	<ul style="list-style-type: none"> Invasive Species Management Plan, which should be developed and implemented in consultation with authorities, including appropriate eradication measures for different species/groups of species.
<p>Bushmeat Hunting</p> <ul style="list-style-type: none"> Construction activities in remote areas could lead to greater demand for bushmeat, stimulate the wildlife trade and facilitate access to hunting areas. 	<ul style="list-style-type: none"> Bushmeat Hunting and Wildlife Trade Management Plan. Prohibition on workforce hunting, selling, or purchasing bushmeat, and training to support this requirement. Prohibition on workforce (except security personnel) having guns in work areas or accommodation. Sensitisation and public awareness campaigns against hunting and bushmeat the trade amongst local communities.
<p>Economic Development and Employment</p> <ul style="list-style-type: none"> Direct employment of local population in workforce, and stimulation of local economy through demand for goods and services will enhance livelihoods and economic activity in local communities, but potentially adverse effects if community relations are not well managed. 	<ul style="list-style-type: none"> Development of an Employment Plan, with clear employment requirements and procedures for the construction workforce. Transparent and culturally appropriate communication with communities regarding employment opportunities. Fair and transparent hiring and staff management procedures.
<p>Cultural Heritage</p> <ul style="list-style-type: none"> Displacement or damage to cultural heritage sites by construction activities, harm to the setting, amenity value, etc. of the site due to construction activities. 	<ul style="list-style-type: none"> Careful site selection, taking account of community consultation/specialist surveys. Development of a Cultural Heritage Management Plan covering tangible and intangible (e.g. local traditions and practices) cultural heritage. Implementation of a "Chance Finds" procedure during construction. <p>See also Guidance Note on Physical Cultural Heritage.</p>
<p>Community Health, Safety and Security</p> <ul style="list-style-type: none"> Poor construction management practices may lead to adverse effects on safety, human health and wellbeing. 	<ul style="list-style-type: none"> Good construction site "housekeeping" and management procedures (including site access). Disease control measures, e.g. no pools of standing water, rodent control, treatment of water. Risk assessments and emergency response planning to consider impacts on local communities. <p>See also Pollution of Soils and Water.</p>
<ul style="list-style-type: none"> Interaction between workforce and local communities may increase occurrence of communicable diseases, including HIV/AIDS and sexually transmitted diseases (STDs). 	<ul style="list-style-type: none"> Implementation of a health management system for the construction workforce, to ensure it is fit for work and that it will not introduce disease into local communities. Training and awareness training for workforce and their dependents on HIV/AIDS and other STDs, and communicable diseases; health awareness raising campaigns for communities on similar topics.
<ul style="list-style-type: none"> Potential safety risks associated with aircraft navigation, through direct collision or interference with radar systems. 	<ul style="list-style-type: none"> Measures to avoid aircraft collision with wind turbines, eg lighting, marking systems and consultation with air traffic authorities in accordance with relevant legislation. Ensure wind farms are marked on air navigation maps in accordance with air traffic safety regulations. Where possible, avoid siting wind farms close to airports or within known flight path envelopes. Minimise radar interference through wind farm and turbine design, such as shape of the turbine tower, the shape and materials of the nacelle, use of radar-absorbent surface treatments, geometric layout and location of turbines. Consider radar design alterations including relocation of the affected radar, radar blanking of the affected area, use of alternative radar systems to cover the affected area, or change to air traffic routes.

Impacts	Mitigation
<ul style="list-style-type: none"> Potential safety risks associated with falling rotor blades or ice formed on rotor blades. The risk of 'blade throw' is very low, and 'ice throw' is only an issue in cold climates or high altitudes. 	<ul style="list-style-type: none"> Wind farm should be designed with adequate safety setbacks, and to ensure buildings and populated areas are outside the trajectory of a possible falling blade. Equip wind turbines with vibration sensors that can react to any imbalance in the rotor blades and shut down the turbine if necessary. Regular scheduled maintenance for wind turbines. Use warning signs to alert the public of risk of ice throw and blade throw, and provide emergency information. Minimise risk of ice throw by using heaters, ice sensors, ceasing operations when ice builds up on blades, use of blade materials that limit ice build-up.
<ul style="list-style-type: none"> Safety issues may arise with public access to wind turbines (e.g. unauthorized climbing of the turbine) or to the wind farm substation. 	<ul style="list-style-type: none"> Prevent public access to turbines, eg gates on access roads; fencing, and preventing access to turbine tower ladders. Use warning signs to alert the public of risk of climbing towers, and provide emergency information.
<p>Social Structures and Community Life</p> <ul style="list-style-type: none"> Real or perceived disruption to normal community life, through the physical presence of a construction workforce. 	<ul style="list-style-type: none"> Adoption of a Stakeholder Engagement Plan, as a framework for early and ongoing community consultation. Implementation of a Grievance Procedure (see Grievance Procedure and Redress Mechanisms guidance note). Works procedures, defining a Code of Appropriate Conduct for all workers. Training for all staff in acceptable behaviour with respect to community interactions.
<ul style="list-style-type: none"> Disruption to normal community life, due to shadow flicker and blade glint. 	<ul style="list-style-type: none"> Use modelling software to identify a 'zone' of flicker. Careful siting and orientation of wind turbines to avoid households located where shadow flicker has a high frequency. Paint the wind turbine tower with non-reflective coating to avoid reflections from towers.
<ul style="list-style-type: none"> Disruption to normal community life due to electromagnetic interference with telecommunication systems (e.g. microwave, television, and radio). 	<ul style="list-style-type: none"> Careful siting of wind turbines to avoid direct physical interference of point-to-point communication systems, and away from the line of site of broadcast transmitters. Broadcast transmitters can be altered to minimise the impact of the wind farm, for example modifying the aerial, installing an amplifier or directional antenna, relocating the antenna, or construction of a new repeater station if interference is detected during operation. Minimise the interference from wind turbines by using non-metallic turbine blades.
<p>Labor and Working Conditions</p> <ul style="list-style-type: none"> Poor management of occupational health and safety could lead to accidents, injuries and illnesses among workers; mental health issues may arise due to remote or enclosed living. Differences in nationality, ethnicity, religion, etc. may lead to discrimination and harassment, and differences (perceived or real) in working conditions between workers may lead to resentments. 	<ul style="list-style-type: none"> Employment practices and working conditions should conform to International Labour Organisation (ILO) Standards and national regulations. Rest and recreational facilities and time should be provided, and rules on alcohol and drugs defined and clearly communicated to workers. The basis for differences in the standard of accommodation should be non-discriminatory; it should be documented and communicated transparently to the workforce. Clear and comprehensive health and safety reporting and grievance procedure system should be established, and be freely available to all of the workforce. <p>See also Employment and Economic Development.</p>



ENERGY / ELECTRICITY SECTOR: GEOTHERMAL POWER PROJECTS

Geothermal power projects involve the generation of electricity from high temperature, underground resources of geothermal water or steam. The transmission lines to deliver electricity to consumers are covered in a separate keysheet (Sector Keysheet: Transmission lines and interconnection systems).

The development of a geothermal power project involves four phases:

- Exploration and reservoir evaluation. This includes surveys and testing of the reservoir.
- Production field development. During this phase, production and reinjection wells are drilled. Drilling will also continue throughout the operational phase of the plant.
- Power plant construction. Impacts associated with the plant construction of geothermal power projects are similar to other industrial developments, eg land take and presence of workers.
- Operation. During operation, the plant will produce liquid effluents, air emissions, solid waste and consume water resources.

Impacts throughout the development and operation stage may also be associated with unplanned events such as well blowouts and pipeline failures.

Scope and structure

This keysheet provides a summary of the activities, typical environmental and social impacts, and potential mitigation and management measures relating to the development of geothermal power projects.

This keysheet should be used specifically to help with drafting ToRs for ESIAs of geothermal power developments and with scoping and conducting ESIAs and preparing ESMPs. It can also help in reviewing ESIAs.

It should be used in conjunction with the Bank's Guidance Notes on ESIAs (including coverage of cumulative impacts) and with the Guidance Notes on specific safeguard topics including transboundary projects.

The keysheet is organised under the following headings, with substantive information provided in table form:

- Project components and activities.
- Sources of impact and receptors/resources.
- Mitigation and management options.

The phases of geothermal power projects considered are: design and planning; exploration and reservoir evaluation; production field development; construction; operation and maintenance; and where appropriate decommissioning (closure).

Project components and activities

The components of geothermal power projects are provided in Table 1, along with the activities involved in developing these projects, broken down by project phase.

Sources of impact, receptors/ resources, and mitigation

Table 2 summarizes the main aspects of geothermal power development activities that lead to typical impacts, the receptors and resources they affect, and options for mitigation. It considers impacts on the physical, biological and socioeconomic environment. The mitigation measures described assume that higher level design and network planning measures, as described in Table 1, have already been implemented.

The guidance on impacts and options for their mitigation can be used to help discussions with the borrower or client and improve their understanding of the Bank's

requirements. They should also be used to assist preparation of ToRs for an ESIA so that they are tailored to the particular circumstances of the road development under consideration.

Table 1: Summary of Activities associated with Geothermal Power Projects

Components	
Power plant <ul style="list-style-type: none"> Wells to access groundwater resource. Steam turbines. Generators. Condensers. Cooling towers. Reinjection pumps. Electricity transformers and connection to grid. 	Ancillary facilities <ul style="list-style-type: none"> Fencing and security gates/posts. Electric cables. Housing and offices (mostly temporary, during construction) and temporary and permanent workshop and storage facilities. Access roads and tracks.
Activity	
Design – System planning, including site selection	Screening , Scoping and ESIA Preparation of ESMP Agreement of loan covenants
Strategic planning (options analysis, cost-benefit analysis, initial design), and potentially strategic environmental and social assessment (SESA), to establish: <ul style="list-style-type: none"> Major constraints and alternatives (e.g. with respect to major settlements, watersheds and areas of biodiversity conservation importance); and Design procedures such that environmental and social considerations are given equal weight to engineering and financial ones. 	
Site-specific planning (detailed design), taking account of environmental and social sensitivities and consultation with communities, draw upon the following environmental and socioeconomic documentation, all of which should comply with national regulations and international good practice: <ul style="list-style-type: none"> Environmental and Social Impact Assessment (ESIA). Environmental and Social Management Plan (ESMP). Stakeholder Engagement Plan (SEP). Resettlement Action Plan (RAP). 	
Exploration, Field Development and Construction	Monitoring of ESMP performance Monitoring of compliance with loan covenants Monitoring of sub-contractor contract provisions
Construction activities will include: <ul style="list-style-type: none"> Geological, geophysical and drilling surveys. Drilling of production and reinjection wells. Establishment of settling ponds for drilling and well testing. Construction of power plant, including cooling towers, pipelines, waste treatment and effluent reinjection facilities. Construction of access roads, storage areas, maintenance facilities and other associated facilities. Construction of electricity transformers and connection to grid. 	
The equipment required will include heavy mobile plant (e.g. excavators and drilling rigs) and temporary fixed plant such as power generators.	
Operation and Maintenance	Project implementation: Compliance Monitoring
<ul style="list-style-type: none"> Extraction of geothermal fluids and surface water. Operation and routine maintenance of plant. Geothermal fluid processing. Generation of spent geothermal fluids, and potentially reinjection of fluids. Emissions of hydrogen sulphide and mercury (associated with flash and dry steam technologies). Generation of solid wastes (e.g. sulphur, silica, carbonate precipitates) from process. Well field monitoring and maintenance. Pipeline maintenance. 	
Routine maintenance of geothermal power plants will entail many of the activities described above for the construction phase, although they are likely to be smaller in scale and time. Drilling of production and reinjection wells will also take place during the life of the project.	

Components	
Power plant <ul style="list-style-type: none"> • Wells to access groundwater resource. • Steam turbines. • Generators. • Condensers. • Cooling towers. • Reinjection pumps. • Electricity transformers and connection to grid. 	Ancillary facilities <ul style="list-style-type: none"> • Fencing and security gates/posts. • Electric cables. • Housing and offices (mostly temporary, during construction) and temporary and permanent workshop and storage facilities. • Access roads and tracks.
Activity	
Decommissioning (Closure)	Project Completion: Compliance Report
<p>Where temporary facilities such as access roads are developed during construction they should be decommissioned and rehabilitated in accordance with a site-specific closure plan developed in consideration of international good practice.</p> <p>The closure process will include site clearance, removal of all equipment, appropriate disposal of waste materials and reinstatement / revegetation as appropriate.</p>	

Table 2: Geothermal Power Projects: Impacts and Mitigation

Impacts	Mitigation
Geology/Hydrogeology <ul style="list-style-type: none"> • Extraction, reinjection and discharge of geothermal fluids may affect quality and quantity of surface and groundwater resources and features such as hot springs. 	<ul style="list-style-type: none"> • Develop a comprehensive geological and hydrogeological model of the reservoir. • Completion of a hydrogeologic and water balance assessment during the project planning stage to identify hydraulic interconnections between the geothermal extraction and reinjection points and any sources of potable water or surface water features. • Isolation of steam producing sources from shallower hydrologic formations which may be used as sources of potable water through careful site selection and properly designed and installed well casing systems.
<ul style="list-style-type: none"> • Pollution of groundwater from discharges and accidental releases during construction and operation. 	See Pollution of Soils and Water below
Soils, Run-off and Flooding <ul style="list-style-type: none"> • Loss of soil / sediments and pollution of watercourses, and interruption of drainage patterns, as a result of ground clearance and earthworks during construction of project facilities. 	<ul style="list-style-type: none"> • Minimisation of cleared areas and soil disturbance, with revegetation as soon as feasible, with native species. • Avoidance of areas liable to flooding, slope instability, and water crossings where possible. • Careful design: e.g. siting and alignment, minimal diversion of watercourses, timing of works (overall duration and seasonality).
Pollution of Soils and Water <ul style="list-style-type: none"> • Loss of drill cuttings and fluids to surface water, groundwater and soil. 	<ul style="list-style-type: none"> • Recovery and appropriate storage of oil-based drilling fluids and cuttings. • Appropriate treatment, recycling, and / or disposal depending on waste characteristics. • Reuse of drilling fluid, where possible. • Removal of tanks or sumps to avoid the release of oil-related materials. • Disposal of water-based drilling fluids into the bore hole following toxicity assessment. • Re-use of water-based cuttings if they are non-toxic (e.g. as construction fill) or disposal in a landfill facility. • During acid treatment of wells, use of leak-proof well casings to a depth appropriate to the geological formation.
<ul style="list-style-type: none"> • Release of spent geothermal fluids. 	<ul style="list-style-type: none"> • Environmental impacts of geothermal fluid discharges should be considered when designing plant. • If fluids are not re-injected, treatment may be required to reduce temperature or heavy metal content to applicable standards in the receiving waterbody. • Potential for contamination of groundwater by reinjected fluids should be minimised through use of leak-proof well casings in the injection wells. • Reuse of geothermal fluids should be considered, e.g. downstream industrial processes such as heating, binary power generation technology.

Impacts	Mitigation
<ul style="list-style-type: none"> Accidental release of drill fluids and additives and geothermal fluids due to well blowout or pipeline failure, leading to contamination of soils, groundwater or surface water. 	<ul style="list-style-type: none"> Regular maintenance of wellheads and geothermal fluid pipelines, including corrosion control and inspection, pressure monitoring; and use of blowout prevention equipment such as shutoff valves. Design of emergency response for well blowout and pipeline rupture, including measures for containment of geothermal fluid spills.
<ul style="list-style-type: none"> Release of sewage and "grey water". 	<ul style="list-style-type: none"> Installation of sewage treatment to meet required standards.
<p>Air Quality</p> <ul style="list-style-type: none"> Emissions of hydrogen sulphide and mercury from power generation (when flash or dry steam technologies are used). 	<ul style="list-style-type: none"> Consider use of technology that includes reinjection of all geothermal fluids and gases, where practicable. When total re-injection is not feasible, and emissions would not exceed environmental, health and safety standards, vent hydrogen sulphide and non-condensable volatile mercury. Abatement systems where required to remove hydrogen sulphide and mercury, e.g. wet or dry scrubber systems or liquid phase reduction / oxidation system for hydrogen sulphide, gas stream condensation with separation or adsorption for mercury.
<ul style="list-style-type: none"> Accidental release of hydrogen sulphide gas from underground formation and geothermal steam due to well blowout or pipeline failure. 	<ul style="list-style-type: none"> Regular maintenance of wellheads and geothermal fluid pipelines, including corrosion control and inspection, pressure monitoring; and use of blowout prevention equipment such as shutoff valves. Design of emergency response for well blowout and pipeline rupture.
<p>Noise and Vibration</p> <ul style="list-style-type: none"> Noise and vibration from power plant during operation, and construction activities may disturb sensitive noise receptors (human and fauna). 	<ul style="list-style-type: none"> Sensitive siting of construction facilities. Use of modern equipment fitted with abatement devices (e.g. mufflers, noise enclosures) if required. Good maintenance regime of construction and operational machinery.
<p>Resources and Waste</p> <ul style="list-style-type: none"> Extraction of water for various processes including cooling water systems, well drilling and injectivity testing may affect existing supply for human communities and ecosystems. 	<ul style="list-style-type: none"> Water study prior to any abstraction, to understand variability of streams serving as source water. Ensure critical flows are maintained during low flow periods to maintain hydrology of watercourse, avoid obstructing the passage of fish or negatively impacting aquatic biota. No abstraction without prior approval of relevant authorities at all locations. Promotion of water efficiency (including leak detection, preventative maintenance of equipment) and water recycling. Monitor temperature difference between effluent and receiving water to comply with applicable standards.
<ul style="list-style-type: none"> Generation of sulphur, silica, and carbonate precipitates from the power generation process. Depending on the concentration of pollutants in this waste such as heavy metals, this may be classified as hazardous waste. 	<ul style="list-style-type: none"> Appropriate management of handling, storage, transport and disposal of wastes. Reuse of non-hazardous wastes as backfill and recycling (e.g. sulphur cake) if appropriate.
<p>Visual Impacts</p> <ul style="list-style-type: none"> Visual impacts particularly from cooling towers. 	<ul style="list-style-type: none"> Careful site selection including consultation with local communities.
<p>Loss, fragmentation and degradation of habitat, and severance of animal migration routes and pathways</p> <ul style="list-style-type: none"> Land clearance for power plant and associated infrastructure may cause loss or fragmentation of protected areas and other areas of conservation interest. 	<ul style="list-style-type: none"> Careful siting of all project components to avoid critical habitat, with advice from biodiversity authorities/wildlife specialists and use of existing transport corridors where possible. Wherever feasible, establishment of buffer zones around conservation areas, watercourses, and other locations identified as ecologically sensitive and avoidance or minimisation of activity within these zones. Rehabilitation of cleared areas with native species, and ecosystem restoration in habitats of conservation value, using specialist advice and input, backed up by a long-term monitoring programme and corrective actions as necessary.

Impacts	Mitigation
<ul style="list-style-type: none"> Construction impacts on habitats and species (e.g. from changes in drainage, soil erosion, pollution of water, soils or air, introduction of invasive species, and general human disturbance). 	<p>Where development in sensitive areas cannot be avoided, mitigation may include:</p> <ul style="list-style-type: none"> Minimisation of area impacted, clear demarcation of remaining intact areas of habitat, and prohibition of activity into those areas for any purpose; maintenance of wildlife corridors between fragmented areas wherever possible. Avoidance of construction activities during sensitive seasons or times of day. No ground clearance upstream of sensitive areas unless appropriately engineered drainage installed. Habitat rehabilitation and ecosystem restoration of areas no longer required after construction, as soon as possible. If loss of Critical Habitat is inevitable, development/implementation of an Offsets Programme. <p>Also see measures under Soils, Run-off and Flooding, and Pollution of Soils and Water above, and Invasive Species below</p>
<p>Bushmeat Hunting</p> <ul style="list-style-type: none"> Construction activities, and subsequently operation, in remote areas could lead to greater demand for bushmeat (from workforce and wider community), stimulate the wildlife trade and facilitate access to hunting areas. 	<ul style="list-style-type: none"> Bushmeat Hunting and Wildlife Trade Management Plan, agreed with government authorities and implemented jointly. Prohibition on workforce hunting, selling, or purchasing bushmeat, and training to support this requirement. Prohibition on workforce (except security personnel) having guns in work areas or accommodation. Sensitisation and public awareness campaigns against hunting and bushmeat the trade amongst local communities.
<p>Direct Impacts on Terrestrial and Marine Flora and Fauna</p> <ul style="list-style-type: none"> Clearance of vegetation may lead to loss of plant species and habitat of conservation interest, and displacement of fauna. 	<ul style="list-style-type: none"> Careful site selection and positioning of all project components, with advice from biodiversity authorities/wildlife specialists. Careful planning of phasing and timing of construction activities. Demarcation and avoidance of areas of conservation interest (high value species, feeding or breeding sites, migration routes, etc.) where possible, and wildlife rescue and translocation where appropriate, under expert supervision. <p>Also see measures under Soils, Run-off and Flooding, and Pollution of Soils and Water above, and Invasive Species below</p>
<ul style="list-style-type: none"> Extraction of water for cooling water system may affect aquatic habitats, and entrainment of aquatic fauna. 	<ul style="list-style-type: none"> Screens and reducing intake velocity to prevent entrainment of aquatic fauna. Where appropriate (in the vicinity of fisheries or protected species) use operational measures and technology such as barrier nets to further reduce the risk of impingement or entrainment of fauna. Reducing the volume of water required, for example through re-use of water in the cooling water system, for example by using cooling towers or cooling ponds, or air cooled systems. Reducing intake flow.
<p>Invasive Species</p> <ul style="list-style-type: none"> Movement of plant and workforce into areas could introduce invasive species which adversely impact fauna, flora, ecosystems, and crops. 	<ul style="list-style-type: none"> Invasive Species Management Plan, which should be developed and implemented in consultation with authorities, including appropriate eradication measures for different species/groups of species. Staff training and awareness raising in communities. No introduction of exotic species (e.g. for site rehabilitation) without specialist vetting and government approval.
<p>Economic Development and Employment</p> <ul style="list-style-type: none"> Direct employment of local population in workforce, and stimulation of local economy through demand for goods and services will enhance livelihoods and economic activity in local communities, but potentially adverse effects if community relations are not well managed. 	<ul style="list-style-type: none"> Development of an Employment Plan, with clear employment requirements and procedures for the construction (and to a lesser extent operational) workforce. Transparent and culturally appropriate communication with communities regarding employment opportunities. Fair and transparent hiring and staff management procedures. Employment requirements and vocational training plan to be agreed with local institutions, so that local people can be trained to meet the project's needs in a timely fashion. Development of measures to manage the transition after construction is complete, including SME development, ongoing opportunities for the workforce in equipment management and maintenance, reskilling and alternative employment.

Impacts	Mitigation
<ul style="list-style-type: none"> Procurement of local goods and services for project and workforce could deplete resources available for local communities. 	<ul style="list-style-type: none"> Procedures for sustainable local procurement, in consultation with local authorities and community leaders. Local capacity building to foster community resilience. Monitoring of local prices, and exploration of corrective measures (e.g. alternative sourcing to reduce local pressure) if appropriate.
<p>Cultural Heritage</p> <ul style="list-style-type: none"> Displacement or damage to cultural heritage sites by construction activities, harm to the setting, amenity value, etc. of the site due to construction or operation. 	<ul style="list-style-type: none"> Careful site selection and siting of all project components, taking account of community consultation/specialist surveys. Development of a Cultural Heritage Management Plan covering tangible and intangible (e.g. local traditions and practices) cultural heritage. Implementation of a "Chance Finds" procedure during construction. See also Guidance Note on Physical Cultural Heritage.
<p>Community Health, Safety and Security</p> <ul style="list-style-type: none"> Poor construction or operational management practices may lead to adverse effects on safety, human health and wellbeing. 	<ul style="list-style-type: none"> Good site "housekeeping" and management procedures (including site access). Disease control measures, e.g. no pools of standing water, rodent control, treatment of water. Risk assessments and emergency response planning to consider impacts on local communities. <p>Also see measures under Soils, Run-off and Flooding, and Pollution of Soils and Water above.</p>
<ul style="list-style-type: none"> Interaction between workforce and local communities may increase occurrence of communicable diseases, including HIV/AIDS and sexually transmitted diseases (STDs). 	<ul style="list-style-type: none"> Implementation of a health management system for the construction workforce, to ensure it is fit for work and that it will not introduce disease into local communities. Training and awareness training for workforce and their dependents on HIV/AIDS and other STDs, and communicable diseases including malaria; health awareness raising campaigns for communities on similar topics.
<ul style="list-style-type: none"> Extraction, reinjection and discharge of geothermal fluids may affect quality and quantity of surface and groundwater resources. 	See Resources and Waste and Pollution of Soils and Water above.
<ul style="list-style-type: none"> Health effects due to exposure to hydrogen sulphide gas. 	<ul style="list-style-type: none"> During the planning phase, consider potential impacts on nearby communities, e.g. proximity to hydrogen sulphide sources, wind direction, etc. Install a hydrogen sulphide monitoring network, based on air dispersion modelling and the location of communities and sources which should be operational at all times to allow early detection and warning of gas releases/emissions. Local communities should input into emergency plans to ensure there is an effective response to warnings.
<ul style="list-style-type: none"> Safety risks to local communities associated with infrastructure, such as hot components, wells. 	<ul style="list-style-type: none"> Deter public access to the power plant, e.g. by fences, warning signs. Minimise the length of pipeline systems. Consider subsurface pipelines or heat shields to prevent general public coming into contact with hot pipes. Appropriate management of decommissioning of infrastructure and wells to leave the site in a safe condition and available for alternative uses, by means of measures such as soil cleanup, revegetation, removal of equipment, sealing wells, removing wellheads, where appropriate.

Impacts	Mitigation
<p>Social Structures and Community Life</p> <ul style="list-style-type: none"> • Real or perceived disruption to normal community life, through the physical presence of a construction workforce. 	<ul style="list-style-type: none"> • Adoption of a Stakeholder Engagement Plan, as a framework for early and ongoing community consultation. • Implementation of a Grievance Procedure (see Grievance Procedure and Redress Mechanisms guidance note). • Works procedures, defining a Code of Appropriate Conduct for all workers. • Training for all staff in acceptable behaviour with respect to community interactions.
<p>Labour and Working Conditions</p> <ul style="list-style-type: none"> • Poor management of occupational health and safety could lead to accidents, injuries and illnesses among workers; mental health issues may arise due to remote or enclosed living. • Differences in nationality, ethnicity, religion, etc. may lead to discrimination and harassment, and differences (perceived or real) in working conditions between workers may lead to resentments. 	<ul style="list-style-type: none"> • Employment practices and working conditions should conform to International Labour Organisation (ILO) Standards and national regulations. • Rest and recreational facilities and time should be provided, and rules on alcohol and drugs defined and clearly communicated to workers. • The basis for differences in the standard of accommodation should be non-discriminatory; it should be documented and communicated transparently to the workforce. • Clear and comprehensive health and safety reporting and grievance procedure system should be established, and be freely available to all of the workforce. • See also Employment and Economic Development and Human Rights

Energy / Electricity sector: Oil and Gas production and transport

This sector keysheet covers all activities involved in the extraction of crude oil, natural gas liquids and natural gas, both onshore and offshore. This includes the transport of gas by pipelines and liquids by tanker, from the production field. It does not consider the processing of liquid natural gas (LNG) or terminals for the import of oil and gas.

The production and transport of oil and gas involves the following phases:

- Seismic exploration.
- Exploratory and production drilling.
- Development and production activities.
- Laying and operation of pipelines.
- Offshore transportation.
- Loading and unloading of tankers.
- Support and ancillary operations, such as support vessel movements.
- Decommissioning.

Impacts throughout the development and operation stage may be associated with unplanned events such as well blowouts and pipeline failures.

As there are significant potential environmental impacts associated with oil and gas production and transport projects, many local regulations and industry standards are in place. This keysheet does not seek to supersede these guidelines and regulations.

Scope and structure

This keysheet provides a summary of the activities, typical environmental and social impacts, and potential mitigation and management measures relating to the production and transport of oil and gas.

This keysheet should be used specifically to help with drafting ToRs for ESIs of oil and gas developments and with scoping and conducting ESIs and preparing ESMPs. It can also help in reviewing ESIs.

It should be used in conjunction with the Bank's Guidance Notes on ESIs (including coverage of cumulative impacts) and with the Guidance Notes on specific safeguard topics including transboundary projects.

The keysheet is organised under the following headings, with substantive information provided in table form:

- Project components and activities.
- Sources of impact and receptors/resources.
- Mitigation and management options.

The phases of oil / gas production / transport projects considered are: design and planning; seismic exploration, exploration and production drilling; development and production activities; transportation; support activities; maintenance; and where appropriate decommissioning (closure).

Project components and activities

The components of oil and gas production and transport projects are provided in Table 1, along with the activities involved, broken down by project phase.

Sources of impact, receptors/ resources, and mitigation

Table 2 summarizes the main aspects of oil and gas production and transport activities that lead to typical impacts, the receptors and resources they affect, and options for mitigation. It considers impacts on the physical, biological and socioeconomic environment. The mitigation measures described assume that higher level

design and network planning measures, as described in Table 1, have already been implemented.

The guidance on impacts and options for their mitigation can be used to help discussions with the borrower or

client and improve their understanding of the Bank's requirements. They should also be used to assist preparation of ToRs for an ESIA so that they are tailored to the particular circumstances of the project under consideration.

Table 1: Summary of Activities Associated with Oil / Gas Production and Transport

Components	
Both offshore and onshore: <ul style="list-style-type: none"> Oil / gas wells with "Christmas tree" to regulate flow. Flowlines. Central production facilities to treat produced hydrocarbons Pipelines to export gas or oil. Other infrastructure including pump stations, metering stations, pigging stations, compressor stations and storage facilities. Onshore only: <ul style="list-style-type: none"> Onshore well pad, drill rig and associated equipment. 	Offshore only: <ul style="list-style-type: none"> Offshore exploration drill rigs (jack-up rig, semi-submersible rig, submersible rig, drillship or drilling barges as floating platform). Offshore drilling and production platform (eg fixed platform, complaint tower, tension leg platform, jack-up platform, spar platform or floating production systems). Manifolds, risers and other subsea infrastructure to transfer hydrocarbons from wells to central processing facility. Export tanker loading facilities.
Activity (1)	
Design – System planning, including route selection	Screening , Scoping and ESIA Preparation of ESMP Agreement of loan covenants
Strategic planning (options analysis, cost-benefit analysis, initial design), and potentially strategic environmental and social assessment (SESA), to establish: <ul style="list-style-type: none"> Major constraints and alternatives (e.g. with respect to major settlements, watersheds and areas of biodiversity conservation importance). Design procedures such that environmental and social considerations are given equal weight to engineering and financial ones. 	
Activity (2)	
Site-specific planning (detailed design), taking account of environmental and social sensitivities and consultation with communities, draw upon the following environmental and socioeconomic documentation, all of which should comply with national regulations and international good practice: <ul style="list-style-type: none"> Environmental and Social Impact Assessment (ESIA). Environmental and Social Management Plan (ESMP). Stakeholder Engagement Plan (SEP). Resettlement Action Plan (RAP). 	
Exploration, Field Development and Construction	Monitoring of ESMP performance Monitoring of compliance with loan covenants Monitoring of sub-contractor contract provisions
Activities will include: <ul style="list-style-type: none"> Seismic surveys using airguns (offshore), explosive and vibrating machinery (onshore). Transport and assembly of drill rig. Exploration drilling. Development drilling and well completion. Installation of other production infrastructure (Christmas trees, flowlines, manifolds etc). Installation of offshore drilling and production platform. Construction of onshore processing facilities. Laying of onshore pipelines (clearing right of way, trenching [if required], pipe laying, welding and bending; testing; coating of welded joints; testing; lowering; trench backfilling; reinstatement). Laying of offshore pipelines. 	
The equipment required for onshore projects will include heavy mobile plant (e.g. excavators) and temporary fixed plant such as power generators. For offshore projects, offshore drilling rigs, helicopters and various types of vessels (support vessels, pipe-laying vessels, heavy lift vessels, tugs etc) will be used.	

Components	
Both offshore and onshore: <ul style="list-style-type: none"> Oil / gas wells with "Christmas tree" to regulate flow. Flowlines. Central production facilities to treat produced hydrocarbons Pipelines to export gas or oil. Other infrastructure including pump stations, metering stations, pigging stations, compressor stations and storage facilities. Onshore only: <ul style="list-style-type: none"> Onshore well pad, drill rig and associated equipment. 	Offshore only: <ul style="list-style-type: none"> Offshore exploration drill rigs (jack-up rig, semi-submersible rig, submersible rig, drillship or drilling barges as floating platform). Offshore drilling and production platform (eg fixed platform, complaint tower, tension leg platform, jack-up platform, spar platform or floating production systems). Manifolds, risers and other subsea infrastructure to transfer hydrocarbons from wells to central processing facility. Export tanker loading facilities.
Activity (2)	
Operation and Maintenance	Project implementation: Compliance Monitoring
<ul style="list-style-type: none"> Additional drilling as required. Production and, depending on project, processing of hydrocarbons. Export of oil and gas via tanker, pipeline or floating storage unit. Generation of solid wastes (e.g. sulphur, silica, carbonate precipitates) from process. Well field monitoring and maintenance, which may include Enhanced Oil Recovery techniques. Maintenance of infrastructure including well work-overs. Pipeline maintenance. Drilling of production also take place during the life of the project. 	
Decommissioning (Closure)	Project Completion: Compliance Report
<p>Where temporary access roads and laydown areas for onshore projects are developed during construction they should be decommissioned and rehabilitated in accordance with a site-specific closure plan developed in consideration of international good practice.</p> <p>At the end of its economic life, the onshore and offshore closure process will include treatment of infrastructure to remove hydrocarbons, removal of infrastructure as appropriate; plugging, testing and capping of wells. This will be done according to a detailed decommissioning and closure plan, which will be approved by the Bank and is also likely to require regulatory approval. Pipelines and other facilities may be removed or left in place, according to the decommissioning and closure plan</p>	

Table 2: Oil and Gas Production and Transport Projects: Impacts and Mitigation

Impacts	Mitigation
<p>Soils, Run-off and Flooding</p> <ul style="list-style-type: none"> Loss of soil / sediments and pollution of watercourses, and interruption of drainage patterns, as a result of ground clearance and earthworks during construction. 	<ul style="list-style-type: none"> Minimisation of cleared areas and soil disturbance, with revegetation as soon as feasible, with native species. Avoidance of areas liable to flooding, slope instability, and water crossings where possible. Careful design: e.g. alignment, minimal diversion of watercourses, timing of works (overall duration and seasonality).
<p>Pollution of Soils and Water</p> <ul style="list-style-type: none"> Release of produced water containing hydrocarbons, chemical additives and other contaminants may cause impacts to the aquatic environment when released to surface waters or sea. 	<ul style="list-style-type: none"> Alternatives to disposal to sea, land or surface waters should be considered at the engineering design phase, including reinjection, reuse by other industry (onshore) or export to shore for treatment and disposal (offshore). Produced water should be treated in line with relevant discharge guidelines before discharge. In the event of failure of the treatment system, a back-up facility should be available at all times. The volume of produced water which requires disposal should be reduced as far as practical, eg adequate well management, shutting in high water producing wells, use of downhole fluid separation techniques. If produced water will be disposed to sea, land or surface water, the choice of chemical additives should take account of their impact on the environment. For onshore projects, evaporation ponds can be an option for treatment and disposal.
<ul style="list-style-type: none"> Release of hydrotest water containing chemical additives may cause impacts to the aquatic environment when released to surface waters or sea. 	<ul style="list-style-type: none"> Where practical, send hydrotest water to shore for treatment and disposal. Minimise volume of hydrotest water released offshore by testing equipment onshore, and re-using the hydrotest water. Reduce the volume of chemical additives needed by minimising the time the water spends in the equipment. The choice of chemical additives should take account of their impact on the environment (including dose needed, toxicity, biodegradability, bioaccumulation etc). Implement a hydrotest water disposal plan which considers rate of discharge, location of discharge (including avoiding disposal in sensitive locations such as coastal waters), environmental risk and monitoring. Hydrotest water should be tested prior to discharge to ensure it meets relevant standards. Where significant quantities are discharged to surface waterbodies, monitoring should be carried to demonstrate no adverse effects on receptors. Limit the volume of water abstracted from watercourses for hydrotesting, to avoid adverse impacts on the watercourse. Screens should be fitted to intake points on waterbodies for onshore hydrotesting. When hydrotest water is discharged to surface water, impacts should be reduced by selecting an appropriate discharge point, reducing the energy in the discharge flow, and controlling the impacts of increased sedimentation. Discharge points to land should be chosen to avoid flooding, erosion, impacts to agricultural land and drinking water.
<ul style="list-style-type: none"> Release of cooling water containing chemical additives may cause impacts to the aquatic environment when released to surface waters or sea. 	<ul style="list-style-type: none"> Environmental impacts of antifoulant chemical dosing should be considered. Where practical, seawater intake depth should be optimised to reduce the need for antifoulants. Screens should be fitted to intake if practical. Discharge depth should be designed to maximise mixing and to ensure temperature is within 3°C of the ambient water temperature at the edge of the mixing zone or within 100m of discharge point.

Impacts	Mitigation
<ul style="list-style-type: none"> Release of other waste water streams may cause impacts to the aquatic environment when released to surface waters or sea. 	<ul style="list-style-type: none"> Consider mixing desalination brine with other waste streams prior to discharge; if this is not feasible the environmental impacts of brine discharge should be carefully considered. Sewage and grey water should be treated in accordance with MARPOL 73/78 requirements prior to discharge (offshore) or required standards for onshore infrastructure. Food waste should be macerated prior to discharge in accordance with MARPOL 73/78 requirements. Bilge, storage displacement, deck drainage and storm waters should be contained and treated prior to discharge in accordance with relevant standards. If these standards cannot be reached, waste water should be transferred to shore for treatment and disposal.
<ul style="list-style-type: none"> Release of waste water from onshore surface storage / disposal pits. 	<ul style="list-style-type: none"> Pits should be constructed away from environmentally sensitive locations. Construction of pits should minimise risks to the environment, for example using an impermeable liner, locating the pit well above the water table, and designing the pits to ensure rainwater does not enter. Fences should be used to prevent access by people, livestock and wildlife. Free hydrocarbons should be regularly removed from the pit. Removal of contents and reinstatement of pit at end of project.
<ul style="list-style-type: none"> Loss of hydrocarbons due to spills. 	<ul style="list-style-type: none"> Implement a Spill Prevention and Control Plan, and Spill Response Plan. A spill risk assessment should be carried out for facilities and vessels. Project should be designed to reduce the risk of spills, for example use of valves which shut in the event of a spill, appropriate corrosion prevention, leak detection systems, and Emergency Shutdown Systems, as appropriate. Well field equipment should be maintained and monitored throughout the lifetime of the project. Personnel should be trained in spill prevention, containment and response, and equipment should be available for use. Spills should be documented and reported.
<p>Air Quality</p> <p>Emissions of NO_x, SO_x, CO, particulates hydrogen sulphide, methane, ethane, BTEX, glycols, PAHs which cause local and long range air pollution, from the following sources:</p>	<p>Project-wide mitigation measures:</p> <ul style="list-style-type: none"> Significant greenhouse gas emissions from all facilities and support activities should be quantified annually as aggregate emissions in accordance with internationally recognised methodologies and reporting procedures. Facilities should be designed to maximise energy efficiency and minimise energy use. Atmospheric dispersion modelling and baseline air quality assessments should inform project design to avoid impacts to the environment or human health.
<ul style="list-style-type: none"> combustion of fuels for power generation, pumps, compressors etc. 	<ul style="list-style-type: none"> Emissions specification of equipment should be considered.

Impacts	Mitigation
<ul style="list-style-type: none"> flaring and venting of hydrocarbons. 	<ul style="list-style-type: none"> Flaring and venting should be reduced in line with international good practice. Continuous venting of associated gas should be avoided. Feasible alternatives to flaring should be considered including using gas for on-site energy needs, export of gas to other facilities or markets, gas injection into reservoirs to maintain pressure, enhanced recovery using gas lift or gas for instrumentation. Alternatives considered should be documented. If alternatives are not possible, the volume of gas flared should be minimised, where the long-term goal of the project should be to eliminate flaring. If flaring is required, measures should be considered to reduce the impact, such as: reducing the volume of gas flared, use of efficient flare tips, maximising flare combustion efficiency, minimising flaring from purges and pilots, minimising liquid carry-over into the gas flare system, control odour and visible smoke emissions through flare operations, locating flare at a safe distance from communities and personnel. Maximising plant reliability will reduce the number of flaring events due to upset conditions. Volumes of gas flared should be monitored, recorded and reported.
<ul style="list-style-type: none"> fugitive emissions. 	<ul style="list-style-type: none"> Use of appropriate valves, flanges, seals etc to reduce leaks. Leak detection and repair programmes should be implemented. Vapour control units (if required) for hydrocarbon loading and unloading. Pressure relief valves should be used in place of open vents in tank roofs.
<ul style="list-style-type: none"> well testing. 	<ul style="list-style-type: none"> Avoid flaring of hydrocarbons where practicable (especially near sensitive receptors). Recover hydrocarbon test fluids where possible. Minimise the volume of hydrocarbons used in testing. Test flare burner should be efficient to minimise incomplete combustion products, black smoke and hydrocarbon fallout.
<p>Resources and Waste</p> <ul style="list-style-type: none"> Generation of general hazardous and non-hazardous waste, such as office waste, batteries, chemical containers, medical waste etc. 	<ul style="list-style-type: none"> Waste should be appropriately segregated, stored and transported to an appropriate facility for re-use, recycling or disposal. A waste management plan should be implemented to track waste movements, and to aim to eliminate, reduce or recycle waste.
<p>Noise and Vibration</p> <ul style="list-style-type: none"> Noise and vibration from seismic activities, drilling and production, construction and installation (especially pile driving) and traffic (road and vessel) may disturb fish and marine mammals, and sensitive onshore receptors (human and fauna) 	<ul style="list-style-type: none"> Plan seismic surveys and offshore construction to avoid sensitive times of year (eg breeding seasons, most productive fishing seasons) and sensitive locations (eg breeding, calving areas, communities). Minimise simultaneous seismic operations when these are close together. Reduce time taken for seismic surveys by being as efficient as possible. Monitor the presence of sensitive species before and throughout the period of noisy activity. If significant impacts to sensitive species are predicted, use experienced observers. Construction or seismic activities should not take place within 500m of observed marine mammals and other sensitive wildlife. Start-up should be postponed until mammals have moved away. If marine mammals or other sensitive wildlife are known to be in the area, soft-start procedures should be used (a gradual increase in sound pressure). Noise levels should be kept to a minimum by using lowest practical power levels for seismic surveys, and methods to reduce or baffle unnecessary high-frequency noise. Noise impacts from onshore flare stacks should be modelled and the location and design should take account of local communities. Vehicle traffic should be minimised, and access through communities should be avoided if possible.

Impacts	Mitigation
<ul style="list-style-type: none"> Generation of drilled cuttings from the well and spent drilling fluids 	<ul style="list-style-type: none"> Non-aqueous drill fluids (NADF) should be contained and transported to shore for recycling or treatment and disposal. These are generally reused onshore. Although drill cuttings and water-based drill fluids (WBDF) may be discharged to sea, projects should consider the alternative options such as injection to wells or containment and transfer to shore for treatment and disposal. Onshore options include injection to wells, containment in tanks or pits prior to recycling, treatment and disposal, and recycling fluids back to vendors. If discharge to sea is the only practical option, a cuttings and fluid disposal plan should be implemented, considering the chemicals chosen, environmental impacts and monitoring. Cuttings from wells drilled with NADF should be treated to meet relevant standards. Drill fluids should also be tested to ensure they are within these standards prior to disposal to sea. Environmental impacts of chemical additives should be considered when designing the fluid system and selecting fluids. Reduce the volume of fluids and cuttings, through slim-hole multi-lateral wells and coiled tubing drilling techniques if practical, and use of high efficiency solids control equipment. Avoid deposition of drill cuttings in sensitive locations by using directional drilling. Where fluids are stored in pits or surface storage, pits should be closed as soon as possible and within 12 months after the end of operations. See also Release of waste water from onshore surface storage / disposal pits. If drilling waste is buried in pits following operations, the risks of contamination from the pit should be minimised.
<ul style="list-style-type: none"> Generation of produced sand which may be contaminated with hydrocarbons. 	<ul style="list-style-type: none"> Reduce the production of sand by effective down-hole sand control measures. For offshore projects, sand should be appropriately stored and transported to shore for treatment and disposal, or injected into a well, where practical. If the only option is disposal to sea, sand should be tested and treated to ensure it meets relevant standards prior to disposal. For onshore projects, sand should be treated with other oil contaminated solids
<ul style="list-style-type: none"> Generation of waste completion and well work-over fluids. 	<ul style="list-style-type: none"> Preferred options for disposal are shipping to shore for treatment and disposal, injection into an available injection disposal well, or use of a closed system which can be shipped to the manufacturer for recycling. For onshore projects, treatment can be on-site or off-site, and can include biological or physical treatment at an approved facility. If disposal to sea is the only available option, the choice of chemicals should take into account their environmental impact. If possible, fluids should be treated with the produced water stream prior to disposal Fluids should be treated to ensure they meet relevant standards prior to disposal, including neutralising spent acids.
<ul style="list-style-type: none"> Generation of naturally occurring radioactive material (NORM) 	<ul style="list-style-type: none"> If NORM is present, a management plan should be implemented to ensure appropriate handling, treatment and disposal procedures are followed to avoid impacts to the environment and human health. Human exposure to NORM should be within internationally recognised limits, and recognised industrial practices should be followed during disposal. All disposal facilities must be licenced to receive this waste.

Impacts	Mitigation
<ul style="list-style-type: none"> • Use of hazardous materials 	<ul style="list-style-type: none"> • Chemicals used offshore should be subject to hazard assessment and risk management techniques to evaluate their environmental risks • Chemicals with lowest potential environmental and health impacts should be used wherever possible, and should be chosen based on internationally recognised systems, such as OSPAR Harmonised Offshore Chemical Notification Format. • Avoid use of chemicals suspected to cause taint, known endocrine disruptors, ozone depleting substances and chemicals containing more than trace quantities of heavy metals.
<p>Visual Impacts</p> <ul style="list-style-type: none"> • Visual impacts from project 	<ul style="list-style-type: none"> • Careful site selection including consultation with local communities. • Use of low profile facilities and appropriate coloured paint, if practical.
<p>Loss, fragmentation and degradation of habitat, and severance of animal migration routes and pathways</p> <ul style="list-style-type: none"> • Land clearance for plant and associated infrastructure may cause loss or fragmentation of protected areas and other areas of conservation interest. 	<ul style="list-style-type: none"> • Careful siting of all project components to avoid critical habitat, with advice from biodiversity authorities/wildlife specialists and use of existing transport corridors where possible. • Wherever feasible, establishment of buffer zones around conservation areas, watercourses, and other locations identified as ecologically sensitive and avoidance or minimisation of activity within these zones. • Rehabilitation of cleared areas with native species, and ecosystem restoration in habitats of conservation value, using specialist advice and input, backed up by a long-term monitoring programme and corrective actions as necessary. • Consider use of existing utility and transport corridors for pipelines and roads. • Burying submarine pipelines when traversing sensitive intertidal habitat.
<ul style="list-style-type: none"> • Construction impacts on habitats and species (e.g. from changes in drainage, soil erosion, pollution of water, soils or air, introduction of invasive species, and general human disturbance). 	<p>Where development in sensitive areas cannot be avoided, mitigation may include:</p> <ul style="list-style-type: none"> • Minimisation of area impacted, clear demarcation of remaining intact areas of habitat, and prohibition of activity into those areas for any purpose; maintenance of wildlife corridors between fragmented areas wherever possible. • Avoidance of construction activities during sensitive seasons or times of day. • No ground clearance upstream of sensitive areas unless appropriately engineered drainage installed. • Habitat rehabilitation and ecosystem restoration of areas no longer required after construction, as soon as possible. • If loss of Critical Habitat is inevitable, development/implementation of an Offsets Programme. <p>See relevant sections re: control of impacts from pollution, air quality, noise / vibration and invasive species.</p>
<p>Bushmeat Hunting</p> <ul style="list-style-type: none"> • Construction activities in remote areas could lead to greater demand for bushmeat (from workforce and wider community), stimulate the wildlife trade and facilitate access to hunting areas. 	<ul style="list-style-type: none"> • Bushmeat Hunting and Wildlife Trade Management Plan, agreed with government authorities and implemented jointly. • Prohibition on workforce hunting, selling, or purchasing bushmeat, and training to support this requirement. • Prohibition on workforce (except security personnel) having guns in work areas or accommodation. • Sensitisation and public awareness campaigns against hunting and bushmeat the trade amongst local communities.

Impacts	Mitigation
<p>Direct Impacts on Terrestrial and Marine Flora and Fauna</p> <ul style="list-style-type: none"> Clearance of vegetation may lead to loss of plant species and habitat of conservation interest, and displacement of fauna. 	<ul style="list-style-type: none"> Careful site selection and siting of all project components, with advice from biodiversity authorities/wildlife specialists. Careful planning of phasing and timing of construction activities. Where pipelines and access roads cross watercourses, design culverts/crossing structures to avoid impacts on fish movement. Revegetate pipeline corridors and drill locations as soon as possible after construction. Consider seismic survey methods that minimise the loss of vegetation. Demarcation and avoidance of areas of conservation interest (high value species, feeding or breeding sites, migration routes, etc.) where possible, and wildlife rescue and translocation where appropriate, under expert supervision. <p>Also see measures under Soils, Run-off and Flooding, Pollution of Soils and Water, above, and Invasive Species below.</p>
<ul style="list-style-type: none"> Extraction of water for cooling water system may affect aquatic habitats, and entrainment of aquatic fauna. 	<ul style="list-style-type: none"> Screens and reducing intake velocity to prevent entrainment of aquatic fauna. Where appropriate (in the vicinity of fisheries or protected species) use operational measures and technology such as barrier nets to further reduce the risk of impingement or entrainment of fauna. Reducing the volume of water required, for example through re-use of water in the cooling water system, for example by using cooling towers or cooling ponds, or air cooled systems. Reducing intake flow to maintain resource use.
<ul style="list-style-type: none"> Disturbance to the seabed from pipe-laying, and installation of infrastructure. 	<ul style="list-style-type: none"> Careful siting of infrastructure to avoid sensitive marine habitat.
<ul style="list-style-type: none"> Severance of animal migration pathways. 	<ul style="list-style-type: none"> Where pipelines and access roads cross watercourses, design culverts/crossing structures to avoid impacts on fish movement. For terrestrial, flying and marine fauna, avoid migration corridors and foraging routes as much as possible. Consider use of animal crossing structure eg bridges, along access roads and pipeline.
<p>Invasive Species</p> <ul style="list-style-type: none"> Movement of plant and workforce into areas could introduce invasive species which adversely impact fauna, flora, ecosystems, and crops. Offshore operations could introduce invasive species via ballast water carried by vessels, or via drill rigs and platforms imported from other parts of the world. 	<ul style="list-style-type: none"> Invasive Species Management Plan, which should be developed and implemented in consultation with authorities, including appropriate eradication measures for different species/groups of species. Staff training and awareness raising in communities. No introduction of exotic species (e.g. for site rehabilitation) without specialist vetting and government approval.
<p>Economic Development and Employment</p> <ul style="list-style-type: none"> Direct employment of local population in workforce, and stimulation of local economy through demand for goods and services will enhance livelihoods and economic activity in local communities, but potentially adverse effects if community relations are not well managed. 	<ul style="list-style-type: none"> Development of an Employment Plan, with clear employment requirements and procedures for the construction workforce. Transparent and culturally appropriate communication with communities regarding employment opportunities. Fair and transparent hiring and staff management procedures. Employment requirements and vocational training plan to be agreed with local institutions, so that local people can be trained to meet the project's needs in a timely fashion. Development of measures to manage the transition after construction is complete, including SME development, ongoing opportunities for the workforce in equipment management and maintenance, reskilling and alternative employment.
<ul style="list-style-type: none"> Presence of oil and gas infrastructure may affect access to fishing areas and shipping lanes. 	<ul style="list-style-type: none"> Community and marine users should be notified of offshore facilities and activities, including marking on nautical charts. Consultation with local communities should be carried out, including appointment of a fisheries liaison officer if appropriate.
<ul style="list-style-type: none"> Procurement of local goods and services for project and workforce could deplete resources available for local communities. 	<ul style="list-style-type: none"> Procedures for sustainable local procurement, in consultation with local authorities and community leaders. Local capacity building to foster community resilience. Monitoring of local prices, and exploration of corrective measures (e.g. alternative sourcing to reduce local pressure) if appropriate.

Impacts	Mitigation
<p>Cultural Heritage</p> <ul style="list-style-type: none"> Displacement or damage to cultural heritage sites by construction activities, harm to the setting, amenity value, etc. of the site due to construction or operation. 	<ul style="list-style-type: none"> Careful site selection and siting of all project components, taking account of community consultation/specialist surveys. Development of a Cultural Heritage Management Plan covering tangible and intangible (e.g. local traditions and practices) cultural heritage. Implementation of a "Chance Finds" procedure during construction. <p>See also Guidance Note on Physical Cultural Heritage.</p>
<p>Community Health, Safety and Security</p> <ul style="list-style-type: none"> Poor construction management practices may lead to adverse effects on safety, human health and wellbeing. 	<ul style="list-style-type: none"> Good construction site "housekeeping" and management procedures (including site access). Disease control measures, e.g. no pools of standing water, rodent control, treatment of water. Risk assessments and emergency response planning to consider impacts on local communities. <p>See also control of pollution under Physical Impacts heading.</p>
<ul style="list-style-type: none"> Health effects due to exposure to hydrogen sulphide gas. 	<ul style="list-style-type: none"> During the planning phase, consider potential of nearby communities, eg proximity to hydrogen sulphide sources, wind direction etc. Install a hydrogen sulphide monitoring network, based on air dispersion modelling and the location of communities and sources. A monitoring system should be operational at all times to allow early detection and warning of gas. Local communities should input into emergency plans to ensure there is an effective response to warnings.
<ul style="list-style-type: none"> Interaction between workforce and local communities may increase occurrence of communicable diseases, including HIV/AIDS and sexually transmitted diseases (STDs). 	<ul style="list-style-type: none"> Implementation of a health management system for the construction workforce, to ensure it is fit for work and that it will not introduce disease into local communities. Training and awareness training for workforce and their dependents on HIV/AIDS and other STDs, and communicable diseases including malaria; health awareness raising campaigns for communities on similar topics.
<ul style="list-style-type: none"> Health effects due to exposure to hydrocarbon spills. 	<ul style="list-style-type: none"> Community impacts resulting from hydrocarbon spills should be considered in Spill Response Plans.
<ul style="list-style-type: none"> Safety risks to local communities associated with infrastructure, such as accessing offshore facilities. 	<ul style="list-style-type: none"> Deter the general public from accessing the infrastructure e.g. fences, warning signs. Standby vessel should be considered for all offshore facilities to support security operations.
<p>Social Structures and Community Life</p> <ul style="list-style-type: none"> Real or perceived disruption to normal community life, through the physical presence of a construction workforce. 	<ul style="list-style-type: none"> Adoption of a Stakeholder Engagement Plan, as a framework for early and ongoing community consultation. Implementation of a Grievance Procedure (see Grievance Procedure and Redress Mechanisms guidance note). Works procedures, defining a Code of Appropriate Conduct for all workers. Training for all staff in acceptable behaviour with respect to community interactions.
<p>Labour and Working Conditions</p> <ul style="list-style-type: none"> Poor management of occupational health and safety could lead to accidents, injuries and illnesses among workers; mental health issues may arise due to remote or enclosed living. Differences in nationality, ethnicity, religion, etc. may lead to discrimination and harassment, and differences (perceived or real) in working conditions between workers may lead to resentments. 	<ul style="list-style-type: none"> Employment practices and working conditions should conform to International Labour Organisation (ILO) Standards and national regulations. Rest and recreational facilities and time should be provided, and rules on alcohol and drugs defined and clearly communicated to workers. The basis for differences in the standard of accommodation should be non-discriminatory; it should be documented and communicated transparently to the workforce. Clear and comprehensive health and safety reporting and grievance procedure system should be established, and be freely available to all of the workforce. <p>See also Employment and Economic Development.</p>



ENERGY/ELECTRICITY SECTOR: BIOFUELS PRODUCTION AND TRANSPORT

Biofuels are any fuel derived from biomass, where biomass is any organic matter made from plants or animals. Biofuels can provide a renewable energy source, which can be used to replace fossil fuels, particularly for transportation as bio-alcohols or biodiesel. Plants used for biofuel production can be either woody energy crops (i.e. fast-growing tree or shrub species, usually harvested by regular coppicing: these are more common in temperate areas) or herbaceous energy crops (e.g., switchgrass, miscanthus, jatropha sorghum, energycane) .

Investment in biofuels can contribute to economic development and enhance quality of life. However, development, expansion and operation of biofuel projects can require large plantations or changes to traditional agricultural practices where out-grower schemes are introduced. They can therefore cause widespread impacts on natural and human environments. Environmental damage may include disruption or contamination of water courses and drainage systems, soil destabilization, habitat fragmentation and destruction, disturbance and loss of fauna and flora, and opening up frontier areas containing pristine landscapes. Biofuel developments may also be a source of adverse impacts on the human environment, particularly the displacement and resettlement of affected families and businesses, and impacts on existing livelihoods. Production of biofuels in place of food production can lead to higher agricultural commodity and food prices. The extent of greenhouse gas emissions reductions associated with biofuels can also vary greatly depending on the crop and production process.

Scope and structure

This keysheet provides a summary of the activities, typical environmental and social impacts, and potential mitigation and management measures relating to the production and transport of biofuels. It includes development, expansion or improvement of projects involving production and processing biofuel feedstock and raw materials, and the transport of liquid biofuels to biofuel processors and blenders. It does not cover subsequent processing, blending and use of biofuels.

This keysheet should be used specifically to help with drafting ToRs for ESIA's of biofuel projects and with scoping and conducting ESIA's and preparing ESMPs. It can also help in reviewing ESIA's.

It should be used in conjunction with the Bank's Guidance notes on ESIA's (including coverage of cumulative impacts) and with the Guidance Notes on specific safeguard topics including transboundary projects.

The keysheet is organised under the following headings, with substantive information provided in table form:

- Project components and activities.
- Sources of impact and receptors/resources.
- Mitigation and management options.

Project components and activities

The components of biofuel projects are provided in Table 1, along with the activities involved in developing and implementing new projects or improving existing projects, broken down by project phase.

Sources of impact, receptors/ resources, and mitigation

Table 2 summarizes the main aspects of biofuel projects that lead to typical impacts, the receptors and resources they affect, and options for mitigation. It considers impacts on the physical, biological and socioeconomic environment. The mitigation measures described assume that higher level design and planning measures, as described in Table 1, have already been implemented.

The guidance on impacts and options for their mitigation can be used to help discussions with the borrower or /client and improve their understanding of the Bank's requirements.

They should also be used to assist preparation of ToRs for an ESIA so that they are Terms of Reference, which can be tailored to the particular circumstances of the biofuel project under consideration.

Table 1: Summary of Activities associated with Biofuel Projects

Components	
<p>Feedstock production</p> <ul style="list-style-type: none"> Plantation area / field, including associated watershed, or area of land to be planted Seed stands/orchards, nursery areas Inputs, including fertilisers, pesticides, herbicides etc. Related infrastructure (e.g. irrigation systems) Primary processing plant. 	<p>Ancillary facilities</p> <ul style="list-style-type: none"> Facilities (e.g. buildings, machinery) for primary processing (e.g. oil extraction) and storage of crops and other goods Security: barriers, security posts Access roads into plantation areas (and if appropriate, a network of access roads into out-grower areas) connecting roads biofuel processing / blending plant
Activity	
Design – Site Selection and Planning	<p>Screening , Scoping and ESIA</p> <p>Preparation of ESMP</p> <p>Agreement of loan covenants</p>
<p>Strategic planning (options analysis, cost-benefit analysis, strategic site selection, initial design), and for major biofuel programmes, strategic environmental and social assessment (SESA), to establish:</p> <ul style="list-style-type: none"> Major constraints and alternatives (e.g. with respect to major settlements, watersheds and areas of biodiversity conservation importance). Design procedures such that environmental and social considerations are given equal weight to biofuel production and financial ones. 	
<p>Site-specific planning (detailed design), taking account of environmental and social sensitivities and consultation with communities, draw upon the following environmental and socioeconomic documentation, all of which should comply with national regulations and international good practice:</p> <ul style="list-style-type: none"> Environmental and Social Impact Assessment (ESIA). Environmental and Social Management Plan (ESMP). Stakeholder Engagement Plan (SEP). Resettlement Action Plan (RAP). 	
Construction/Project Development	<p>Monitoring of ESMP performance</p> <p>Monitoring of compliance with loan covenants</p> <p>Monitoring of sub-contractor contract provisions</p>
<p>Construction/project development activities will include:</p> <ul style="list-style-type: none"> Preparation for and construction of access roads and other infrastructure (e.g. staff accommodation, workshops, nursery areas, etc.). For new plantations/ fields, site preparation (e.g. clearance, ploughing, slash burning). Planting of seeds, transplanting of young plants. Establishing temporary access to work and ancillary areas, demarcating clearance zones, establishing access control. Import of relatively small quantities of building materials. Construction of primary processing facilities. Sourcing and establishing water supply from surface and/or groundwater, where necessary for irrigation. 	
<p>The equipment required will include heavy mobile plant (e.g. graders, bulldozers, excavators) and temporary fixed plant such as concrete batching plant and power generators.</p>	
Operation and Maintenance	Project implementation: Compliance Monitoring
<p>Operation and maintenance of biofuels projects will entail many of the activities described above for the project development phase. It will include activities such as breeding, planting, cultivation and management (e.g. pruning, thinning, controlled burns, pest management) of plants, and the harvesting and primary processing of crops. Biofuel projects may entail varying levels of intervention, involving control of environmental conditions such as water quality, nutrient supply, and pest and disease prevalence. Out-grower schemes will also include agricultural extension for smallholders covering crop cultivation techniques, soil and water conservation, safe and sustainable application of pesticides and herbicides, etc.</p> <p>Primary processing of biofuel crops will include extraction of oil or milling of woody crops.</p> <p>These activities may contribute to direct and indirect impacts described in Table 2.</p>	

Components	
<p>Feedstock production</p> <ul style="list-style-type: none"> • Plantation area / field, including associated watershed, or area of land to be planted • Seed stands/orchards, nursery areas • Inputs, including fertilisers, pesticides, herbicides etc. • Related infrastructure (e.g. irrigation systems) • Primary processing plant. 	<p>Ancillary facilities</p> <ul style="list-style-type: none"> • Facilities (e.g. buildings, machinery) for primary processing (e.g. oil extraction) and storage of crops and other goods • Security: barriers, security posts • Access roads into plantation areas (and if appropriate, a network of access roads into out-grower areas) connecting roads biofuel processing / blending plant
Activity	
Decommissioning (Closure)	Project Completion: Compliance Report
<p>Where temporary roads and facilities are no longer required (if, for example, they are not required for maintenance or harvesting of crops) they should be decommissioned and rehabilitated in accordance with a site-specific closure plan developed in consideration of international good practice.</p> <p>The decommissioning process will include site clearance, removal of all equipment and facilities, appropriate disposal of waste materials, soil ripping and re-grading where necessary.</p>	

Table 2: Biofuel Developments: Impacts and Mitigation

Impacts	Mitigation
<p>Geology/Hydrogeology</p> <ul style="list-style-type: none"> • Interruption of hydrogeology and groundwater flows from ground clearance, construction of access roads, haul roads and other works, and from increased water retention in new plantation areas. 	<ul style="list-style-type: none"> • Take account of local hydrological conditions in site/route selection and design (e.g. avoid interrupting permanent waterways, do not hamper natural drainage of water bodies and watercourses, avoid or restrict operations in areas prone to flooding especially during rainy season). • See Pollution of Soils and Water below.
<p>Soils, Run-off and Flooding</p> <ul style="list-style-type: none"> • Loss, damage or disruption of soil from ground clearance or construction works for access roads and other facilities, or during harvesting; may lead to introduction of soils to waterbodies. • Degradation of soil due to poor agricultural practices • Changes in drainage patterns and water retention in newly planted areas leading to altered patterns of soil erosion and flooding. 	<ul style="list-style-type: none"> • Minimisation of cleared areas and soil disturbance, retention of any topsoil removed for restoration following activities in an area, revegetation as soon as feasible with native species. • Early installation and regular maintenance of drainage and diversion structures to maintain natural drainage patterns. • Use of silt traps, etc; drainage outlets to discharge into vegetated areas if possible; vegetation along watercourses and drainage lines to be retained if possible. • Manage erosion by contour planting, barriers, use of plant cover / intercrops or shelterbelts and drainage channels. • Careful consideration of location (areas of instability etc.) and timing (overall duration and seasonality) of works, and design to reduce erosion and facilitate maintenance. • Management of soil to minimise loss of productive capacity, for example using crops suited to local conditions, minimise soil compaction and practicing Integrated Nutrient Management.
<p>Pollution of Soils and Water</p> <ul style="list-style-type: none"> • Pollution of watercourses from non-point sources (e.g. pesticides, herbicides, fertilisers in run-off from agricultural land), as well as waste from primary processing of biofuel crops and workforce sewage. 	<ul style="list-style-type: none"> • Reduce nutrient and chemical inputs (e.g. through use of biological pest and weed control methods, appropriate choice and siting of plantations). • Ensure that waste and drainage water complies with discharge standards and treat accordingly. • Implementation of standard good wastewater and agrochemical management and disposal procedures. • Installation of sewage treatment to meet required standards; hygiene training for workforce.
<ul style="list-style-type: none"> • Release of hazardous substances (e.g. accidental diesel spills and leaks) leading to soil, surface or groundwater contamination. 	<ul style="list-style-type: none"> • Materials handling and control procedures, use of storage and containment equipment meeting international standards. • Control of construction vehicle, tractor, and harvesting equipment movements and prohibition of vehicle washing in watercourses, and other similar practices. • Emergency response plans during construction and operation.

Impacts	Mitigation
<p>Air Quality</p> <ul style="list-style-type: none"> Dust and emissions from construction, maintenance and operational activities, could affect human health, vegetation and wildlife. 	<ul style="list-style-type: none"> Sensitive site selection and siting of project components. Use of modern equipment meeting appropriate emissions standards, and regular preventative maintenance. Dust control and suppression measures around cleared or harvested areas and construction, e.g. dampening, use of vegetation hedges. No use of ozone depleting substances during construction. Use of appropriate solid waste disposal facilities (including prohibition on burning of waste materials).
<p>Noise and Vibration</p> <ul style="list-style-type: none"> Noise and vibration from equipment, increased traffic due to transport of biofuels, and processing activities, may disturb sensitive noise receptors (human, fauna). 	<ul style="list-style-type: none"> Sensitive local siting of components and construction sites, accompanied where necessary by noise attenuation measures. Use of modern equipment fitted with abatement devices (e.g. mufflers, noise enclosures); good maintenance regime. Strict controls of timing of noisy activities e.g. tree felling; prohibition on night working if possible. Observance of seasonal sensitivities (e.g. breeding seasons), and alteration of activity to reduce noise levels at that time.
<p>Resources and Waste</p> <ul style="list-style-type: none"> Use of agricultural land for biofuel crops can place pressure on local food supply and increase prices. 	<p>See Physical and Economic Displacement of People, Property, Assets and Resources and Community Health, Safety and Security.</p>
<ul style="list-style-type: none"> Abstraction of water from surface or ground water sources to irrigate crops may affect supply for human communities and ecosystems. 	<ul style="list-style-type: none"> Water study prior to any abstraction, to inform a Sustainable Water Management Plan. No abstraction without prior approval of relevant authorities at all locations. Promotion of water efficiency (including leak detection, preventative maintenance of equipment) and water recycling. Implement irrigation water conservation measures such as reducing evaporation, controlling weeds in inter-row strips, keeping records of irrigation and rainfall to understand trends in water use. Maximise available precipitation by reducing, using and storage run-off where possible. Select crops compatible with available water resources.
<ul style="list-style-type: none"> Inefficient waste management during construction, operation and maintenance leading to excess consumption of materials, generation of wastes/emissions, pollution of soils and water. 	<ul style="list-style-type: none"> Preparation of Waste Management Plan following the waste hierarchy, supported by training and awareness-raising around topic of waste for workforce and for local community. Earthworks to be designed to achieve a balance between cut and fill wherever possible. Use of authorised contractors for hazardous and any other wastes which the project cannot dispose of safely.

Impacts	Mitigation
<p>Loss, fragmentation and degradation of habitat, and severance of animal migration routes and pathways.</p> <ul style="list-style-type: none"> Land clearance for new plantations / fields and associated infrastructure such as access roads, and processing facilities causing loss, degradation or fragmentation of protected or ecologically sensitive areas (e.g. forest, wetlands, migration routes), and other areas of conservation interest. Introduction of low diversity plantations or crops, causing loss and degradation of habitat, and loss of biodiversity within plantations / fields. 	<ul style="list-style-type: none"> Careful siting of all project components, with advice from biodiversity authorities/wildlife specialists. Wherever feasible, establishment of buffer zones around conservation areas, watercourses, and other locations identified as ecologically sensitive, and avoidance or minimisation of activity within these zones. Rehabilitation of cleared areas with native species where possible, and ecosystem restoration in habitats of conservation value, using specialist advice and input so as to maintain the integrity of the habitat, backed up by a long-term monitoring programme and corrective actions as necessary.
<ul style="list-style-type: none"> Impacts on habitats and species from habitat alteration and degradation during construction and operation (e.g. changes in water flow and drainage, soil erosion, pollution of water, soils or air, loss of tree species diversity). 	<p>Where development in sensitive areas cannot be avoided, mitigation may include:</p> <ul style="list-style-type: none"> Minimisation of area impacted, clear demarcation of remaining intact areas of habitat, and prohibition of activity in those areas for any purpose; maintenance of wildlife corridors between fragmented areas wherever possible. No ground clearance upstream of sensitive areas unless appropriately engineered drainage installed. Habitat rehabilitation and ecosystem restoration of areas no longer required after construction, as soon as possible. Wildlife crossings for terrestrial animals, and design of culverts/ crossing structures to avoid impacts on animal movement. If loss of Critical Habitat is inevitable, development/implementation of an Offsets Programme. <p>See also Pollution of Soils and Water above, and Induced Access and Invasive Species below.</p>
<p>Impacts from Induced Access</p> <ul style="list-style-type: none"> Development of biofuels projects in remote or undeveloped areas, especially construction of roads into fields and plantations, may lead to further development, increased disturbance and pressure on natural resources through bushmeat hunting, logging, fire, etc. 	<ul style="list-style-type: none"> Careful site selection, with advice from biodiversity authorities/ wildlife specialists to avoid remote and previously inaccessible areas where possible. Where possible, instate access controls on roads leading to project facilities (e.g. plantations, processing facilities) in otherwise undeveloped or remote areas. <p>See also Bushmeat Hunting below.</p>
<p>Direct Impacts on Flora and Fauna</p> <ul style="list-style-type: none"> Clearance of vegetation may lead to loss of plant species and habitat of conservation interest; direct loss of plant species through harvesting. Clearance, construction, and operational activities (e.g. planting, harvesting, processing, traffic, increased human presence) may displace/disturb animals. 	<ul style="list-style-type: none"> Careful site selection and siting of all project components, with advice from biodiversity authorities/wildlife specialists. Careful planning of phasing and timing of activities. Demarcation and avoidance of areas of conservation interest (high value species, feeding or breeding sites, migration routes, etc.) where possible, and wildlife rescue and translocation where appropriate, under expert supervision. <p>Also see measures under Soils, Run-off and Flooding, Pollution of Soils and Water, and Induced Access above, and Invasive Species below.</p>
<p>Invasive Species</p> <ul style="list-style-type: none"> Movement of plant and workforce into areas (especially more remote areas), and of road traffic, could introduce invasive species which adversely impact fauna, flora, ecosystems, and crops. Cultivation of non-native species may result in establishment of wild populations, or genetic mixing with wild populations, leading to negative impacts on local flora and fauna. 	<ul style="list-style-type: none"> Invasive Species Management Plan, developed and implemented in consultation with authorities, including appropriate eradication measures for different species/groups of species. Staff training and awareness raising in communities on potential impacts of invasive species. Encourage use of indigenous species in biofuel production. No introduction of exotic species (e.g. for culture) without comprehensive study and government approval. Where exotic species are cultured, monitor status of native species in surrounding area. Where possible, clearance of invasive species during routine maintenance.

Impacts	Mitigation
<p>Physical and Economic Displacement of People, Property, Assets and Resources</p> <ul style="list-style-type: none"> Development of biofuel projects may physically displace people, or lead to loss of agricultural land. Potential for economic displacement of specific individuals or groups with existing reliance on land used for biofuel production if they are excluded from projects. 	<ul style="list-style-type: none"> Careful site selection and siting of project facilities, avoiding occupation of areas which are inhabited or regarded as having high value by communities where possible. Early development and sensitive implementation of resettlement planning, in accordance with national regulations and international good practice to compensate for any losses (both physical and economic). Put in place employment plan, giving preference to employment within local communities. Develop detailed baseline of existing reliance on agricultural land in the project area, both within and outside local communities; from this, identify specific groups that may not benefit from the project and adopt corrective measures as required; develop compensation measures for affected parties.
<p>Economic Development and Employment</p> <ul style="list-style-type: none"> Direct employment of local population in workforce, and stimulation of local economy through export of and demand for goods and services will enhance livelihoods and economic activity in local communities; potential for adverse effects if expectations not met and community relations are not well managed. 	<ul style="list-style-type: none"> A community-based approach is encouraged: the workforce should as much as possible be sourced from the local area or region; further skills required for feedstock production, processing or maintenance activities to be included in local training programs and developed within the community, in order to retain value in local community. Development of an Employment Plan, with clear employment requirements and procedures for the workforce. Transparent and culturally appropriate communication with communities regarding employment opportunities. Fair and transparent hiring and staff management procedures.
<p>Cultural Heritage</p> <ul style="list-style-type: none"> Displacement or damage to cultural heritage sites by ground clearance and other activities; exclusion of community from areas of cultural importance; harm to the setting, amenity value, etc. of particular locations in the area. Changes to intangible cultural heritage due to increased access, and interaction with non-local workforce. 	<ul style="list-style-type: none"> Careful site selection and siting of all project components, taking account of community consultation/specialist surveys. Development of a Cultural Heritage Management Plan covering tangible and intangible (e.g. local traditions and practices) cultural heritage. Implementation of a "Chance Finds" procedure during construction. <p>See also Guidance Note on Physical Cultural Heritage.</p>
<p>Community Health, Safety and Security</p> <ul style="list-style-type: none"> Poor management practices may lead to adverse effects on safety, human health and wellbeing. 	<ul style="list-style-type: none"> Good site "housekeeping" and management procedures (including site access). Disease control measures, e.g. no pools of standing water, rodent control, treatment of water. Minimise community exposure to agrochemicals; training and agricultural extension in their use. Risk assessments and emergency response planning to consider impacts on local communities. Awareness raising campaigns for communities. <p>See also Pollution of Soils and Water, Air Quality, and Noise/Vibration above.</p>
<ul style="list-style-type: none"> Changes to local food availability or increased price of food due to use of agricultural land for biofuel production may lead to malnutrition. 	<ul style="list-style-type: none"> Risks to food security in the region and locality should be assessed before a project is developed. If a food security assessment indicates that there is a risk, a mitigation plan should be developed and implemented. This should include measures to enhance food security, for example by setting aside land for communities to grow staple foods, increasing yield, sponsoring agricultural support programmes, and providing opportunities for workers to carry out food production for their household.
<ul style="list-style-type: none"> Interaction between workforce and local communities may increase occurrence of communicable diseases, including HIV/AIDS and sexually transmitted diseases (STDs). 	<ul style="list-style-type: none"> Implementation of a health management system for the workforce, to ensure it is fit for work and that it will not introduce disease into local communities. Training and awareness training for workforce and their dependents on HIV/AIDS and other STDs, and communicable diseases including malaria; health awareness raising campaigns for communities on similar topics.

Impacts	Mitigation
<p>Workforce-Community Interactions</p> <ul style="list-style-type: none"> • Real or perceived disruption to normal community life, through the physical presence of a workforce. 	<ul style="list-style-type: none"> • Adoption of a Stakeholder Engagement Plan, as a framework for early and ongoing community consultation. • Implementation of a Grievance Procedure (see Grievance Procedure and Redress Mechanisms guidance note). • Works procedures, defining a Code of Appropriate Conduct for all workers. • Training for all staff in acceptable behaviour with respect to community interactions.
<p>In-migration</p> <ul style="list-style-type: none"> • Local development and improved access may encourage migration into the area, causing conflict with resident communities, and putting pressure on resources and infrastructure. 	<ul style="list-style-type: none"> • Careful site selection and siting of all project components, after consultation with communities and local authorities. • Preparation and implementation of an Influx/In-migration Management Plan, in consultation with local authorities. <p>See also Economic Development and Employment, and Induced Access above.</p>
<p>Labour and Working Conditions</p> <ul style="list-style-type: none"> • Poor management of occupational health and safety could lead to accidents, injuries and illnesses among workers (e.g. during harvesting or processing); mental health issues may arise due to remote or enclosed living. • Differences in nationality, ethnicity, religion, etc. may lead to discrimination and harassment, and differences (perceived or real) in working conditions between workers may lead to resentments. 	<ul style="list-style-type: none"> • Employment practices and working conditions should conform to International Labour Organisation (ILO) Standards and national regulations. • Rest and recreational facilities and time should be provided, and rules on alcohol and drugs defined and clearly communicated to workers. • The basis for differences in the standard of accommodation should be non-discriminatory; it should be documented and communicated transparently to the workforce. • Clear and comprehensive health and safety reporting and grievance procedure system should be established, and be freely available to all of the workforce. <p>See also Employment and Economic Development.</p>

ENERGY / ELECTRICITY SECTOR: MINERAL EXPLOITATION

The exploitation of minerals can provide a significant source of foreign exchange, as well as supporting domestic construction and industrial processes, and can therefore act as a major catalyst to economic development and to quality of life. However, very significant environmental and social impacts can occur due to the large scale of many mining operations and associated activities. Large-scale mining projects often require the development of railways, ports, new or updated roads and access to power; these topics are covered in the separate keysheets in this series. This sector keysheet covers all activities involved in the exploitation of minerals, using the following methods:

- Underground mining.
- Open-pit mining.
- Alluvial mining.
- Solution mining.
- Marine dredging.

Mining operations include extraction of the ore and waste products, preliminary processing of the ore, waste storage and management. This keysheet covers all stages of the process, from exploration, development and construction, operation, and decommissioning, but does not cover metallurgical processing of ore off-site, or the transport of ore from the site (see other keysheets on railways, ports and road infrastructure, as noted above, for coverage of these topics).

Scope and structure

This keysheet provides a summary of the activities, typical environmental and social impacts, and potential mitigation and management measures relating to mineral exploitation projects. This keysheet should be used specifically to help with drafting ToRs for ESIA of mineral exploitation developments and with scoping and conducting ESIA and preparing ESMPs. It can also help in reviewing ESIA.

It should be used in conjunction with the Bank's Guidance Notes on ESIA (including coverage of cumulative impacts) and with the Guidance Notes on specific safeguard topics including transboundary projects. The keysheet is organised under the following headings, with substantive information provided in table form:

- Project components and activities.
- Sources of impact and receptors/resources.
- Mitigation and management options.

Project components and activities

The components of mineral exploitation projects are provided in Table 1, along with the activities involved, broken down by project phase.

Sources of impact, receptors/ resources, and mitigation

Table 2 summarizes the main aspects of mineral exploitation activities that lead to typical impacts, the receptors and resources they affect, and options for mitigation. It considers impacts on the physical, biological and socioeconomic environment. The mitigation measures described assume that higher level design and network planning measures, as described in Table 1, have already been implemented.

The guidance on impacts and options for their mitigation can be used to help discussions with the borrower or client and improve their understanding of the Bank's requirements. They should also be used to assist preparation of ToRs for an ESIA so that they are tailored to the particular circumstances of the mineral exploitation project under consideration.

Table 1: Summary of Activities Associated with Mineral Exploitation Projects

Components	
<ul style="list-style-type: none"> • Mine pits / underground workings. • On-site transport of ore and waste (conveyors, roads with trucks etc). • Primary processing facilities. • Waste storage areas, tailings storage. 	<ul style="list-style-type: none"> • Rock and ore stockpiles. • Water management infrastructure. • Offices, workshops, worker accommodation. • Associated infrastructure, such as power plants roads, railways, etc.
Activity	
Design – System planning, including route selection	Screening , Scoping and ESIA Preparation of ESMP Agreement of loan covenants
Strategic planning (options analysis, cost-benefit analysis, initial design), and potentially strategic environmental and social assessment (SESA), to establish: <ul style="list-style-type: none"> • Major constraints and alternatives (e.g. with respect to major settlements and existing infrastructure, groundwater resources and watersheds and areas of biodiversity conservation importance) • Design procedures such that environmental and social considerations are given equal weight to engineering and financial ones 	
Site-specific planning (detailed design), taking account of environmental and social sensitivities and consultation with communities, draw upon the following environmental and socioeconomic documentation, all of which should comply with national regulations and international good practice: <ul style="list-style-type: none"> • Environmental and Social Impact Assessment (ESIA). • Environmental and Social Management Plan (ESMP). • Stakeholder Engagement Plan (SEP). • Resettlement Action Plan (RAP). 	
Exploration, Development and Construction	Monitoring of ESMP performance Monitoring of compliance with loan covenants Monitoring of sub-contractor contract provisions
Activities will include: <ul style="list-style-type: none"> • Exploration activities. • Access roads, drill sites and underground exploration tunnels. • Construction of primary processing plant (if appropriate). • Construction of other infrastructure, including waste management infrastructure, transport, water. management facilities, power plant(s). 	
The equipment required will include heavy mobile plant (e.g. bulldozers, excavators, tunnelling equipment) and temporary fixed plant such as power generators, concrete batching plant.	
Operation and Maintenance	Project implementation: Compliance Monitoring
<ul style="list-style-type: none"> • Excavation using trucks and shovels, drilling, blasting etc. • Solution mining through injection of water into deposits. • Dredging of the seabed through stationary, self-propelled or land-based approaches (marine dredge mining). • Use of mechanised excavation and pumps to mine deposits on the seafloor (deep sea mining) • Material handling (ore and waste rock). • Primary processing (commutation of ore, e.g. crushing and grinding, mineral concentrations, washing, leaching etc.). • Wastewater treatment and discharge. 	
Decommissioning (Closure)	Project Completion: Compliance Report
<ul style="list-style-type: none"> • Removal of buildings and other physical infrastructure. • Closure open pits. • Stabilising underground workings / shafts and preventing public access. • Reclamation of slopes. • Treatment of water draining from mine, as required. • Contouring, landscaping and revegetation. • Ongoing maintenance and monitoring following closure. 	

Table 2: Mineral Exploitation Projects: Impacts and Mitigation

Impacts	Mitigation
<p>Soils, Run-off and Flooding</p> <ul style="list-style-type: none"> Loss of soil / sediments and pollution of watercourses, and interruption of drainage patterns, as a result of ground clearance and earthworks during construction. 	<ul style="list-style-type: none"> Minimisation of cleared areas and soil disturbance, and revegetation with native species as soon as feasible. Avoidance of areas liable to flooding, slope instability, and water crossings where possible. Careful design: e.g. minimal diversion of watercourses, timing of works (overall duration and seasonality). Minimise the risk of landslides, destabilisation of soils and debris/ mud flows through appropriate design and construction practices. Where topsoil is stripped and stored for reuse, soil conservation measures should be followed, taking account location, duration of storage, and how it will be reused. Erosion from topsoil piles should be prevented.
<p>Pollution of Soils and Water</p> <ul style="list-style-type: none"> Contamination of ground and surface water. 	<ul style="list-style-type: none"> Effluent streams including mine drainage and process effluent should be managed and treated to meet applicable discharge guideline values prior to discharge. The impact on receiving water bodies should be considered, taking account of the use of the water body, assimilative capacity and other sources of discharge to the water body. Discharges of oil and grease should be minimised by installing and maintaining efficient traps and sumps at refuelling facilities, workshops, storage areas etc. Oil spill kits should be available, and made a requirement of emergency response plans. A risk assessment should be carried out for water quality in open storage ponds, such as tailings ponds, and appropriate controls should be in place to meet local effluent discharge limits.
<ul style="list-style-type: none"> Discharge of sewage effluent from accommodation facilities polluting watercourses. 	<ul style="list-style-type: none"> Installation of sewage treatment to meet required standards; hygiene training for workforce.
<ul style="list-style-type: none"> Erosion of exposed surfaces and increased sedimentation due to stormwater run-off. 	<ul style="list-style-type: none"> Reduce exposure of sediment generating materials to wind / water, for example through proper placement of soil piles, diverting runoff around disturbed areas, establishing riparian zones, grading of disturbed areas and revegetation of disturbed areas as soon as possible. Drains, stream channels and other watercourses should be protected from erosion by slope limitation, linings, rip-rap, and appropriate design and construction. Erosion on slopes and roads should be minimised by surface treatment, contouring, terracing, slope reduction and appropriate drainage. The risk of sediment being transported off-site should be minimised through use of settlement ponds and silt fences, taking account of seasonal variability in the hydrological regime (i.e. rainy season conditions). Discharges from settlement facilities should comply with local suspended solid discharge limits, and be consistent with the receiving water body use.
<ul style="list-style-type: none"> Contamination of water resources by acid rock drainage and metals leaching. 	See Resources and Waste below.
<ul style="list-style-type: none"> Contamination of groundwater due to surface leach processes (solution mining). 	<ul style="list-style-type: none"> Infiltration of leach solutions should be prevented by appropriate liners and drainage systems on ponds and storage heaps. Pipelines carrying leach solutions containing dissolved minerals should have secondary bunded containment. Leak detection and leak response systems should be in place for pipelines and plant. The water level and quality in process solution storage ponds and other surface water ponds containing process effluent should be monitored.

Impacts	Mitigation
<ul style="list-style-type: none"> Contamination of soils, groundwater and surface water due to spills of hazardous materials. 	<ul style="list-style-type: none"> Secondary containment should be used to minimise risk of fuel and other chemical spills from pipelines and storage areas, such as double-walled pipelines, impermeable liners and shut-off valves. Use of cyanide should be in accordance with the International Cyanide Management Code.
<p>Air Quality</p> <ul style="list-style-type: none"> Fugitive dust emissions from blasting, tailings structures, stockpiles, haul roads and infrastructure. 	<ul style="list-style-type: none"> Minimise dust emissions from exposed surfaces by dust suppression techniques, eg reducing traffic speeds, wetting exposed surfaces. Covering exposed soils, erodible materials and storage of dusty materials as much as possible, eg. by revegetating or covering. New areas should only be cleared when strictly necessary. Emissions from loading, transfer and discharge of dusty materials should be minimised by covering, minimising fall height, shielding from the wind, and spray systems as required.
<ul style="list-style-type: none"> Emissions of gases from combustion of fuels in power plants and equipment. 	<ul style="list-style-type: none"> Emissions should comply with local legislation and industry standards.
<ul style="list-style-type: none"> Emissions from smelting and roasting of precious metals (note: this is often carried out on-site, whereas other forms of processing are off-site and therefore outside the scope of this keysheet). 	<ul style="list-style-type: none"> Where smelting of gold and silver takes place on-site, testing should be undertaken to determine if mercury collection is required. Roasting of concentrates can lead to emissions of mercury, arsenic, SO₂ and other metals: these emissions should be managed, for example through operating at a controlled temperature or use of a gas scrubbing system. When smelting platinum group metals, management measures should be in place to minimise formation of nickel carbonyl and chromium VI.
<p>Noise and Vibration</p> <ul style="list-style-type: none"> Noise and vibration from construction and mining activities, traffics may disturb sensitive receptors such as communities and sensitive fauna. 	<ul style="list-style-type: none"> Sensitive siting of construction facilities and roads, based on proximity to receptors and prevailing land use. Noise levels at receptors should meet local legislation and industry standards. If necessary noise emissions should be controlled eg through noise barriers, optimising traffic routes and cladding. Observance of seasonal sensitivities (e.g. breeding seasons), and alteration of activity to reduce noise levels at that time. Speed controls and other traffic calming measures to reduce excessive acceleration around settlements/sensitive receptors.
<ul style="list-style-type: none"> Noise and vibration from blasting may disturb sensitive receptors such as communities and sensitive fauna. 	<ul style="list-style-type: none"> Minimise or avoid use of explosives through use of mechanical ripping if possible. Reduce noise and vibration from blasting through efficient design and planning, use of appropriate drilling grids. Crushers and other equipment causing vibration should have adequately designed foundations.
<p>Resources and Waste</p> <ul style="list-style-type: none"> Generation of general hazardous and non-hazardous waste, such as office waste, waste oils, batteries, chemical containers etc. 	<ul style="list-style-type: none"> Waste should be appropriately segregated, stored and transported to an appropriate facility for re-use, recycling or disposal. Non-hazardous solid waste should not be disposed of with waste rock unless under exceptional circumstances which are included in the project's ESIA. Hazardous waste should be handled by specialists and disposed of in accordance with regulatory permits. Waste oil should be used as a supplementary fuel where practicable, and in accordance with local legislation and industry guidance.
<ul style="list-style-type: none"> Use of large volume of water in processing and related activities can lead to reduction in surface and groundwater availability. 	<ul style="list-style-type: none"> Infrastructure design should take into account the water balance of the mine and related process plant. A Sustainable Water Supply Management Plan should be implemented, to manage water use, minimising impact on water users, and avoid depletion of aquifers. The volume of make-up water should be minimised. Where feasible, process water should be reused, recycled and treated. The impacts on the mine's water balance should be considered prior to dewatering. Consult with stakeholders including local water users to understand water demand and potential environmental impacts of water use.

Impacts	Mitigation
<ul style="list-style-type: none"> Generation of large volumes of rock waste. 	<ul style="list-style-type: none"> Rock dumps should be designed to minimise erosion and reduce safety risks, taking account of local geotechnical and material properties. Design of facilities should take account of potential changes to geotechnical properties of waste rock dumps which may occur due to weathering. <p>See Generation of PAG materials and ARD.</p>
<ul style="list-style-type: none"> Generation of leach pad waste. 	<ul style="list-style-type: none"> Leach pad waste should be collected and treated so that discharges meet standard in local legislation and industry guidance. Decommissioning plan should include remediation and treatment techniques to ensure no significant adverse impacts on water quality after closure.
<ul style="list-style-type: none"> Generation of large volumes of tailings. 	<ul style="list-style-type: none"> A tailings management strategy should be implemented for the handling, disposal and storage of tailings, taking into account properties of the tailings, topography, and receptors. This should be subject to independent review. Design, operation and maintenance of tailings management structures should comply with appropriate industry standards. Monitoring of water quality and structures should take place during operation and decommissioning. Design should take account of risk of seismic activity, potential liquefaction, geotechnical stability, hydraulic failure. Emergency preparedness and response plans should be in place in case of catastrophic failure. Design should consider seepage management and stability analysis; seepage within and downstream of tailings structures should be monitored for the lifetime of the structure. Tailings structures, including ditches and drains diverting water away from tailings structures, should be designed to take account of flood events. A full water balance and risk assessment should be carried out for the mine, including tailings. Zero discharge tailings facilities should be considered. On land disposal systems should be considered, that can isolate acid leachate generating material from oxidation or water. Management strategy should consider creating paste with tailings and using in pits and underground workings as a method of disposal. Deep sea tailings placement should only be considered if there are no appropriate land-based alternatives, and when an impact assessment has shown that it will not cause significant adverse environmental or social impacts.
<ul style="list-style-type: none"> Generation of potentially acid generating (PAG) materials and acid rock drainage (ARD). 	<ul style="list-style-type: none"> Procedures should be in place to characterise waste geochemical properties, and to manage PAG materials. Tests should be conducted from the feasibility study onwards to evaluate the potential for ARD, and this should be continued throughout the lifetime of the mine. Measures should be in place to minimise ARD, if required, such as limiting exposure of PAG materials to water and oxygen, water management to avoid it coming into contact with PAG materials and treatment of water as required.
<ul style="list-style-type: none"> Use of energy during all transport, exploration, mining and processing. 	<ul style="list-style-type: none"> Minimise exploratory drilling and digging through use of remote sensing. Minimise energy use by equipment by using appropriately sized motors and pumps.
<p>Visual Impacts</p> <ul style="list-style-type: none"> Visual impacts from project, eg erosion, waste dumps, open pits, removal of natural vegetation cover. 	<ul style="list-style-type: none"> Consultation with local communities about post-closure land use. Reclamation design should take account of visual aspects of local landscape and proximity to viewpoints. Careful site design including placement of access roads and ancillary facilities, and use of screening to minimise visual impacts.

Impacts	Mitigation
<p>Loss, fragmentation and degradation of habitat, and severance of animal migration routes and pathways</p> <ul style="list-style-type: none"> Land clearance for mine, processing plant, access routes and associated infrastructure may cause loss or fragmentation of protected areas and other areas of conservation interest. 	<ul style="list-style-type: none"> Careful siting of all project components to avoid critical habitat, with advice from biodiversity authorities/wildlife specialists and potentially affected communities. Careful planning of phasing and timing of construction activities. Wherever feasible, establishment of buffer zones around conservation areas, watercourses, and other locations identified as ecologically sensitive and avoidance or minimisation of activity within these zones. Rehabilitation of cleared areas with native species, and ecosystem restoration in habitats of conservation value, using specialist advice and input, backed up by a long-term monitoring programme and corrective actions as necessary. Soil which is stored for use during site reclamation should be sufficient to support native species and proposed future land uses, and should be conserved to protect quality and composition. Consider use of existing utility and transport corridors for roads.
<ul style="list-style-type: none"> Construction and operational impacts on habitats and species (e.g. from changes in drainage, soil erosion, pollution of water, soils or air, introduction of invasive species, and general human disturbance). 	<p>Where development in sensitive areas cannot be avoided, mitigation may include:</p> <ul style="list-style-type: none"> Minimisation of area impacted, clear demarcation of remaining intact areas of habitat, and prohibition of activity into those areas for any purpose; maintenance of wildlife corridors between fragmented areas wherever possible. Avoidance of construction activities during sensitive seasons or times of day. Minimising disturbance to soils and vegetation. Minimising disturbance to watercourses, eg by maintaining natural drainage paths as much as possible, and restoring if they are disrupted, maintaining catchment areas, protecting channel stability, No ground clearance upstream of sensitive areas unless appropriately engineered drainage installed. Habitat rehabilitation and ecosystem restoration of areas no longer required after construction, as soon as possible. Bridges and culverts should be designed to manage peak flows. Watercourse crossings should be designed, constructed and maintained to minimise erosion and degradation of channel beds. If loss of Critical Habitat is inevitable, development/implementation of an Offsets Programme. <p>See relevant sections re. control of impacts from pollution, air quality, noise / vibration and invasive species</p>
<p>Impacts from Induced Access</p> <ul style="list-style-type: none"> Mining developments in remote areas will encourage in-migration, and can lead to land clearance for agriculture, and increased disturbance and pressure on natural resources through bushmeat hunting, logging, fire, etc. 	<ul style="list-style-type: none"> Careful route selection and siting of all project components, with advice from biodiversity authorities/wildlife specialists to avoid remote and previously inaccessible areas where possible. A construction camp siting strategy regarding siting to avoid attracting people towards more remote areas, where possible. Restrictions on access to all temporary access roads, and their removal after construction. See also Bushmeat Hunting below.
<p>Bushmeat Hunting</p> <ul style="list-style-type: none"> Construction activities and access to remote areas could lead to greater demand for bushmeat (from workforce and wider community), stimulate the wildlife trade and facilitate access to hunting areas. 	<ul style="list-style-type: none"> Bushmeat Hunting and Wildlife Trade Management Plan, agreed with government authorities and implemented jointly. Prohibition on workforce hunting, selling, or purchasing bushmeat, and training to support this requirement. Prohibition on workforce (except security personnel) having guns in work areas or accommodation. Sensitisation and public awareness campaigns against hunting and bushmeat the trade amongst local communities.

Impacts	Mitigation
<p>Direct Impacts on Flora and Fauna</p> <ul style="list-style-type: none"> Clearance of vegetation for mine, processing plant and access routes and associated infrastructure may lead to loss of plant species and habitat of conservation interest, and displacement of fauna. 	<ul style="list-style-type: none"> Careful site selection and siting of all project components, with advice from biodiversity authorities/wildlife specialists and potentially affected communities. Careful planning of phasing and timing of construction activities. Where pipelines and access roads cross watercourses, design culverts/crossing structures to avoid impacts on fish movement. Demarcation and avoidance of areas of conservation interest (high value species, feeding or breeding sites, migration routes, etc.) where possible, and wildlife rescue and trans-location where appropriate, under expert supervision. <p>Also see measures under Soils, Run-off and Flooding, Pollution of Soils and Water, above, and Invasive Species below.</p>
<ul style="list-style-type: none"> Impacts on the marine environment due to habitat loss and disturbance, increased suspended sediment, changes to water quality and temperature (marine dredging and mining). 	<ul style="list-style-type: none"> Sensitive siting of projects to avoid sensitive marine habitat. Detailed impact assessment should be carried to identify potential risks to the marine environment.
<p>Invasive Species</p> <ul style="list-style-type: none"> Movement of plant and workforce into areas could introduce invasive species which adversely impact fauna, flora, ecosystems, and crops. 	<ul style="list-style-type: none"> Invasive Species Management Plan, which should be developed and implemented in consultation with authorities, including appropriate eradication measures for different species/groups of species. Chemical herbicides should be avoided where possible, and if required staff should receive appropriate training and equipment. Staff training and awareness raising in communities. No introduction of exotic species (e.g. for site rehabilitation) without specialist vetting and government approval.
<p>Economic Development and Employment</p> <ul style="list-style-type: none"> Direct employment of local population in workforce, and stimulation of local economy through demand for goods and services will enhance livelihoods and economic activity in local communities, but potentially adverse effects if community relations are not well managed. 	<ul style="list-style-type: none"> Development of an Employment Plan, with clear employment requirements and procedures for the construction workforce. Transparent and culturally appropriate communication with communities regarding employment opportunities. Fair and transparent hiring and staff management procedures. Employment requirements and vocational training plan to be agreed with local institutions, so that local people can be trained to meet the project's needs in a timely fashion. Development of measures to manage the transition after construction is complete, including SME development, ongoing opportunities for the workforce in equipment management and maintenance, reskilling and alternative employment.
<ul style="list-style-type: none"> Procurement of local goods and services for project and workforce could deplete resources available for local communities. 	<ul style="list-style-type: none"> Procedures for sustainable local procurement, in consultation with local authorities and community leaders Local capacity building to foster community resilience Monitoring of local prices, and exploration of corrective measures (e.g. alternative sourcing to reduce local pressure) if appropriate
<p>Physical and Economic Displacement of People, Property, Assets and Resources</p> <ul style="list-style-type: none"> Development of mine and associated infrastructure may physically displace people, or lead to the loss of assets. 	<ul style="list-style-type: none"> Careful siting of all project components, and avoid occupation of areas which are inhabited or regarded as of high value by communities (e.g. horticulture, community orchards) where possible. Early development and sensitive implementation of resettlement planning, in accordance with national regulations and international good practice to compensate for any losses (both physical and economic).
<ul style="list-style-type: none"> Land subsidence causing damage to property to leave land prone to flooding. 	<ul style="list-style-type: none"> Design and excavation of mine should take potential subsidence into consideration, including monitoring and filling with concrete where necessary. Subsidence areas should be managed to ensure it is returned to an acceptable land-use to the local community and that appropriate drainage is installed.
<p>Cultural Heritage</p> <ul style="list-style-type: none"> Displacement or damage to cultural heritage sites by construction activities, harm to the setting, amenity value, etc. of the site due to construction or operation. 	<ul style="list-style-type: none"> Careful site selection and siting of all project components, taking account of community consultation/specialist surveys. Development of a Cultural Heritage Management Plan covering tangible and intangible (e.g. local traditions and practices) cultural heritage. Implementation of a "Chance Finds" procedure during construction. See also Guidance Note on Physical Cultural Heritage.

Impacts	Mitigation
<p>In-migration</p> <ul style="list-style-type: none"> Individuals are likely to migrate into the area which may cause conflict with resident communities, and put pressure on resources and infrastructure. 	<ul style="list-style-type: none"> Careful route selection and siting of all project components, after consultation with communities and local authorities. Preparation and implementation of an Influx/In-migration Management Plan, in consultation with local authorities. <p>See also Economic Development and Employment, and Induced Access above.</p>
<p>Workforce-Community Interactions</p> <ul style="list-style-type: none"> Real or perceived disruption to normal community life, through the physical presence of a construction workforce. 	<ul style="list-style-type: none"> Adoption of a Stakeholder Engagement Plan, as a framework for early and ongoing community consultation. Implementation of a Grievance Procedure (see Grievance Procedure and Redress Mechanisms guidance note). Works procedures, defining a Code of Appropriate Conduct for all workers. Training for all staff in acceptable behaviour with respect to community interactions.
<p>Community Health, Safety and Security</p> <ul style="list-style-type: none"> Poor construction management practices may lead to adverse effects on safety, human health and wellbeing 	<ul style="list-style-type: none"> Good construction site “housekeeping” and management procedures (including site access). Disease control measures, e.g. no pools of standing water, rodent control, treatment of water. Risk assessments and emergency response planning to consider impacts on local communities. <p>See also control of pollution under Physical Impacts heading.</p>
<ul style="list-style-type: none"> Interaction between workforce and local communities may increase occurrence of communicable diseases, including HIV/AIDS and sexually transmitted diseases (STDs). 	<ul style="list-style-type: none"> Implementation of a health management system for the construction workforce, to ensure it is fit for work and that it will not introduce disease into local communities. Training and awareness for workforce and their dependents on HIV/AIDS and other STDs, and communicable diseases malaria; health awareness raising campaigns for communities on similar topics.
<ul style="list-style-type: none"> Health risks to local communities due to presence of standing water and water storage which could be a waterborne disease vector breeding site. 	<ul style="list-style-type: none"> An integrated control strategy should be implemented, which may include raising awareness, vector control, minimising standing water.
<ul style="list-style-type: none"> Safety risks to local communities associated with infrastructure including tailings dams. 	<ul style="list-style-type: none"> Emergency preparedness and response plans should be in place and communicated to the local community. <p>See also Resources and Waste above.</p>
<p>Social Structures and Community Life</p> <ul style="list-style-type: none"> Real or perceived disruption to normal community life, through the physical presence of a construction workforce. 	<ul style="list-style-type: none"> Adoption of a Stakeholder Engagement Plan, as a framework for early and ongoing community consultation. Implementation of a Grievance Procedure (see Grievance Procedure and Redress Mechanisms guidance note). Works procedures, defining a Code of Appropriate Conduct for all workers. Training for all staff in acceptable behaviour with respect to community interactions.
<p>Labour and Working Conditions</p> <ul style="list-style-type: none"> Poor management of occupational health and safety could lead to accidents, injuries and illnesses among workers; mental health issues may arise due to remote or enclosed living. Differences in nationality, ethnicity, religion, etc. may lead to discrimination and harassment, and differences (perceived or real) in working conditions between workers may lead to resentments. 	<ul style="list-style-type: none"> Employment practices and working conditions should conform to International Labour Organisation (ILO) Standards and national regulations. Rest and recreational facilities and time should be provided, and rules on alcohol and drugs defined and clearly communicated to workers. The basis for differences in the standard of accommodation should be non-discriminatory; it should be documented and communicated transparently to the workforce. Clear and comprehensive health and safety reporting and grievance procedure system should be established, and be freely available to all of the workforce. <p>See also Employment and Economic Development.</p>

AGRICULTURE / AGRIBUSINESS SECTOR: AGRICULTURAL WATER SUPPLY AND IRRIGATION

Investment in projects ensuring provision of water supply to agricultural activities facilitates the production of goods, contributing to economic development, livelihoods and enhanced quality of life. However, the construction, rehabilitation, maintenance and operation of water supply and irrigation systems have often caused widespread adverse impacts on natural and human environments. Environmental damage may include disruption or contamination of water courses and drainage systems, soil destabilization, habitat fragmentation and destruction, disturbance and loss of fauna and flora, and opening up frontier areas containing pristine landscapes. These developments may also be a source of adverse impacts on the human environment, particularly reduction in water supply and conflicts over water use, the displacement and resettlement of affected families and businesses, and health and safety.

Scope and structure

This keysheet provides a summary of the activities, typical environmental and social impacts, and potential mitigation and management measures relating to the development of agricultural water supply and irrigation systems. Water supply and irrigation projects considered include construction, improvement or expansion of surface, ground or waste water fed systems, involving water harvesting or abstraction, storage, conveyance, distribution and drainage of water for agricultural use; and the construction and maintenance of the structures necessary for these processes.

This keysheet should be used specifically to help with drafting ToRs for ESIA of agricultural water supply and irrigation developments and with scoping and conducting ESIA and preparing ESMPs. It can also help in reviewing ESIA. It should be used in conjunction with the Bank's Guidance notes on ESIA (including coverage of cumulative impacts) and with the Guidance Notes on specific safeguard topics including transboundary projects.

The keysheet is organised under the following headings, with substantive information provided in table form:

- Project components and activities.
- Sources of impact and receptors/resources.
- Mitigation and management options.

The phases of agricultural water supply and irrigation projects considered are: design and planning, including site selection; construction; operation and maintenance; and where appropriate decommissioning (closure).

Project components and activities

The components of agricultural water supply and irrigation developments are provided in Table 1, along with the activities involved in developing new or upgraded systems, and in operating systems, broken down by project phase.

Sources of impact, receptors/ resources, and mitigation

Table 2 summarizes the main aspects of agricultural water supply and irrigation development activities that lead to typical impacts, the receptors and resources they affect, and options for mitigation. It considers impacts on the physical, biological and socioeconomic environment. The mitigation measures described assume that higher level design and alignment planning measures, as described in Table 1, have already been implemented.

The guidance on impacts and options for their mitigation can be used to help discussions with the borrower or /client and improve their understanding of the Bank's requirements. They should also be used to assist preparation of ToRs for an ESIA so that they are Terms of Reference, which can be tailored to the particular circumstances of the water supply/irrigation project under consideration.

Table 1: Summary of Activities associated with Agricultural Water Supply and Irrigation

Components	
Water Supply and Irrigation <ul style="list-style-type: none"> • Distribution channels, pipelines, pumping stations. • Surface water diversions and impoundments (e.g. dams, reservoirs, ponds, tanks). • Intake facilities or irrigation wells/boreholes etc. • Application systems (e.g. border strips, sprinklers, subsurface). • Surface and subsurface drainage systems, water recovery systems. • Control structures, including erosion control. 	Ancillary Works <ul style="list-style-type: none"> • Temporary construction facilities (e.g. workshops, laydown areas, working corridor outside the footprint, workers' accommodation, quarries). • Access roads within and between temporary facilities and the area being developed, permanent access and maintenance roads. • Land grading.
Activity (1)	
Design – Site Selection and Planning	Screening, Scoping and ESIA Preparation of ESMP Agreement of loan covenants
Strategic planning (options analysis, cost-benefit analysis, strategic site selection, initial design), and for major agricultural development programmes, strategic environmental and social assessment (SESA), to establish: <ul style="list-style-type: none"> • Major environmental and social constraints and alternatives (e.g. with respect to major settlements, watersheds and areas of biodiversity conservation importance). • Design procedures such that environmental and social considerations are given equal weight to engineering and financial ones. 	
Site-specific planning (detailed design), taking account of environmental and social sensitivities and consultation with communities, drawing upon the following environmental and socioeconomic documentation, all of which should comply with national regulations and international good practice: Environmental and Social Impact Assessment. <ul style="list-style-type: none"> • Environmental and Social Management Plan (ESMP); Stakeholder Engagement Plan (SEP). • Resettlement Action Plan (RAP). 	
Activity (2)	
Construction	Monitoring of ESMP performance Monitoring of compliance with loan covenants Monitoring of sub-contractor contract provisions
Construction activities will include: <ul style="list-style-type: none"> • Establishing temporary access to work and ancillary areas, demarcating clearance zones, establishing access control. • Clearance and levelling of some areas and major earthworks (e.g. creating impoundments, distribution canals, grading of land, introducing ditches and other control structures) where required. • Sourcing and establishing water supply from surface / groundwater (e.g. creating diversions, digging irrigation wells). • Laying pipelines, building control / impoundment structures (e.g. pumping systems, dams, tanks) and irrigation channels and structures. • Location and development of quarries, import of materials, e.g. aggregate/ballast. • Improvement of existing drainage and introduction of new drainage, including culverts if required. 	
The equipment required will include heavy mobile plant (e.g. graders, bulldozers, excavators) and temporary fixed plant such as concrete batching plant and power generators.	
Operation and Maintenance	Project implementation: Compliance Monitoring
During operation activities will include the abstraction of water from a local water source; water storage in containment areas such as tanks or reservoirs; distribution of water to and within agricultural land; and control and treatment of water runoff from these areas. These activities may contribute to direct and indirect impacts described in Table 2.	
Maintenance of agricultural water supply and irrigation systems will entail many of the activities described above for the construction phase, although in general they are likely to be smaller in scale and spatial extent. It will include activities such as clearing and maintaining water distribution and storage systems, and servicing mechanical components such as pumps.	
Decommissioning (Closure)	Project Completion: Compliance Report
Where temporary roads and facilities used in the construction phase are no longer required (if, for example, they are not required for maintenance) they should be decommissioned and rehabilitated in accordance with a site-specific closure plan developed in consideration of international good practice. The decommissioning process will include site clearance, removal of all equipment, appropriate disposal of waste materials, soil ripping and re-grading where necessary.	
Water supply and irrigation systems are normally intended to operate for a prolonged period, and so it would not be appropriate for closure or decommissioning plans to be prepared until a few years prior to this occurring.	

Table 2: Agricultural Water Supply and Irrigation Developments: Impacts and Mitigation

Impacts	Mitigation
<p>Geology/Hydrogeology</p> <ul style="list-style-type: none"> • Interruption or disruption of surface and groundwater flows from construction, excavation and ground clearance, and reduced flows during operation. • Lowering of water table due to excessive abstraction; this may result in salinization, especially in coastal areas. 	<ul style="list-style-type: none"> • Design to take account of local hydrological conditions (e.g. avoid crossing permanent waterways, do not hamper drainage of surface water, avoid works in areas prone to flooding especially during rainy season). • Minimise the loss of water caused by leaks, evaporation and infiltration through canals and reservoirs (e.g. maintain vegetation along water canals). • Ensure proper water management by adjusting pumped volumes annually depending on aquifer recharge, establishing fees for water users, controlling access to irrigation water for other purposes than irrigation.
<ul style="list-style-type: none"> • Pollution of groundwater from discharges and accidental releases during construction and maintenance, and from agricultural runoff during operation. 	See Pollution of Soils and Water below
<p>Soils, Run-off and Flooding</p> <ul style="list-style-type: none"> • Loss, damage or disruption of soil/sediments, including waterlogging due to excessive irrigation. • Introduction of sediments to watercourses or interruption of drainage patterns, as a result of ground clearance, earthworks and the introduction of drainage structures. 	<ul style="list-style-type: none"> • Minimisation of cleared areas and soil disturbance, with revegetation as soon as feasible (with native species if not crops). • Early installation and regular maintenance of drainage and diversion structures, silt traps, etc; drainage outlets to discharge into vegetated areas if possible; vegetation along watercourses and drainage lines to be retained if possible. • Retention of topsoil for restoration (including tilling and revegetation) as soon as practicable. • Careful consideration of timing of works (overall duration and seasonality). • Design water distribution systems so as to reduce sedimentation and facilitate drainage and maintenance. • In order to avoid water saturation, regulate irrigation, maintain drainage network, select irrigation system that is low-demanding in water and appropriate for crops.
<p>Pollution of Soils and Water</p> <ul style="list-style-type: none"> • Non-point source pollution caused by agricultural runoff (of nutrients from fertilisers; pesticides) and construction workforce sewage effluent polluting watercourses. 	<ul style="list-style-type: none"> • Ensure that drainage water complies with discharge standards and treat wastewater accordingly. • Agricultural extension to train farmers in appropriate, sustainable application of fertiliser and other agrochemicals. • Implementation of standard good wastewater management procedures. • Installation of sewage treatment to meet required standards; hygiene training for workforce.
<ul style="list-style-type: none"> • Release of hazardous substances during construction or maintenance (e.g. accidental spills and leaks) leading to soil, surface or groundwater contamination. 	<ul style="list-style-type: none"> • Materials handling and control procedures, use of storage and containment equipment meeting international standards. • Control of construction vehicle movements and prohibition of vehicle washing in watercourses, and similar practices. • Emergency response plans during construction (contractors and local authorities) and operation (local authorities).
<p>Air Quality</p> <ul style="list-style-type: none"> • Dust and emissions from construction and maintenance activities, could affect human health, vegetation and wildlife. 	<ul style="list-style-type: none"> • Sensitive site selection and siting of construction facilities. • Use of modern equipment meeting appropriate emissions standards, and regular preventative maintenance. • Dust control and suppression measures, such as dampening, use of vegetation hedges. • No use of ozone depleting substances during construction.
<p>Noise and Vibration</p> <ul style="list-style-type: none"> • Noise and vibration from construction and maintenance equipment, traffic and activities, may disturb sensitive noise receptors (human, fauna). 	<ul style="list-style-type: none"> • Sensitive local access road route selection and siting of construction facilities, accompanied where necessary by noise attenuation measures. • Use of modern, well maintained equipment fitted with abatement devices (e.g. mufflers, noise enclosures). • Strict controls of timing of noisiest construction activities; prohibition on night working. • Observance of seasonal sensitivities (e.g. breeding seasons), and alteration of activity to reduce noise levels at that time.

Impacts	Mitigation
<p>Resources and Waste</p> <ul style="list-style-type: none"> Abstraction of significant volume of water from surface or ground water sources for agricultural use may affect supply for human communities and ecosystems. 	<ul style="list-style-type: none"> Abstraction to take place with approval of relevant authorities at all locations. Water study prior to any abstraction, to inform a Sustainable Water Management Plan. Regular preventative maintenance of all system components to ensure minimal wastage of water Promotion of water efficiency (including leak detection) and water recycling
<ul style="list-style-type: none"> Inefficient waste management during construction, operation and maintenance leading to excess consumption of materials, generation of wastes/emissions, pollution of soils and water. 	<ul style="list-style-type: none"> Preparation of Waste Management Plan following the waste hierarchy, supported by staff training. Earthworks to be designed to achieve a balance between cut and fill wherever possible. Use of authorised contractors for hazardous and any other wastes which the project cannot dispose of safely.
<p>Loss, fragmentation and degradation of habitat, and severance of animal migration routes and pathways</p> <ul style="list-style-type: none"> Construction of water storage and conveyance structures causing loss, degradation or fragmentation of protected or ecologically sensitive areas (e.g. wetlands, migration routes), and other areas of conservation interest, and degradation following poorly managed rehabilitation. 	<ul style="list-style-type: none"> Careful siting of all project components, with advice from biodiversity authorities/wildlife specialists. Wherever feasible, establishment of buffer zones around conservation areas, watercourses, and other locations identified as ecologically sensitive and avoidance or minimisation of activity within these zones. Rehabilitation of cleared areas with native species, and ecosystem restoration in habitats of conservation value, using specialist advice and input so as to maintain the integrity of the habitat, backed up by a long-term monitoring programme and corrective actions as necessary.
<ul style="list-style-type: none"> Impacts on habitats and species from habitat alteration and degradation (e.g. from reduction in water supply, changes in water flow and drainage, soil erosion, pollution of water, soils or air, introduction of invasive species). 	<p>Where development in sensitive areas cannot be avoided, mitigation may include:</p> <ul style="list-style-type: none"> Minimisation of area impacted, clear demarcation of remaining intact areas of habitat, and prohibition of activity into those areas for any purpose; prohibit or minimise activities in vicinity of sensitive areas, e.g. upstream. Habitat rehabilitation and ecosystem restoration of areas no longer required to occur as soon as possible after construction. If loss of Critical Habitat is inevitable, development/implementation of an Offsets Programme. <p>See also Pollution of Soils and Water above, and Invasive Species and Induced Access below.</p>
<p>Impacts from Induced Access</p> <ul style="list-style-type: none"> Water supply development may facilitate the spread of agricultural activities and human access in remote or undeveloped areas, which can lead to further development, increased disturbance and pressure on natural resources through bushmeat hunting, logging, fire, etc. 	<ul style="list-style-type: none"> Careful site selection and siting of all project components, with advice from biodiversity authorities/wildlife specialists to avoid remote and previously inaccessible areas where possible Restrictions on access to all temporary access roads, and their removal after construction Access controls on permanent access roads (e.g. those serving remote storage structures) required for maintenance <p>See also Bushmeat Hunting below</p>
<p>Direct Impacts on Flora and Fauna</p> <ul style="list-style-type: none"> Earthworks and clearance may lead to loss of plant species and habitats of conservation interest Development could displace animals and disturb their habitats, by direct disturbance during construction and operation (e.g. from noise, light disturbance at night, general human presence). 	<ul style="list-style-type: none"> Careful site selection and siting of all project components, with advice from biodiversity authorities/wildlife specialists. Careful planning of phasing and timing of construction activities. Demarcation and avoidance of areas of conservation interest (high value species, feeding or breeding sites, migration routes, etc.) where possible, and wildlife rescue and translocation where appropriate, under expert supervision. <p>Also see measures under Soils, Run-off and Flooding, Pollution of Soils and Water, Noise / Vibration and Induced Access above, and Invasive Species below.</p>
<p>Invasive Species</p> <ul style="list-style-type: none"> Movement of plant and workforce into areas could introduce invasive species which adversely impact fauna, flora, ecosystems, and crops; particular risk for aquatic vegetation which is likely to proliferate within canals etc. 	<ul style="list-style-type: none"> Invasive Species Management Plan, which should be developed and implemented in consultation with authorities, including appropriate eradication measures for different species/groups of species. Staff training and awareness raising in communities. No introduction of exotic species (e.g. for site rehabilitation) without specialist vetting and government approval. Where possible, clearance of invasive species during routine maintenance of water storage and distribution systems.

Impacts	Mitigation
<p>Physical and Economic Displacement of People, Property, Assets and Resources</p> <ul style="list-style-type: none"> Development or upgrading of irrigation systems, allowing agricultural expansion, may physically displace people, or lead to loss of assets, e.g. loss of traditional agriculture or livestock grazing. Water flow reduction downstream of the irrigation site, causing adverse effects on water supply for other users. 	<ul style="list-style-type: none"> Careful site selection and siting of all project components, avoid occupation of areas which are inhabited or regarded as of high value by communities (e.g. horticulture, community orchards) where possible. Early development and sensitive implementation of resettlement planning, in accordance with national regulations and international good practice to compensate for any losses (both physical and economic). Develop compensation measures for affected parties, e.g. downstream water users, livestock and traditional farmers, such as developing alternative grazing areas. Create a water user organisation, involving men and women, to effectively manage water resources and ensure an equitable access among users.
<p>Economic Development and Employment</p> <ul style="list-style-type: none"> Direct employment of local population in workforce, and stimulation of local economy through demand for goods and services will enhance livelihoods and economic activity in local communities; potential for adverse effects if expectations not met and community relations are not well managed. 	<ul style="list-style-type: none"> Development of an Employment Plan, with clear employment requirements and procedures for the construction and operational/maintenance workforce. Transparent and culturally appropriate communication with communities regarding employment opportunities Fair and transparent hiring and staff management procedures. Employment requirements and vocational training plan to be agreed with local institutions, so that local people can be trained to meet the project's needs in a timely fashion. Development of measures to manage post-construction transition (e.g. SME development, ongoing opportunities for the workforce in water supply management, reskilling and alternative employment, e.g. in agriculture).
<ul style="list-style-type: none"> Procurement of local goods and services for development of water supply/irrigation system and workforce could deplete resources available for local communities. 	<ul style="list-style-type: none"> Procedures for sustainable local procurement, in consultation with local authorities and community leaders. Local capacity building to foster community resilience. Monitoring of local prices; exploration of corrective measures (e.g. alternative sourcing) if appropriate.
<p>Cultural Heritage</p> <ul style="list-style-type: none"> Displacement or damage to cultural heritage sites by construction activities, harm to local setting, amenity value, etc. due to construction or agricultural development. Change to intangible cultural heritage due to increased access, and interaction with workforce. 	<ul style="list-style-type: none"> Careful site selection and siting of all project components, taking account of community consultation/specialist surveys. Development of a Cultural Heritage Management Plan covering tangible and intangible (e.g. local traditions and practices) cultural heritage. Implementation of a "Chance Finds" procedure during construction. <p>See also Guidance Note on Physical Cultural Heritage.</p>
<p>Community Health, Safety and Security</p> <ul style="list-style-type: none"> Poor construction management practices may lead to adverse effects on safety, human health and wellbeing. 	<ul style="list-style-type: none"> Good construction site "housekeeping" and management procedures (including site access). Risk assessments and emergency response planning to consider impacts on local communities. <p>See also Pollution of Soils and Water, Air Quality, and Noise/Vibration above.</p>
<ul style="list-style-type: none"> Interaction between workforce and local communities may increase occurrence of communicable diseases, including HIV/AIDS and sexually transmitted diseases (STDs). 	<ul style="list-style-type: none"> Implementation of a health management system for the construction workforce, to ensure it is fit for work and that it will not introduce disease into local communities. Training and awareness raising for workforce and their dependents on HIV/AIDS and other STDs, and communicable diseases; health awareness raising campaigns for communities on similar topics.
<ul style="list-style-type: none"> Changes in exposure to water borne and water related diseases, especially those associated with water dwelling disease vectors (new areas of standing water created) or poor sanitary conditions. 	<ul style="list-style-type: none"> Provide information, education and communication about safe uses of irrigation water and occupational safety. Facilitate programmes/measures to ensure appropriate sanitary and medical facilities are available. Implement environmental management measures for vector control: e.g. monitoring for key vectors; contact avoidance via site selection; focal insecticide and molluscicide application.

Impacts	Mitigation
<ul style="list-style-type: none"> • Workforce-Community Interactions • • Real or perceived disruption to normal community life, through the physical presence of a workforce; in particular, potential for conflicts to occur over water use. 	<ul style="list-style-type: none"> • Adoption of a Stakeholder Engagement Plan, as a framework for early and ongoing community consultation. • Implementation of a Grievance Procedure (see Grievance Procedure and Redress Mechanisms guidance note). • Works procedures, defining a Code of Appropriate Conduct for all workers, including acceptable behaviour with respect to community interactions. • Adoption of a Sustainable Water Management Plan, which takes existing community usage into consideration.
<p>In-migration</p> <ul style="list-style-type: none"> • Individuals are likely to migrate into the area which may cause conflict with resident communities, and put pressure on resources and infrastructure. 	<ul style="list-style-type: none"> • Careful site selection and siting of all project components, after consultation with communities and local authorities. • Preparation and implementation of an Influx/In-migration Management Plan, in consultation with local authorities <p>See also Economic Development and Employment, and Induced Access above.</p>
<p>Labour and Working Conditions</p> <ul style="list-style-type: none"> • Poor management of occupational health and safety leading to accidents, injuries and illnesses among workers (e.g. risks of working close to water); mental health issues due to remote or enclosed living. • Differences in nationality, ethnicity, religion, etc. may lead to discrimination and harassment, and differences (perceived or real) in working conditions between workers may lead to resentment. 	<ul style="list-style-type: none"> • Employment practices and working conditions should conform to International Labour Organisation (ILO) Standards and national regulations. • Rest and recreational facilities and time should be provided, and rules on alcohol and drugs defined and clearly communicated to workers. • The basis for differences in the standard of accommodation should be non-discriminatory; it should be documented and communicated transparently to the workforce. . • Clear and comprehensive health and safety reporting and grievance procedure system should be established, and be freely available to all of the workforce. <p>See also Employment and Economic Development.</p>



AGRICULTURE / AGRIBUSINESS SECTOR: LIVESTOCK PROJECTS

Investment in livestock projects facilitates the production of food and other goods, contributing to economic development, livelihoods and enhanced quality of life. However, the development, expansion and operation of livestock projects have often caused adverse impacts on natural and human environments. Environmental damage may include disturbance and loss of fauna and flora, loss or degradation of terrestrial habitats and pollution of water. These developments may also be a source of adverse impacts on the human environment, particularly in terms of the displacement and resettlement of affected families and businesses, and health and safety.

Scope and structure

This keysheet provides a summary of the activities, typical environmental and social impacts, and potential mitigation and management measures relating to the management of livestock projects. Livestock projects considered include development, expansion or improvement of operations ranging from intensive to extensive systems, and from small scale livestock husbandry to industrial scale livestock production. Traditional pastoralism and agro-pastoralism are also included. Activities considered include breeding, growing, containment and movement/transport of livestock, and construction and maintenance of associated facilities.

This keysheet should be used specifically to help with drafting ToRs for ESIs of livestock projects and with scoping and conducting ESIs and preparing ESMPs. It can also help in reviewing ESIs. It should be used in conjunction with the Bank's Guidance Notes on ESIs (including coverage of cumulative impacts) and with the Guidance Notes on specific safeguard topics, including transboundary projects.

The keysheet is organised under the following headings, with substantive information provided in table form:

- Project components and activities.
- Sources of impact and receptors/resources.
- Mitigation and management options.

The phases of livestock production projects considered are: design and planning, including site selection; construction; operation and maintenance; and where appropriate project closure.

Project components and activities

The components of livestock projects are provided in Table 1, along with the activities involved in developing or expanding livestock projects, and in their operation, broken down by project phase.

Sources of impact, receptors/ resources, and mitigation

Table 2 summarizes the main aspects of livestock projects that lead to typical impacts, the receptors and resources they affect, and options for mitigation. It considers impacts on the physical, biological and socioeconomic environment. The mitigation measures described assume that higher level design and alignment planning measures, as described in Table 1, have already been implemented.

The guidance on impacts and options for their mitigation can be used to help discussions with the borrower or client and improve their understanding of the Bank's requirements. They should also be used to assist preparation of ToRs for an ESI so that they are tailored to the particular circumstances of the livestock project under consideration.

Table 1: Summary of Activities associated with Livestock Projects

Components	
Livestock Production <ul style="list-style-type: none"> • Livestock (e.g. cattle, sheep, goats, pigs, camels, horses, donkeys, and other small stock such as rabbits, rodents and poultry). • Grazing land or land supporting fodder production. • Livestock containment (e.g. pens, fences, buildings). • Inputs (e.g. feed, treatments such as antibiotics, fertilisers and pesticides for cultivation of feed/grazing). • Water supply: abstraction from ground or surface water (e.g. impoundments, intake facilities, wells/boreholes). • Surface drainage systems and control structures. 	Associated Facilities <ul style="list-style-type: none"> • Housing and other facilities required for workforce. • Buildings and facilities for storage of feed, water, chemicals and machinery. • Facilities for managing project wastes (e.g. wastewater, manure, dead animals). • Access roads to and from livestock containment areas and associated facilities.
Activity (1)	
Design – Site Selection and Planning	Screening, Scoping and ESIA Preparation of ESMP Agreement of loan covenants
Strategic planning (options analysis, cost-benefit analysis, strategic site selection, initial design), and for larger (i.e. regional scale) livestock production programmes, strategic environmental and social assessment (SESA), to establish: <ul style="list-style-type: none"> • Major environmental and social constraints and alternatives (e.g. with respect to major settlements, watersheds and areas of biodiversity conservation importance). • Design procedures such that environmental and social considerations are given equal weight to engineering and financial ones. 	
Site-specific planning (detailed design), taking account of environmental and social sensitivities and consultation with communities, drawing upon the following environmental and socioeconomic documentation, all of which should comply with national regulations and international good practice: <ul style="list-style-type: none"> • Environmental and Social Impact Assessment (ESIA). • Environmental and Social Management Plan (ESMP). • Stakeholder Engagement Plan (SEP). • Resettlement Action Plan (RAP). 	
Construction	Monitoring of ESMP performance Monitoring of compliance with loan covenants Monitoring of sub-contractor contract provisions
Construction and preparation activities will include: <ul style="list-style-type: none"> • Establishing temporary access to work and ancillary areas, demarcating clearance zones, establishing access control. • Clearance and preparation of land to be used for housing and grazing of livestock, and some earthworks (e.g. introducing ditches and other control structures) where required. • Sourcing and establishing water supply from surface / groundwater (e.g. creating diversions, digging irrigation wells). • Clearance and levelling of some small areas (e.g. for associated facilities) where required, in preparation for construction activities (e.g. buildings, access roads); import of relatively small quantities of building materials. • Improvement of existing drainage and introduction of new drainage, including culverts if required. 	
The equipment required during construction may, depending on the scale of the project, include heavy mobile plant (e.g. graders, bulldozers, excavators) and temporary fixed plant such as concrete batching plant and power generators.	
Activity (2)	
Operation and Maintenance	Project implementation: Compliance Monitoring
During operation, activities will involve breeding, growing, containment and movement/transport of livestock. These activities may contribute to direct and indirect impacts described in Table 2.	
Maintenance of livestock production projects will entail many of the activities described above for the construction phase, although in general they are likely to be smaller in scale and spatial extent. It will include activities such as maintaining buildings and equipment involved in the containment of livestock, and the storage and distribution of feed, water and other inputs.	
Decommissioning (Closure)	Project Completion: Compliance Report
Where project facilities are no longer required (e.g. following closure of the project, temporary facilities used during the construction phase only) they should be decommissioned and rehabilitated in accordance with a site-specific closure plan developed in consideration of international good practice. The decommissioning process for facilities will include site clearance, removal of all equipment, appropriate disposal of waste materials, soil ripping and re-grading where necessary.	

Table 2: Livestock Production Projects: Impacts and Mitigation

Impacts	Mitigation
<p>Geology/Hydrogeology</p> <ul style="list-style-type: none"> • Interruption or disruption of surface and groundwater flows from ground clearance, construction of roads and other associated facilities, and water supply requirements (e.g. lowering of water table due to excessive abstraction). 	<ul style="list-style-type: none"> • Design to take account of local hydrological conditions (e.g. avoid construction near or crossing of permanent waterways, do not hamper drainage of surface water, avoid works in areas prone to flooding especially during rainy season). • Ensure proper water management, including controlling access to water for other purposes than livestock water supply, and minimising the loss of water caused by leaks, evaporation and infiltration through regular maintenance.
<p>Soils, Run-off and Flooding</p> <ul style="list-style-type: none"> • Loss, damage or disruption of soil/sediments during construction works, and from livestock presence (e.g. trampling). • Introduction of sediments to watercourses or interruption of drainage patterns, as a result of ground clearance and earthworks and the introduction of drainage structures, and large numbers of livestock using a small number of watering points. 	<ul style="list-style-type: none"> • Minimisation of cleared areas and soil disturbance, with revegetation as soon as feasible (with native species). • Restrict livestock access to fragile/unstable soil; adapt the type and number of animals to the land carrying capacity. • Early installation and regular maintenance of drainage and diversion structures, silt traps, etc; drainage outlets to discharge into vegetated areas if possible; vegetation along watercourses and drainage lines to be retained if possible. • Retention of topsoil for restoration (including tilling and revegetation) as soon as practicable. • Careful consideration of timing of works (overall duration and seasonality).
<p>Pollution of Soils and Water</p> <ul style="list-style-type: none"> • Pollution of watercourses caused by wastes from livestock, and workforce sewage effluent, as well as runoff from grazing areas and land used for growing feed (containing fertilisers, pesticides and herbicides etc.). 	<ul style="list-style-type: none"> • Ensure that waste and drainage water complies with discharge standards and treat accordingly. • Implementation of standard good wastewater management and disposal procedures; wastewater drainage outlets to discharge into vegetated areas if possible; vegetation along watercourses and drainage lines to be retained if possible. • Implement agricultural techniques minimising the use of fertilisers, pesticides, herbicides etc. • Installation of sewage treatment to meet required standards; hygiene training for workforce.
<ul style="list-style-type: none"> • Release of hazardous substances associated with construction/maintenance activities or with transport of goods (e.g. accidental spills and leaks), leading to soil, surface or groundwater contamination. 	<ul style="list-style-type: none"> • Materials handling and control procedures, use of appropriate storage and containment equipment. • Control of vehicle movements and prohibition of vehicle washing in watercourses, and similar practices • Emergency response plans during construction (contractors and local authorities) and operation (local authorities).
<p>Air Quality</p> <ul style="list-style-type: none"> • Dust and emissions from construction activities, and from vehicles and machinery during operation, could affect human health, vegetation and wildlife. • Odours associated with livestock and waste may have nuisance value for nearby receptors. 	<ul style="list-style-type: none"> • Sensitive site selection, and siting of construction works and access roads. • Use of modern equipment, meeting appropriate emissions standards, and regular preventative maintenance. • Implement measures to increase efficiency of vehicle use, aiming to reduce the number of journeys and vehicles required. • No use of ozone depleting substances during construction or operation. • Dust and odour control and suppression measures, such as dampening and use of vegetation hedges. • Implement appropriate waste disposal measures.
<p>Noise and Vibration</p> <ul style="list-style-type: none"> • Noise and vibration from construction, maintenance and operational equipment, traffic and activities, and from livestock itself, may disturb sensitive noise receptors (human and fauna) 	<ul style="list-style-type: none"> • Sensitive route selection for access roads, and siting of construction works and facilities, accompanied where necessary by noise attenuation measures. • Use of modern, well maintained equipment fitted with abatement devices (e.g. mufflers, noise enclosures). • Strict control of timing of activities (e.g. prohibition on night working where possible). • Observance of seasonal sensitivities (e.g. breeding seasons), and alteration of activity to reduce noise levels at that time.

Impacts	Mitigation
<p>Resources and Waste</p> <ul style="list-style-type: none"> Abstraction of large volumes of water from surface or ground water sources for watering livestock may affect supply for human communities and ecosystems. Inefficient waste management during construction, operation and maintenance leading to excess consumption of materials, generation of wastes/emissions, pollution of soils and water. 	<ul style="list-style-type: none"> Abstraction to take place with approval of relevant authorities at all locations Water study prior to any abstraction, to inform a Sustainable Water Management Plan Regular preventative maintenance of all system components to ensure that water wastage is as far as possible limited Promotion of water efficiency (including leak detection) and water recycling Preparation of Waste Management Plan following the waste hierarchy, supported by training and awareness-raising around topic of waste for workforce and for local community. Use of authorised contractors for hazardous and any other wastes which the project cannot dispose of safely. Encourage manure recovery for use as fertiliser.
<p>Loss, fragmentation and degradation of habitat, and severance of animal migration routes and pathways</p> <ul style="list-style-type: none"> Ground clearance and construction works causing loss, degradation or fragmentation of protected or ecologically sensitive areas (e.g. wetlands, migration routes), and other areas of conservation interest, and degradation following poorly managed rehabilitation. Impacts on habitats and species from habitat alteration and degradation (e.g. from reduction in water supply, changes in water flow and drainage, soil erosion, pollution of water, soils or air, introduction of invasive species). Grazing pressure and livestock movement routes causing degradation, fragmentation and loss of habitat, and reducing or severing animal migration routes and pathways. 	<ul style="list-style-type: none"> Careful siting of all project components, with advice from biodiversity authorities/wildlife specialists. Wherever feasible, establishment of buffer zones around conservation areas, watercourses, and other locations identified as ecologically sensitive, and avoidance or minimisation of activity within these zones. Rehabilitation of cleared areas with native species, and ecosystem restoration in habitats of conservation value, using specialist advice and input so as to maintain the integrity of the habitat, backed up by a long-term monitoring programme and corrective actions as necessary. <p>Where development in sensitive areas cannot be avoided, mitigation may include:</p> <ul style="list-style-type: none"> Minimisation of area impacted, clear demarcation of remaining intact areas of habitat, and prohibition of activity into those areas for any purpose; prohibit or minimise activities in the vicinity of sensitive areas. Habitat rehabilitation and ecosystem restoration of areas no longer required to occur as soon as possible after construction. If loss of Critical Habitat is inevitable, development/implementation of an Offsets Programme. Education of workforce and local communities as to the potential damage livestock may cause to ecosystems, and on methods for avoiding damage (e.g. control of livestock, avoidance of sensitive areas). <p>See also Pollution of Soils and Water above, and Invasive Species and Induced Access below.</p>
<p>Impacts from Induced Access</p> <ul style="list-style-type: none"> Development of livestock projects in remote or undeveloped areas leading to further development, increased disturbance and pressure on natural resources through bushmeat hunting, logging, fire, etc. 	<ul style="list-style-type: none"> Careful site selection, with advice from biodiversity authorities/wildlife specialists to avoid remote and previously inaccessible areas where possible. Where possible, instate access controls on roads leading to livestock containment areas or associated facilities in otherwise undeveloped or remote areas. <p>See also Bushmeat Hunting below.</p>
<p>Bushmeat Hunting</p> <ul style="list-style-type: none"> Increased development in remote areas could lead to greater demand for bushmeat (from workforce and wider community), stimulate the wildlife trade and facilitate access to hunting areas. 	<ul style="list-style-type: none"> Preparation of a Bushmeat Hunting and Wildlife Trade Management Plan, agreed with government authorities and implemented jointly. Sensitisation and public awareness campaigns against hunting and bushmeat trade amongst livestock project workers and local communities.

Impacts	Mitigation
<p>Direct Impacts on Flora and Fauna</p> <ul style="list-style-type: none"> Earthworks and clearance may lead to loss of plant species and habitats of conservation interest. Presence of livestock and humans may displace animals and disturb their habitats, by direct disturbance during construction and operation (e.g. livestock grazing and movements, increased human and vehicle presence, noise, light disturbance at night, construction of associated facilities). 	<ul style="list-style-type: none"> Careful site selection and siting of project facilities, with advice from biodiversity authorities/wildlife specialists. Careful planning of phasing and timing of construction activities. Demarcation and avoidance of areas of conservation interest (high value species, feeding or breeding sites, migration routes, etc.) where possible, and wildlife rescue and translocation where appropriate, under expert supervision. Establish compensatory wildlife refuges, as needed. <p>See also measures under Soils, Run-off and Flooding, Pollution of Soils and Water, Noise / Vibration and Induced Access above, and Invasive Species below.</p>
<ul style="list-style-type: none"> Degradation of health and size of populations of native species due to spread of diseases from livestock. 	<ul style="list-style-type: none"> Veterinary screening of all livestock for diseases prior to introduction into an area. Proper containment of livestock, to reduce interaction with wild animal populations. Monitor diseases in livestock and implement appropriate actions to eliminate any diseases detected, especially those with potential to spread to wild populations (e.g. control vectors using bioenvironmental management techniques).
<p>Invasive Species</p> <ul style="list-style-type: none"> Movement of equipment, vehicles and workforce into project area, or introduction of non-native species during rehabilitation, could introduce invasive species which adversely impact fauna, flora, ecosystems, and crops. 	<ul style="list-style-type: none"> Invasive Species Management Plan, which should be developed and implemented in consultation with authorities, including appropriate eradication measures for different species/groups of species. Training and awareness-raising amongst workers, livestock herders and communities on potential impacts of invasive species. No introduction of exotic species (e.g. for site rehabilitation) without specialist vetting and government approval. Where possible, clearance of invasive species during routine maintenance of water storage and distribution systems.
<ul style="list-style-type: none"> Accidental release of livestock (especially non-native species) may result in establishment of populations or genetic mixing with wild populations, leading to negative impacts on local flora and fauna (e.g. competition for food resources, loss of genetic diversity). 	<ul style="list-style-type: none"> Proper containment of livestock to reduce chance of escape. Monitor status of wild populations in surrounding area.
<p>Physical and Economic Displacement of People, Property, Assets and Resources</p> <ul style="list-style-type: none"> Land take for development of livestock projects may physically displace people, or lead to loss of assets (e.g. loss of land of agricultural importance, reduction or interruption to water supply). Potential for economic displacement of specific individuals or groups with existing income from livestock production if they are excluded from projects. 	<ul style="list-style-type: none"> Careful consideration and selection of areas proposed for livestock projects, and siting of project facilities, to avoid occupation of areas which are inhabited or regarded as having high value by communities where possible. Early development and sensitive implementation of resettlement planning, in accordance with national regulations and international good practice to compensate for any losses (both physical and economic). Develop detailed baseline of existing reliance on land resources in the project area; from this, identify specific groups that may not benefit from the project and adopt corrective measures as required. Develop compensation measures for affected parties (e.g. excluded farmers, downstream water users).
<p>Economic Development and Employment</p> <ul style="list-style-type: none"> Direct employment of local population in workforce, and stimulation of local economy through export of and demand for goods and services will enhance livelihoods and economic activity in local communities; potential for adverse effects if expectations not met and community relations are not well managed. 	<ul style="list-style-type: none"> Development of an Employment Plan, with clear employment requirements and procedures for the construction (and if appropriate, operational) workforce. Transparent and culturally appropriate communication with communities regarding opportunities for involvement in the project. Fair and transparent hiring and staff management procedures. Employment requirements and vocational training plan to be agreed with local institutions, so that local people can be trained to meet the project's needs in a timely fashion.
<p>Cultural Heritage</p> <ul style="list-style-type: none"> Displacement or damage to cultural heritage sites caused by construction or grazing, harm to local setting, amenity value, etc. Change to intangible cultural heritage due to increased access, and interaction with non-local workforce. 	<ul style="list-style-type: none"> Careful site selection and siting of all project facilities, taking account of community consultation/specialist surveys. Development of a Cultural Heritage Management Plan covering tangible and intangible (e.g. local traditions and practices) cultural heritage. Implementation of a "Chance Finds" procedure during construction of facilities. <p>See also Guidance Note on Physical Cultural Heritage.</p>

Impacts	Mitigation
<p>Community Health, Safety and Security</p> <ul style="list-style-type: none"> Poor construction management practices may lead to adverse effects on safety, human health and wellbeing. 	<ul style="list-style-type: none"> Good construction site “housekeeping” and management procedures (including site access). Risk assessments and emergency response planning to consider impacts on local communities. <p>See also control of pollution under Physical Impacts heading.</p>
<ul style="list-style-type: none"> Changes to local food availability, due to conversion of land previously used for growing subsistence crops to graze or house livestock, and commercialisation of livestock production with increased emphasis on export of livestock to market. 	<ul style="list-style-type: none"> Provision of community support and development mechanisms for subsistence livestock and crop farming. Ensure sufficient local availability of land to guarantee food security and subsistence cropping, in particular to adversely affected individuals or groups.
<ul style="list-style-type: none"> Interaction between non-local workforce and local communities may increase occurrence of communicable diseases, including HIV/AIDS and sexually transmitted diseases (STDs). Increased likelihood of certain vector-, animals- or water-borne diseases spreading within workforce and local community due to presence of livestock and standing water; health risks associated with chemicals used and wastes produced during operation (e.g. pesticides, noxious gases). 	<ul style="list-style-type: none"> Implementation of a health management system for the workforce, to ensure it is fit for work and that it will not introduce disease into local communities. Training and awareness raising for workforce and their dependents on HIV/AIDS and other STDs, and communicable diseases including malaria; health awareness raising campaigns for communities on similar topics. Monitor diseases in livestock and implement appropriate actions to eliminate any diseases detected, especially those with potential to spread to humans (e.g. vector control, use of quarantine, contact avoidance, focal use of insecticides etc.). Ensure adequate and sufficient medical and veterinary services are included within project planning. Regulate livestock waste and ensure appropriate ventilation in livestock buildings to control emissions of noxious gases. Safely manage chemicals (e.g. appropriate containers and labelling, workforce training, use of protective equipment).
<p>Workforce-Community Interactions</p> <ul style="list-style-type: none"> Real or perceived disruption to normal community life, through the physical presence of a non-local workforce. 	<ul style="list-style-type: none"> Adoption of a Stakeholder Engagement Plan, as a framework for early and ongoing community consultation. Implementation of a Grievance Procedure (see Grievance Procedure and Redress Mechanisms guidance note). Works procedures, defining a Code of Appropriate Conduct for all workers, including acceptable behaviour with respect to community interactions.
<p>In-migration</p> <ul style="list-style-type: none"> Individuals are likely to migrate into the project area from the local/regional area, which may cause conflict with residents, and put pressure on resources and infrastructure. 	<ul style="list-style-type: none"> Careful site selection and siting of all project facilities, after consultation with communities and local authorities. Preparation and implementation of an Influx/In-migration Management Plan, in consultation with local authorities. <p>See also Economic Development and Employment, and Induced Access above.</p>
<p>Labour and Working Conditions</p> <ul style="list-style-type: none"> Poor management of occupational health and safety leading to accidents, injuries and illnesses among workers; mental health issues due to remote or enclosed living. Differences in nationality, ethnicity, religion, etc. may lead to discrimination and harassment, and differences (perceived or real) in working conditions between workers may lead to resentment. 	<ul style="list-style-type: none"> Employment practices, working conditions and workforce living conditions should conform to International Labour Organisation (ILO) Standards and national regulations. Rest and recreational facilities and time should be provided, and rules on alcohol and drugs defined and clearly communicated to workers. The basis for differences in the standard of accommodation should be non-discriminatory; it should be documented and communicated transparently to the workforce. Clear and comprehensive health and safety reporting and grievance procedure system should be established, and be freely available to all of the workforce. <p>See also Employment and Economic Development</p>

AGRICULTURE / AGRIBUSINESS SECTOR: AQUACULTURE PROJECTS

Investment in aquaculture projects facilitates the obtainment of food and other products, contributing to economic development, sustainable livelihoods and enhanced quality of life. However, the establishment, rehabilitation, maintenance and operation of aquaculture systems may cause adverse impacts on both natural and human environments. Environmental damage may include disruption or contamination of water courses and drainage systems, soil destabilization, habitat fragmentation and destruction, and disturbance and loss of fauna and flora. These developments may also be a source of adverse impacts on the human environment, particularly reduction in water supply and conflicts over water use, the displacement and resettlement of affected families and businesses, and health and safety.

Scope and structure

This keysheet provides a summary of the activities, typical environmental and social impacts, and potential mitigation and management measures relating to the development of aquaculture projects, including those on sea coasts and in fresh waters. Projects considered include development, improvement or expansion of intensive, semi-intensive and extensive aquaculture systems; and the construction and maintenance of the structures necessary for these systems.

This keysheet should be used specifically to help with drafting ToRs for ESIA of aquaculture developments and with scoping and conducting ESIA and preparing ESMPs. It can also help in reviewing ESIA. It should be used in conjunction with the Bank's Guidance Notes on ESIA (including coverage of cumulative impacts) and with the Guidance Note on specific safeguard topics including transboundary projects.

The keysheet is organised under the following headings, with substantive information provided in table form:

- Project components and activities.
- Sources of impact and receptors/resources.
- Mitigation and management options.

The phases of aquaculture projects considered are: design and planning, including site selection; construction; operation and maintenance; and where appropriate decommissioning (closure).

Project components and activities

The components of aquaculture developments are provided in Table 1, along with the activities involved in developing new or upgraded systems, and in operating systems, broken down by project phase.

Sources of impact, receptors/ resources, and mitigation

Table 2 summarizes the main aspects of aquaculture projects that lead to typical impacts, the receptors and resources they affect, and options for mitigation. It considers impacts on the physical, biological and socioeconomic environment. The mitigation measures described assume that higher level design and alignment planning measures, as described in Table 1, have already been implemented.

The guidance on impacts and options for their mitigation can be used to help discussions with the borrower or client and improve their understanding of the Bank's requirements. They should also be used to assist preparation of ToRs for an ESIA so that they are tailored to the particular circumstances of the aquaculture development under consideration.

Table 1: Summary of Activities associated with Aquaculture

Components	
Aquaculture Systems <ul style="list-style-type: none"> • Intake facilities or wells/boreholes etc. • Distribution channels, pipelines, pumping stations. • Water impoundments (e.g. ponds, tanks). • Containment structures (e.g. cages, pens, nets) or supporting structures (e.g. tables, ropes). • Inputs, including feeds, fertilisers, pesticides, treatments (e.g. hormones, prophylactic antibiotics). • Equipment and machinery for distributing feed etc. • Processing and storage buildings and facilities, e.g. equipment for cleaning, canning, drying, freezing. 	Ancillary Works <ul style="list-style-type: none"> • Temporary construction facilities (e.g. workshops, laydown areas, working corridor outside the footprint, workers' accommodation, quarries). • Access roads within and between temporary facilities and the area being developed, permanent access and maintenance roads. • Distribution systems for products, e.g. vehicles.
Activity	
Design – Site Selection and Planning	Screening, Scoping and ESIA Preparation of ESMP Agreement of loan covenants
Strategic planning (options analysis, cost-benefit analysis, strategic site selection, initial design), and for major aquaculture development programmes, strategic environmental and social assessment (SESA), to establish: <ul style="list-style-type: none"> • Major environmental and social constraints and alternatives (e.g. with respect to major settlements, watersheds and areas of biodiversity conservation importance). • Design procedures such that environmental and social considerations are given equal weight to engineering and financial ones. 	
Site-specific planning (detailed design), taking account of environmental and social sensitivities and consultation with communities, drawing upon the following environmental and socioeconomic documentation, all of which should comply with national regulations and international good practice: <ul style="list-style-type: none"> • Environmental and Social Impact Assessment (ESIA); • Environmental and Social Management Plan (ESMP); • Stakeholder Engagement Plan (SEP); and • Resettlement Action Plan (RAP). 	
Construction	Monitoring of ESMP performance Monitoring of compliance with loan covenants Monitoring of sub-contractor contract provisions
Construction activities will include: <ul style="list-style-type: none"> • Establishing temporary access to work and ancillary areas, demarcating clearance zones, establishing access control. • Clearance and levelling of some areas and major earthworks (e.g. creating tanks/ponds, distribution canals, introducing ditches and other control structures) where required. • Sourcing and establishing water supply from surface / groundwater (e.g. creating diversions or wells). • Laying pipelines, building control / impoundment structures (e.g. pumping systems, dams, tanks) as well as associated buildings, roads, water crossings. • Improvement of existing drainage and introduction of new drainage, including culverts if required; and • Import of materials, e.g. aggregate. 	
The equipment required will include mobile plant (e.g. bulldozers, excavators) and could also include temporary fixed plant such as concrete batching plant and power generators.	
Operation and Maintenance	Project implementation: Compliance Monitoring
During operation activities will involve the capture/breeding, growth and harvesting of fish, shellfish, cephalopods, algae and other aquatic species. Aquaculture operations may entail varying levels of intervention (depending on how intensive the production system is), involving control of environmental conditions such as water quality, food supply, and pest and disease prevalence.	
These activities may contribute to direct and indirect impacts described in Table 2.	
Maintenance of aquaculture systems will entail many of the activities described above for the construction phase, although in general they are likely to be smaller in scale and spatial extent. It will include activities such as clearing and maintaining water distribution and storage systems, and servicing mechanical components such as pumps.	

Components	
Activity	
Decommissioning (Closure)	Project Completion: Compliance Report
<p>Where temporary roads and facilities used in the construction phase are no longer required (if, for example, they are not required for maintenance) they should be decommissioned and rehabilitated in accordance with a site-specific closure plan developed in consideration of international good practice. The decommissioning process will include site clearance, removal of all equipment, appropriate disposal of waste materials, soil ripping and re-grading where necessary.</p> <p>Aquaculture projects are normally intended to operate for a prolonged period, and so it would not be appropriate for closure or decommissioning plans to be prepared until a few years prior to this occurring.</p>	

Table 2: Aquaculture Developments: Impacts and Mitigation

Impacts	Mitigation
<p>Geology/Hydrogeology</p> <ul style="list-style-type: none"> • Interruption or disruption of surface and groundwater flows from construction, excavation and ground clearance. • Reduced flows or lowering of water table due to abstraction, possibly resulting in salinization. 	<ul style="list-style-type: none"> • Design to take account of local hydrological conditions (e.g. avoid crossing permanent waterways, do not hamper drainage of surface water, avoid works in areas prone to flooding especially during rainy season). • Limit sealed or compacted areas as much as possible, to maintain natural recharge of the water table. • Water study prior to any abstraction, to inform a Sustainable Water Management Plan.
<ul style="list-style-type: none"> • Disruption of coastal processes (e.g. wave, tidal and current regime, sediment transport, flood and storm protection). • Saline intrusion into groundwater. 	<ul style="list-style-type: none"> • Siting and design to take account of shore configuration, currents, groundwater flows, and existing habitats. • Design and construction of compensatory shore protection and other measures to maintain coastal processes. • Monitoring of groundwater salinity; where necessary further mitigation may include control/diversion structures for saltwater, installation of cut off wells, sourcing of alternative water supply.
<ul style="list-style-type: none"> • Pollution of groundwater from discharges and accidental releases during construction and maintenance, and from wastewater during operation. 	See Pollution of Soils and Water below
<p>Soils, Run-off and Flooding</p> <ul style="list-style-type: none"> • Loss, damage or disruption of soil/sediments during construction and maintenance. 	<ul style="list-style-type: none"> • Minimisation of cleared areas and soil disturbance, with revegetation as soon as feasible (with native species). • Early installation and regular maintenance of drainage and diversion structures, silt traps, etc; drainage outlets to discharge into vegetated areas if possible; vegetation along watercourses and drainage lines to be retained if possible. • Retention of topsoil for restoration (including tilling and revegetation) as soon as practicable. • Careful consideration of timing of works (overall duration and seasonality).
<ul style="list-style-type: none"> • Introduction of sediments to coastal waters or inland watercourses, or interruption of drainage patterns, as a result of ground clearance, earthworks and operational maintenance of systems. 	
<p>Pollution of Soils and Water</p> <ul style="list-style-type: none"> • Pollution of coastal waters or inland watercourses from operational wastewater (e.g. nutrients, pesticides, fertilisers, treatments), as well as from fish processing and workforce sewage. 	<ul style="list-style-type: none"> • Reduce nutrient and chemical inputs to water, e.g. through use of biological pest control methods. • Ensure that waste and drainage water complies with discharge standards and treat accordingly. • Implementation of standard good wastewater management and disposal procedures. • Installation of sewage treatment to meet required standards; hygiene training for workforce.
<ul style="list-style-type: none"> • Release of hazardous substances during construction or maintenance (e.g. accidental spills and leaks) leading to soil, surface or groundwater contamination. 	<ul style="list-style-type: none"> • Materials handling and control procedures, use of storage and containment equipment meeting international standards. • Control of construction vehicle movements and prohibition of vehicle washing in watercourses, and similar practices. • Emergency response plans during construction (contractors and local authorities) and operation (local authorities).

Impacts	Mitigation
<p>Air Quality</p> <ul style="list-style-type: none"> Dust and emissions from construction and maintenance activities, could affect human health, vegetation and wildlife. Odours associated with preparation facilities may have nuisance value for nearby receptors. 	<ul style="list-style-type: none"> Sensitive site selection and siting of construction and processing facilities. Use of modern equipment meeting appropriate emissions standards, and regular preventative maintenance. Dust control and suppression measures, such as dampening, use of vegetation hedges. No use of ozone depleting substances during construction. Use of appropriate solid waste disposal facilities.
<p>Noise and Vibration</p> <ul style="list-style-type: none"> Noise and vibration from construction and maintenance equipment, traffic and activities may disturb sensitive noise receptors (human, fauna, including underwater noise impacts on fish and marine mammals, e.g. from piling during construction). 	<ul style="list-style-type: none"> Sensitive local route selection and siting of facilities, accompanied where necessary by noise attenuation measures. Use of modern, well maintained equipment fitted with abatement devices (e.g. mufflers, noise enclosures). Use of sensitive construction methods, e.g. "soft start" or "slow start" piling. Strict controls of timing of activities, e.g. blasting and other high noise emissions; prohibition on night working. Observance of seasonal sensitivities (e.g. breeding seasons), and alteration of activity to reduce noise levels at that time.
<p>Resources and Waste</p> <ul style="list-style-type: none"> Abstraction of significant volume of water from surface or ground water sources for supply to aquaculture system may affect supply for human communities and ecosystems. 	<ul style="list-style-type: none"> Abstraction to take place with approval of relevant authorities at all locations. Water study prior to any abstraction, to inform a Sustainable Water Management Plan. Regular preventative maintenance of all system components to ensure that water wastage is as far as possible limited. Promotion of water efficiency (including leak detection) and water recycling.
<ul style="list-style-type: none"> Inefficient waste management during construction, operation and maintenance leading to excess consumption of materials, generation of wastes/emissions, pollution of soils and water; in particular, impacts of wastewater contaminated with nutrients and chemicals. 	<ul style="list-style-type: none"> Preparation of Waste Management Plan following the waste hierarchy, supported by staff training Earthworks to be designed to achieve a balance between cut and fill wherever possible Use of authorised contractors for hazardous and any other wastes which the project cannot dispose of safely. <p>See Pollution of Soils and Water above.</p>
<p>Loss, fragmentation and degradation of habitat, and severance of animal migration routes and pathways</p> <ul style="list-style-type: none"> Site footprint and earthworks during construction or maintenance causing loss, degradation or fragmentation of protected or ecologically sensitive areas (e.g. wetlands, migration routes), and other areas of conservation interest; and degradation following poorly managed rehabilitation. Impacts on habitats and species from habitat alteration and degradation (e.g. from reduction in downstream water supply, changes in water flow and drainage, soil erosion, pollution of water, soils or air, introduction of invasive species). 	<ul style="list-style-type: none"> Careful siting of all project components, with advice from biodiversity authorities/wildlife specialists, to avoid those which are most sensitive and provide priority ecosystem services (e.g. mangroves for coastal aquaculture). Wherever feasible, establishment of buffer zones around conservation areas, watercourses, and other locations identified as ecologically sensitive and avoidance or minimisation of activity within these zones. Use of design and operational measures to maintain fish migration routes wherever possible. Rehabilitation of cleared areas with native species, and ecosystem restoration in habitats of conservation value, using specialist advice and input so as to maintain the integrity of the habitat, backed up by a long-term monitoring programme and corrective actions as necessary. <p>Where development in sensitive areas cannot be avoided, mitigation may include:</p> <ul style="list-style-type: none"> Minimisation of area impacted, clear demarcation of remaining intact areas of habitat, and prohibition of activity into those areas for any purpose; prohibit or minimise activities in vicinity of sensitive areas, e.g. fragile coastal habitats, upstream of these intact areas of habitat. Habitat rehabilitation and ecosystem restoration of areas no longer required to occur as soon as possible after construction. If loss of Critical Habitat is inevitable, development/implementation of an Offsets Programme. <p>See relevant sections re: control of impacts from pollution, invasive species, and induced access.</p>

Impacts	Mitigation
<p>Impacts from Induced Access</p> <ul style="list-style-type: none"> Development of aquaculture projects in previously undeveloped areas can lead to further development, increased disturbance and pressure on natural resources. 	<ul style="list-style-type: none"> Careful site selection and siting of all project components, with advice from biodiversity authorities/wildlife specialists to avoid previously undeveloped areas where possible. Restrictions on access to all temporary access roads, and their removal after construction. Access controls on permanent access roads.
<p>Direct Impacts on Flora and Fauna</p> <ul style="list-style-type: none"> Earthworks and clearance may lead to loss of plant species and habitats of conservation interest. Development could displace animals and disturb their habitats, by direct disturbance during construction and operation (e.g. from noise, light disturbance at night, general human presence). Degradation of native populations due to spread of diseases from cultured species. 	<ul style="list-style-type: none"> Careful site selection and siting of all project components, with advice from biodiversity authorities/wildlife specialists. Careful planning of phasing and timing of construction activities. Demarcation and avoidance of areas of conservation interest (high value species, feeding or breeding sites, migration routes, etc.) where possible, and wildlife rescue and translocation where appropriate, under expert supervision. Monitoring of diseases in cultured stock and appropriate actions to eliminate these diseases. <p>Also see measures under soils, run-off and flooding, pollution of soils and water, noise / vibration and induced access above, and invasive species below.</p>
<p>Invasive Species</p> <ul style="list-style-type: none"> Movement of plant and workforce into areas could introduce invasive species which adversely impact fauna, flora, ecosystems, and crops. Accidental release of cultured species (especially non-native ones) may result in establishment of populations or genetic mixing with wild populations, leading to negative impacts on local flora and fauna. 	<ul style="list-style-type: none"> Invasive Species Management Plan, developed and implemented in consultation with authorities, including appropriate eradication measures for different species/groups of species. Staff training and awareness raising in communities on potential impacts of invasive species. Encourage use of indigenous species in aquaculture systems. No introduction of exotic species (e.g. for culture) without comprehensive study and government approval. Where exotic species are cultured, monitor status of native species in surrounding area. Where possible, clearance of invasive species during routine maintenance of water storage and distribution systems.
<p>Physical and Economic Displacement of People, Property, Assets and Resources</p> <ul style="list-style-type: none"> Development of aquaculture projects may physically displace people, or lead to loss of assets (e.g. fishing grounds, or land) or loss of income from other water based economic activities (e.g. navigation, tourism). Changes in water flow reduction downstream of the aquaculture development (or down-current for coastal aquaculture), causing adverse effects on water availability or quality for other users. 	<ul style="list-style-type: none"> Careful site selection and siting of all project components, avoid occupation of areas which are inhabited or regarded as of high value by communities where possible. Put in place employment plan, giving preference to employment within local communities. Early development and sensitive implementation of resettlement planning, in accordance with national regulations and international good practice to compensate for any losses (both physical and economic). Develop compensation measures for affected parties, e.g. downstream water users, fishermen, coastal tourism.
<p>Economic Development and Employment</p> <ul style="list-style-type: none"> Direct employment of local population in workforce, and stimulation of local economy through export of and demand for goods and services to enhance livelihoods and economic activity in local communities; potential for adverse effects if expectations not met and community relations are not well managed. 	<ul style="list-style-type: none"> Development of an Employment Plan, with clear employment requirements and procedures for the construction and operational/maintenance workforce; fair and transparent hiring and staff management procedures. Transparent and culturally appropriate communication with communities regarding employment opportunities. Employment requirements and vocational training plan to be agreed with local institutions, so that local people can be trained to meet the project's needs in a timely fashion. Development of measures to manage post-construction transition (e.g. SME development, ongoing opportunities for the workforce in aquaculture, reskilling and alternative employment).
<ul style="list-style-type: none"> Procurement of local goods and services for development of aquaculture system and workforce could deplete resources available for local communities. 	<ul style="list-style-type: none"> Procedures for sustainable local procurement, in consultation with local authorities and community leaders. Local capacity building to foster community resilience. Monitoring of local prices; exploration of corrective measures (e.g. alternative sourcing) if appropriate.

Impacts	Mitigation
<p>Cultural Heritage</p> <ul style="list-style-type: none"> Displacement or damage to cultural heritage sites by construction activities, harm to local setting, amenity value, etc. due to construction Change to intangible cultural heritage due to increased access, and interaction with workforce. 	<ul style="list-style-type: none"> Careful site selection and siting of all project components, taking account of community consultation/specialist surveys. Development of a Cultural Heritage Management Plan covering tangible and intangible (e.g. local traditions and practices) cultural heritage. Implementation of a "Chance Finds" procedure during construction. <p>See also Guidance Note on Physical Cultural Heritage</p>
<p>Community Health, Safety and Security</p> <ul style="list-style-type: none"> Poor construction management practices may lead to adverse effects on safety, human health and wellbeing. 	<ul style="list-style-type: none"> Good construction site "housekeeping" and management procedures (including site access) Risk assessments and emergency response planning to consider impacts on local communities <p>See also control of pollution under Physical Impacts heading.</p>
<ul style="list-style-type: none"> Interaction between workforce and local communities may increase occurrence of communicable diseases, including HIV/AIDS and sexually transmitted diseases (STDs). 	<ul style="list-style-type: none"> Implementation of a health management system for the construction workforce, to ensure it is fit for work and that it will not introduce disease into local communities. Training and awareness raising for workforce and their dependents on HIV/AIDS and other STDs, and communicable diseases including malaria; health awareness raising campaigns for communities on similar topics.
<ul style="list-style-type: none"> Changes in exposure to water borne and water related diseases, especially those associated with water dwelling disease vectors (new areas of standing water created) or poor sanitary conditions. 	<ul style="list-style-type: none"> Provide information, education and communication about safe uses of water and occupational safety. Facilitate programmes/measures to ensure appropriate sanitary and medical facilities are available. Implement environmental management measures for vector control: e.g. monitoring for key vectors; contact avoidance via site selection; focal insecticide and molluscicide application; other vector control measures (e.g. changes in water levels and flow rates).
<p>Workforce-Community Interactions</p> <ul style="list-style-type: none"> Real or perceived disruption to normal community life, through the physical presence of a workforce. 	<ul style="list-style-type: none"> Adoption of a Stakeholder Engagement Plan, as a framework for early and ongoing community consultation. Implementation of a Grievance Procedure (see Grievance Procedure and Redress Mechanisms guidance note). Works procedures, defining a Code of Appropriate Conduct for all workers, including acceptable behaviour with respect to community interactions.
<p>In-migration</p> <ul style="list-style-type: none"> Individuals are likely to migrate into the area which may cause conflict with resident communities, and put pressure on resources and infrastructure. 	<ul style="list-style-type: none"> Careful site selection and siting of all project components, after consultation with communities and local authorities. Preparation and implementation of an Influx/In-migration Management Plan, in consultation with local authorities. <p>See also Economic Development and Employment, and Induced Access above</p>
<p>Labour and Working Conditions</p> <ul style="list-style-type: none"> Poor management of occupational health and safety leading to accidents, injuries and illnesses among workers (e.g. risks of working close to water); mental health issues due to remote or enclosed living. Differences in nationality, ethnicity, religion, etc. may lead to discrimination and harassment, and differences (perceived or real) in working conditions between workers may lead to resentment. 	<ul style="list-style-type: none"> Employment practices and working conditions should conform to International Labour Organisation (ILO) Standards and national regulations. Rest and recreational facilities and time should be provided, and rules on alcohol and drugs defined and clearly communicated to workers. The basis for differences in the standard of accommodation should be non-discriminatory; it should be documented and communicated transparently to the workforce. Clear and comprehensive health and safety reporting and grievance procedure system should be established, and be freely available to all of the workforce. <p>See also Employment and Economic Development and Human Rights</p>

AGRICULTURE / AGRIBUSINESS SECTOR: ARTISANAL FISHERIES MANAGEMENT PROJECTS

Investment in artisanal fisheries management projects increases the availability of food and other products, contributing to economic development, sustainable livelihoods and enhanced quality of life. However, the development, expansion and operation of artisanal fisheries projects have often caused adverse impacts on natural and human environments. Environmental damage may include disturbance and loss of fauna and flora, destruction of freshwater, estuarine and marine habitats, loss or degradation of terrestrial habitats and pollution of water. These developments may also be a source of adverse impacts on the human environment, particularly in terms of reduction in local food supply and conflicts over fishing rights, and the displacement and resettlement of affected families and businesses.

Scope and structure

This keysheet provides a summary of the activities, typical environmental and social impacts, and potential mitigation and management measures relating to the development of artisanal fisheries management projects, including for marine, brackish water and freshwater fisheries. Fisheries management projects covered comprise investment in artisanal fisheries (i.e. small-scale household or community-based fisheries, involving a relatively low input of technology and capital ()), and utilising traditional fishing methods and equipment, such as seine, trawl, gill, drift or trammel nets, angling and long-lining). Activities considered include capture, primary processing and export of fish, shellfish, cephalopods and other aquatic animals, and as well as small-scale construction and renovation of associated facilities.

This keysheet should be used specifically to help with drafting ToRs for ESIs of artisanal fisheries management projects and with scoping and conducting ESIs and preparing ESMPs. It can also help in reviewing ESIs. It should be used in conjunction with the

Bank's Guidance Notes on ESIs (including coverage of cumulative impacts) and with the Guidance Notes on specific safeguard topics, including if appropriate transboundary projects.

The keysheet is organised under the following headings, with substantive information provided in table form:

- Project components and activities.
- Sources of impact and receptors/resources.
- Mitigation and management options.

The phases of artisanal fisheries projects considered are: design and planning, including site selection; construction (of any facilities required); operation and maintenance; there is unlikely to be a formal project closure phase.

Project components and activities

The components of artisanal fisheries management projects are provided in Table 1, along with the activities involved in developing or expanding artisanal fisheries projects, and in their operation, broken down by project phase.

Sources of impact, receptors/ resources, and mitigation

Table 2 summarizes the main aspects of artisanal fisheries management projects that lead to typical impacts, the receptors and resources they affect, and options for mitigation. It considers impacts on the physical, biological and socioeconomic environment. The mitigation measures described assume that higher level design and planning measures, as described in Table 1, have already been implemented.

The guidance on impacts and options for their mitigation can be used to help discussions with the borrower or client and improve their understanding of the Bank's requirements. They

should also be used to assist preparation of ToRs for an ESIA so that they are tailored to the particular circumstances of the artisanal fisheries management project under consideration.

Table 1: Summary of Activities associated with Artisanal Fisheries Projects

Components	Mitigation
Artisanal Fisheries <ul style="list-style-type: none"> Fishing equipment, e.g. nets, hooks, lines, traps. Fishing vessels, e.g. small boats, canoes. Landing and offloading areas, e.g. jetties, wharves. 	Associated Facilities <ul style="list-style-type: none"> Facilities for small-scale primary processing, and for storage, e.g. buildings; equipment for cleaning, preparing and processing. Access roads from landing areas to processing facilities and markets. Boat and equipment repair facilities.
Activity	
Design – Site Selection and Planning	Screening, Scoping and ESIA Preparation of ESMP Agreement of loan covenants
Strategic planning (options analysis, cost-benefit analysis, strategic site selection, initial design), and for larger (i.e. regional scale) artisanal fisheries development programmes, strategic environmental and social assessment (SESA), to establish: <ul style="list-style-type: none"> Major environmental and social constraints and alternatives (e.g. with respect to settlements and areas of biodiversity conservation importance). Design procedures such that environmental and social considerations are given equal weight to development objectives and financial viability. 	
Site-specific planning (detailed design), taking account of environmental and social sensitivities and consultation with communities, drawing upon the following environmental and socioeconomic documentation, all of which should comply with national regulations and international good practice: <ul style="list-style-type: none"> Environmental and Social Impact Assessment (ESIA). Environmental and Social Management Plan (ESMP). Stakeholder Engagement Plan (SEP). Resettlement Action Plan (RAP). 	
Construction	Monitoring of ESMP performance Monitoring of compliance with loan covenants Monitoring of sub-contractor contract provisions
Construction and preparation activities will include: <ul style="list-style-type: none"> Establishing temporary access to work and ancillary areas, demarcating clearance zones, establishing access control. Clearance and levelling of some small areas (e.g. for landing, processing, storage or repair facilities) where required, in preparation for small-scale construction activities (e.g. buildings, jetties, local roads). Import of relatively small quantities of building materials. Repair or construction of small vessels, including sourcing of materials, e.g. wood. Repair or construction of fishing equipment. 	
The equipment required may include mobile plant (e.g. bulldozers, excavators) and temporary fixed plant such as concrete batching plant and power generators	
Operation and Maintenance	Project implementation: Compliance Monitoring
During operation activities will involve capture of fish, shellfish, cephalopods and other aquatic animals, from vessels or from shore. This may involve a range of methods, including use of seine, trawl, gill, drift or trammel nets, angling and long-lining. Once returned to shore and offloaded, and there may be some small-scale primary processing of the catch (e.g. cleaning, preparing, drying, salting, freezing) and storage. The catch may be consumed locally or may be transported to a market for local or regional sale.	
These activities may contribute to direct and indirect impacts described in Table 2.	
Maintenance of artisanal fisheries management projects will entail many of the activities described above for the construction phase, although in general they are likely to be smaller in scale and spatial extent. It will include activities such as maintaining and renovating vessels, equipment, landing areas and processing facilities.	

Components	Mitigation
Activity	
Decommissioning (Closure)	Project Completion: Compliance Report
Where temporary facilities used in the construction phase are no longer required (if, for example, they are not required for maintenance) they should be decommissioned and rehabilitated in accordance with a site-specific closure plan developed in consideration of international good practice. Project closures, where required for redundant facilities, should include site clearance, removal of all equipment, appropriate disposal of waste materials, soil ripping and re-grading where necessary.	

Table 2: Artisanal Fisheries Management Projects: Impacts and Mitigation

Impacts	Mitigation
Geology/Hydrogeology <ul style="list-style-type: none"> • Interruption or disruption of surface and groundwater flows from small-scale ground clearance and construction of landing, storage or processing facilities. • Disruption of coastal processes (e.g. wave, tidal and current regime, sediment transport, flood and storm protection) from construction of landing and boat mooring facilities. 	<ul style="list-style-type: none"> • Design to take account of local hydrological conditions (e.g. taking extra care near permanent watercourses, do not hamper drainage of surface water, avoid works in areas prone to flooding especially during rainy season). • Siting and design to take account of shoreline configuration, near-shore currents, groundwater flows, and existing habitats. • Design and construction of compensatory shore protection and other measures to maintain coastal processes. • Monitoring of groundwater salinity; where necessary further mitigation may include control/diversion structures for saltwater, installation of cut off wells, sourcing of alternative water supply.
Soils, Run-off and Flooding <ul style="list-style-type: none"> • Loss, damage or disruption of soil/sediments during small-scale construction works. • Introduction of sediments to watercourses or interruption of drainage patterns, as a result of ground clearance and earthworks. 	<ul style="list-style-type: none"> • Minimisation of cleared areas and soil disturbance, with revegetation as soon as feasible (with native species). • Early installation and regular maintenance of drainage and diversion structures, silt traps, etc; drainage outlets to discharge into vegetated areas if possible; vegetation along watercourses and drainage lines to be retained if possible. • Retention of topsoil for restoration (including tilling and revegetation) as soon as practicable. • Careful consideration of timing of works (overall duration and seasonality).
Pollution of Soils and Water <ul style="list-style-type: none"> • Pollution of watercourses caused by wastewater from processing facilities, as well as small increases in sewage inputs due to workforce during construction works. • Release of hazardous substances associated with construction/maintenance activities or with transport of goods (e.g. accidental spills and leaks), leading to soil, surface or groundwater contamination. 	<ul style="list-style-type: none"> • Ensure that waste and drainage water complies with discharge standards and treat accordingly. • Implementation of standard good wastewater management and disposal procedures. • Wastewater drainage outlets to discharge into vegetated areas if possible; vegetation along watercourses and drainage lines to be retained if possible. • Installation of sewage treatment to meet required standards; hygiene training for workforce. • Materials handling and control procedures, use of appropriate storage and containment equipment. • Control of vehicle movements and prohibition of vehicle washing in watercourses, and similar practices. • Emergency response plans during construction (contractors and local authorities).
Air Quality <ul style="list-style-type: none"> • Dust and emissions from small-scale construction activities, and from vehicles and motorised vessels, could affect human health, vegetation and wildlife. • Odours associated with preparation facilities may cause nuisance to nearby receptors. 	<ul style="list-style-type: none"> • Sensitive site selection, and siting of construction works and access roads. • Use of modern equipment, meeting appropriate emissions standards, and regular preventative maintenance. • Encourage use of non-motorised vessels where appropriate; equip motorized vessels with well maintained, modern motors. • Dust control and suppression measures, such as dampening and use of vegetation hedges. • No use of ozone depleting substances during construction or operation. • Implement appropriate solid waste disposal measures at processing sites.

Impacts	Mitigation
<p>Noise and Vibration</p> <ul style="list-style-type: none"> Noise and vibration from small-scale construction activities, and from vehicles and motorised vessels, may disturb sensitive noise receptors (human and fauna, including fish and marine mammals). 	<ul style="list-style-type: none"> Sensitive route selection for access roads, and siting of construction works and facilities, accompanied where necessary by noise attenuation measures. Use of modern, well maintained equipment fitted with abatement devices (e.g. mufflers, noise enclosures). Strict control of timing of activities (e.g. prohibition on night working where possible). Observance of seasonal sensitivities (e.g. breeding seasons), and alteration of activity to reduce noise levels at that time.
<p>Resources and Waste</p> <ul style="list-style-type: none"> Excessive or unregulated capture of a small range of target species and accidental capture of other non-targeted species may deplete stocks and place pressure on local food resources. 	<ul style="list-style-type: none"> Institute measures to ensure sustainability of fisheries, through use of quotas, seasonal and 'sensitive area' closures, compulsory permitting etc.; encouraging sustainable traditional practices and restricting practices allowing large and non-specific catches (e.g. trawling, use of fish poisons or explosives); education and awareness-raising around overfishing. Include consideration of local resource needs within planning of quotas.
<ul style="list-style-type: none"> Inefficient waste management during construction, operation and maintenance leading to excess consumption of materials, generation of wastes/emissions, pollution of soils and water. 	<ul style="list-style-type: none"> Preparation of Waste Management Plan following the waste hierarchy, supported by training and awareness-raising around topic of waste for workforce and for local community. Use of authorised contractors for hazardous and any other wastes which the project cannot dispose of safely.
<p>Loss, fragmentation and degradation of habitat, and severance of animal migration routes and pathways</p> <ul style="list-style-type: none"> Small-scale construction works causing loss, degradation or fragmentation of protected or ecologically sensitive areas (e.g. wetlands, migration routes), and other areas of conservation interest. 	<ul style="list-style-type: none"> Careful siting of all project components, with advice from biodiversity authorities/wildlife specialists. Wherever feasible, establishment of buffer zones around conservation areas, watercourses, and other locations identified as ecologically sensitive, and avoidance or minimisation of activity within these zones. Rehabilitation of cleared areas with native species, and ecosystem restoration in habitats of conservation value, using specialist advice and input so as to maintain the integrity of the habitat, backed up by a long-term monitoring programme and corrective actions as necessary. <p>Where development in sensitive areas cannot be avoided, mitigation may include:</p> <ul style="list-style-type: none"> Minimisation of area impacted, clear demarcation of remaining intact areas of habitat, and prohibition of activity into those areas for any purpose; prohibit or minimise activities in the vicinity of sensitive areas. Habitat rehabilitation and ecosystem restoration of areas no longer required to occur as soon as possible after construction. If loss of Critical Habitat is inevitable, development/implementation of an Offsets Programme. Education of workforce and local communities as to the potential damage fisheries may cause to ecosystems, and on methods for avoiding damage (e.g. using buoys and designated anchoring locations). <p>See relevant sections re: control of impacts from pollution, invasive species, and induced access.</p>
<ul style="list-style-type: none"> Impacts on habitats and species from habitat alteration and degradation during construction and operation (e.g. changes in water flow and drainage, soil erosion, pollution of water, soils or air). 	
<ul style="list-style-type: none"> Impacts on habitats and species from habitat alteration and degradation caused by fishing activities (e.g. anchor or net damage to subsurface habitats) 	<ul style="list-style-type: none"> Discourage use of destructive fishing practices, such as trawling; provide materials and training in support of sustainable and non-destructive fishing practices. Education and awareness-raising around potential impacts of different fishing methods on habitats and the importance of habitat conservation.
<p>Impacts from Induced Access</p> <ul style="list-style-type: none"> Development of artisanal fisheries projects in remote or undeveloped areas leading to further development, increased disturbance and pressure on natural resources through bushmeat hunting, logging, fire, etc. 	<ul style="list-style-type: none"> Careful site selection, with advice from biodiversity authorities/wildlife specialists to avoid remote and previously inaccessible areas where possible. Where possible, instate access controls on roads leading to project facilities (e.g. jetties, processing facilities) in otherwise undeveloped or remote areas.

Impacts	Mitigation
<p>Direct Impacts on Flora and Fauna</p> <ul style="list-style-type: none"> Small-scale ground clearance may lead to loss of plant species and habitats of conservation interest. Development may displace animals and disturb their habitats (e.g. increased vessel and vehicle presence, construction of landing areas and processing facilities). 	<ul style="list-style-type: none"> Careful site selection and siting of project facilities, with advice from biodiversity authorities/wildlife specialists. Careful planning of phasing and timing of construction activities. Demarcation and avoidance of areas of conservation interest (high value species, feeding or breeding sites, migration routes, etc.) where possible, and wildlife rescue and translocation where appropriate, under expert supervision. <p>Also see measures under soils, run-off and flooding, pollution of soils and water, noise / vibration and induced access above, and invasive species below</p>
<ul style="list-style-type: none"> Direct mortality of target and non-target species, leading to depletion of their populations, including involuntary capture in lost nets. 	<ul style="list-style-type: none"> Institute measures to ensure sustainability of fisheries, through use of quotas, seasonal and 'sensitive area' closures, compulsory permitting etc.; encouraging sustainable traditional practices and restricting harmful practices (e.g. trawling, use of fish poisons or explosives); education and awareness-raising around overfishing, sensitive species and habitats.
<p>Invasive Species</p> <ul style="list-style-type: none"> Movement of a workforce into the project area, or introduction of non-native species during rehabilitation, could introduce invasive species which adversely impact fauna, flora, ecosystems, and crops. 	<ul style="list-style-type: none"> Invasive Species Management Plan, which should be developed and implemented in consultation with authorities, including appropriate eradication measures for different species/groups of species. Staff training and awareness-raising in communities. No introduction of exotic species (e.g. for site rehabilitation) without specialist vetting and government approval.
<p>Physical and Economic Displacement of People, Property, Assets and Resources</p> <ul style="list-style-type: none"> Construction of associated facilities may physically displace people, or lead to loss of assets (e.g. loss of land of agricultural importance). Potential for economic displacement of specific individuals or groups with existing income from fisheries if they are excluded from projects, or of other water based economic activities (e.g. navigation, tourism). 	<ul style="list-style-type: none"> Careful site selection and siting of project facilities, avoiding occupation of areas which are inhabited or regarded as having high value by communities where possible. Early development and sensitive implementation of resettlement planning, in accordance with national regulations and international good practice to compensate for any losses (both physical and economic). Put in place employment plan, giving preference to employment within local communities. Develop detailed baseline of existing reliance on fishery resources in the project area, both within the local community and outside of the community of focus; from this, identify specific groups that may not benefit from the project and adopt corrective measures as required. Develop compensation measures for affected parties (e.g. excluded fishermen).
<p>Economic Development and Employment</p> <ul style="list-style-type: none"> Direct employment of local population in the construction workforce. Stimulation of local economy through export of produce to market, and increased demand for goods and services to enhance livelihoods and economic activity in local communities; potential for adverse effects if expectations not met and community relations are not well managed. 	<ul style="list-style-type: none"> For artisanal fisheries projects, a community-based approach is encouraged: the small construction workforce should be sourced in the local or regional area; further skills required for fishing, processing or maintenance activities to be included in local training programs and developed within the community, in order to retain value within that local community. Development of an Employment Plan, with clear employment requirements and procedures for the construction workforce. Transparent and culturally appropriate communication with communities regarding employment opportunities.
<ul style="list-style-type: none"> Procurement of local goods and services for development of related facilities and equipment, and for the workforce could deplete resources available for local communities. 	<ul style="list-style-type: none"> Procedures for sustainable local procurement, in consultation with local authorities and community leaders.
<p>Cultural Heritage</p> <ul style="list-style-type: none"> Displacement or disturbance to cultural heritage sites caused by construction or fishing activities, harm to local setting, amenity value, etc. due to construction. Change to intangible cultural heritage due to increased access, and interaction with non-local workforce. 	<ul style="list-style-type: none"> Careful site selection and siting of all project facilities, taking account of community consultation/specialist surveys. Development of a Cultural Heritage Management Plan covering tangible and intangible (e.g. local traditions and practices) cultural heritage. Implementation of a "Chance Finds" procedure during construction. <p>See also Guidance Note on Physical Cultural Heritage.</p>

Impacts	Mitigation
<p>Community Health, Safety and Security</p> <ul style="list-style-type: none"> Poor construction management practices may lead to adverse effects on safety, human health and wellbeing. 	<ul style="list-style-type: none"> Good construction site “housekeeping” and management procedures (including site access). Risk assessments and emergency response planning to consider impacts on local communities. <p>See also control of pollution under Physical Impacts heading.</p>
<ul style="list-style-type: none"> Changes to local food availability, due to export of increased proportion of captured fish, may lead to malnutrition. 	<ul style="list-style-type: none"> Provision of community support and development mechanisms for subsistence fisheries/aquaculture
<ul style="list-style-type: none"> Interaction between any non-local construction workers and local communities may increase occurrence of communicable diseases, including HIV/AIDS and sexually transmitted diseases (STDs). 	<ul style="list-style-type: none"> Implementation of a health management system for the workforce, to ensure it is fit for work and that it will not introduce disease into local communities. Training and awareness raising for workforce and their dependents on HIV/AIDS and other STDs, and communicable diseases including malaria; health awareness raising campaigns for communities on similar topics.
<p>Workforce-Community Interactions</p> <ul style="list-style-type: none"> Real or perceived disruption to normal community life, through the physical presence of a non-local workforce. 	<ul style="list-style-type: none"> Adoption of a Stakeholder Engagement Plan, as a framework for early and ongoing community consultation Implementation of a Grievance Procedure (see Grievance Procedure and Redress Mechanisms guidance note). Works procedures, defining a Code of Appropriate Conduct for all workers, including acceptable behaviour with respect to community interactions.
<p>Labour and Working Conditions</p> <ul style="list-style-type: none"> Poor management of occupational health and safety leading to accidents, injuries and illnesses among workers. Differences (perceived or real) in working conditions between workers may lead to resentment. 	<ul style="list-style-type: none"> Construction employment practices, working conditions and workforce living conditions should conform to International Labour Organisation (ILO) Standards and national regulations. Clear and comprehensive health and safety reporting and a grievance procedure system should be established, and be freely available to all of the workforce. <p>See also Employment and Economic Development.</p>

AGRICULTURE / AGRIBUSINESS SECTOR: SUSTAINABLE LAND MANAGEMENT PROJECTS

Sustainable land management is an approach to managing land that balances environmental protection and the preservation of ecosystem services with development (e.g. forestry, agriculture, extraction, residential development). Sustainable land management contributes to economic development, livelihoods, improved community health and safety, enhanced quality of life and environmental protection. However, it may also have adverse impacts on natural and human environments. Environmental damage may include disruption or contamination of water courses and natural drainage systems, soil destabilization, habitat fragmentation and destruction, and disturbance and loss of fauna and flora. Adverse impacts on the human environment may also result, including changes in the balance of rights and responsibilities between land users displacement and resettlement of affected families and businesses, and impacts on health and safety.

Scope and structure

This keysheet provides a summary of the activities, typical environmental and social impacts, and potential mitigation and management measures relating to the development of sustainable land management projects, i.e. projects, ranging in scale from local to international, that involve the co-ordination of land resource management across sectors and interest groups with the intention of improving the efficiency, equity and sustainability of land use.

This keysheet should be used specifically to help with drafting ToRs for ESIs of sustainable land management projects and with scoping and conducting ESIs and preparing ESMPs. It can also help in reviewing ESIs. It should be used in conjunction with the Bank's Guidance Notes on ESIs (including coverage of cumulative impacts) and with the Guidance Notes on specific safeguard topics including transboundary projects.

The keysheet is organised under the following headings, with substantive information provided in table form:

- Project components and activities.
- Sources of impact and receptors/resources.
- Mitigation and management options.

The phases of sustainable land management projects considered are: design and planning, including site selection; project development; operation and maintenance.

Project components and activities

The components of sustainable land management are provided in Table 1, along with the activities involved in developing and implementing new projects or improving existing projects, broken down by project phase.

Sources of impact, receptors/ resources, and mitigation

Table 2 summarizes the main aspects of sustainable land management activities that lead to typical impacts, the receptors and resources they affect, and options for mitigation. It considers impacts on the physical, biological and socioeconomic environment. The mitigation measures described assume that higher level design and planning measures, as described in Table 1, have already been implemented.

The guidance on impacts and options for their mitigation can be used to help discussions with the borrower or client and improve their understanding of the Bank's requirements. They should also be used to assist preparation of ToRs for an ESI so that they are tailored to the particular circumstances of the sustainable land management project under consideration.

Table 1: Summary of Activities associated with Sustainable Land Management

Components	Mitigation
<p>Sustainable Land Management</p> <ul style="list-style-type: none"> Enabling environment (i.e. policies and legislation relevant to management of land, especially property rights). Institutional context and capacity (i.e. bodies responsible for implementing legislation and strategy). Land and water resources (e.g. agricultural land, forests, other terrestrial habitats, mineral resources, surface and ground water networks). Land users (e.g. resident populations, farmers, foresters, industry). Management instruments (e.g. assessment, monitoring, stakeholder engagement, allocation instruments). Related infrastructure (e.g. irrigation systems, water and wastewater storage, distribution and treatment systems). 	<p>Ancillary Components</p> <ul style="list-style-type: none"> Temporary construction facilities (e.g. workshops, laydown areas, working corridor outside the footprint, workers' accommodation). Access roads within and between temporary facilities and areas being developed; permanent access roads.
Activity (1)	
Design – Site Selection and Planning	<p>Screening, Scoping and ESIA</p> <p>Preparation of ESMP</p> <p>Agreement of loan covenants</p>
<p>Strategic planning (options analysis, cost-benefit analysis, strategic site selection, initial design), and for regional or larger scale sustainable land management programmes, strategic environmental and social assessment (SESA), to establish:</p> <ul style="list-style-type: none"> Major environmental and social features (e.g. with respect to major settlements, agricultural areas, watersheds and areas of biodiversity conservation importance). Design procedures such that environmental and social considerations are given equal weight to engineering and financial ones. 	
<p>Site-specific planning (detailed design), taking account of environmental and social sensitivities and consultation with communities, drawing upon the following environmental and socioeconomic documentation, all of which should comply with national regulations and international good practice:</p> <ul style="list-style-type: none"> Environmental and Social Impact Assessment (ESIA); Environmental and Social Management Plan (ESMP); Stakeholder Engagement Plan (SEP); and Resettlement Action Plan (RAP). 	
Activity (2)	
Project Development	<p>Monitoring of ESMP performance</p> <p>Monitoring of compliance with loan covenants</p> <p>Monitoring of sub-contractor contract provisions</p>
<p>During project development activities will include:</p> <ul style="list-style-type: none"> Preparation of policies, laws and regulations focused on enabling sustainable land management; creation of, or capacity building within, institutions responsible for land resource management. Assessment of land and water availability and quality, and stakeholder/user requirements; followed by allocation of rights and responsibilities for land and water management. Construction or improvement of related infrastructure and associated works (e.g. access roads; earthworks during creation of reservoirs; ground clearance for establishment of agricultural facilities, water treatment areas etc.). Identification of key areas of natural habitat with importance for safeguarding of land and water resources; protection and/or restoration of these areas. 	
Operation and Maintenance	Project implementation: Compliance Monitoring
<p>During the operational phases of sustainable land management projects, key activities will include protection of important natural habitats; negotiation and partitioning of land and water usage rights; development activities (e.g. intensified agricultural or forestry use, mineral extraction); water supply and wastewater treatment; monitoring of performance indicators. These activities may contribute to direct and indirect impacts described in Table 2.</p>	
<p>Maintenance of related infrastructure will entail activities similar to those described above for the construction phase, although in general they are likely to be smaller in scale and spatial extent. It will include activities such as road maintenance and clearing and maintaining water and wastewater collection, storage and treatment systems.</p>	
Decommissioning (Closure)	Project Completion: Compliance Report
<p>Where temporary facilities necessary to the project are no longer required (if, for example, they are not required for maintenance) they should be decommissioned and rehabilitated in accordance with a site-specific closure plan developed in consideration of international good practice. The decommissioning process will include site clearance, removal of all equipment, appropriate disposal of waste materials, soil ripping and re-grading where necessary.</p>	
<p>Sustainable land management approaches will not, in other respects, require formal closure or decommissioning.</p>	

Table 2: Sustainable Land Management: Impacts and Mitigation

Impacts	Mitigation
<p>Geology/Hydrogeology</p> <ul style="list-style-type: none"> Positive: maintenance of natural flows and water table level through control of water usage. Interruption or disruption of surface and groundwater flows from construction, excavation and ground clearance during introduction of related infrastructure. 	<ul style="list-style-type: none"> Design to take account of local hydrological conditions (e.g. taking extra care near permanent watercourses, do not hamper drainage of surface water, avoid works in areas prone to flooding especially during rainy season).
<p>Soils, Run-off and Flooding</p> <ul style="list-style-type: none"> Positive: protection of natural habitats (e.g. forests, wetlands) leading to reduced soil erosion, sediment input and flood risk. Loss, damage or disruption of soil from construction, excavation and ground clearance during development or introduction of related infrastructure. 	<ul style="list-style-type: none"> Minimisation of cleared areas and soil disturbance in key habitats, retention of topsoil for restoration following construction activities, revegetation of cleared areas as soon as feasible with native species. Early installation and regular maintenance of drainage around agricultural land and construction areas, silt traps, etc; outlets to discharge into vegetated areas if possible; vegetation along watercourses and drainage lines to be retained if possible. Careful consideration of timing of works (overall duration and seasonality), and design to reduce sedimentation and facilitate maintenance.
<p>Pollution of Soils and Water</p> <ul style="list-style-type: none"> Positive: improvement in water quality due to protection of key habitats and control of polluting activities (e.g. fees for polluters, better management of agricultural inputs). Release of hazardous substances during construction or maintenance activities (e.g. accidental spills and leaks) and during operation (e.g. fertilisers, pesticides, chemicals used in wastewater treatment) leading to soil, surface or groundwater contamination. 	<ul style="list-style-type: none"> Implementation of standard good wastewater management procedures, including appropriate treatment to international standards and monitoring quality of receiving waters and soils; plan discharge of wastewater in accordance with the absorbing capacity of receiving water bodies. Conserve vegetation along water bodies and near wetlands, especially at wastewater discharge points. Materials handling and control procedures, use of storage and containment equipment meeting international standards. Control of construction/maintenance vehicle movements and prohibition of vehicle washing in watercourses, and similar practices. Emergency response plans during construction (contractors and local authorities) and operation (local authorities).
<p>Air Quality</p> <ul style="list-style-type: none"> Positive: potential benefits (e.g. improved air quality, carbon sequestration) resulting from improved practices and protection of key habitats (e.g. forests, wetlands). Dust and emissions from construction and maintenance activities could affect human health, vegetation and wildlife. 	<ul style="list-style-type: none"> Sensitive site selection and siting of project components. Use of modern equipment meeting appropriate emissions standards, and regular preventative maintenance. Dust control and suppression measures such as dampening, use of vegetation hedges etc. No use of ozone depleting substances during construction.
<p>Noise and Vibration</p> <ul style="list-style-type: none"> Noise and vibration from construction and maintenance equipment, traffic and activities, may disturb sensitive noise receptors (human, fauna). 	<ul style="list-style-type: none"> Sensitive local siting of components and construction sites, accompanied where necessary by noise attenuation measures. Use of modern, well maintained equipment fitted with abatement devices (e.g. mufflers, noise enclosures). Strict controls of timing of activities, e.g. blasting and other high noise emissions; prohibition on night working. Observance of seasonal sensitivities (e.g. breeding seasons), and alteration of activity to reduce noise levels at that time.

Impacts	Mitigation
<p>Resources and Waste</p> <ul style="list-style-type: none"> Positive: consideration of all land and water uses and users within management plan should result in more efficient and equitable use of resources. Inefficient resource use and waste management during construction, operation and maintenance leading to excess consumption of materials, generation of wastes/emissions, pollution of soils and water. 	<ul style="list-style-type: none"> Plans for land/water usage to be informed by detailed study as part of project preparation and design, considering all uses and users. Any abstraction to take place with approval of relevant authorities at all locations. Regular preventative maintenance of all system components to ensure that water wastage is as far as possible limited. Promotion of water efficiency and water recycling: implement water fees/tariffs and other demand management measures to avoid the wastage of water or over-consumption. Clearly define rights to resources and any responsibilities, fees and conditions in consultation with affected groups. Preparation of Waste Management Plan following the waste hierarchy, supported by staff training. Earthworks to be designed to achieve a balance between cut and fill wherever possible. Use of authorised contractors for hazardous and any other wastes which the project cannot dispose of safely. Implementation of standard good wastewater management procedures.
<p>Loss, fragmentation and degradation of habitat, and severance of animal migration routes and pathways</p> <ul style="list-style-type: none"> Positive: assigning value to habitats linked to ecosystem services should enable improvements in protection of these habitats (e.g. forests, grasslands, wetlands, riparian habitats), and result in positive impacts for species reliant on them. Outputs from sustainable land management activities (e.g. wastewater and non-point source pollution agricultural intensification) causing loss, degradation or fragmentation of protected or ecologically sensitive areas, and other areas of conservation interest; degradation following poorly managed rehabilitation; with resultant impacts on species supported by these habitats. 	<ul style="list-style-type: none"> Careful siting of all project components, with advice from biodiversity authorities/wildlife specialists Wherever feasible, establishment of buffer zones around conservation areas, watercourses, and other locations identified as ecologically sensitive and avoidance or minimisation of activity within these zones Rehabilitation of cleared areas with native species, and ecosystem restoration in habitats of conservation value (especially those providing ecosystem services related to land or water resources), using specialist advice and input so as to maintain the integrity of the habitat, backed up by a long-term monitoring programme and corrective actions as necessary. <p>Where development in sensitive areas cannot be avoided, mitigation may include:</p> <ul style="list-style-type: none"> Minimisation of area impacted, clear demarcation of remaining intact areas of habitat, and prohibition of activity into those areas for any purpose; prohibit or minimise activities in vicinity of sensitive areas, e.g. upstream. Habitat rehabilitation and ecosystem restoration of areas no longer required to occur as soon as possible after construction. If loss of Critical Habitat is inevitable, development/implementation of an Offsets Programme. <p>See also Pollution of Soils and Water above, and Induced Access below.</p>
<p>Impacts from Induced Access</p> <ul style="list-style-type: none"> Development activities may encourage or facilitate human access in remote or undeveloped areas, which can lead to further development, increased disturbance and pressure on natural resources through bushmeat hunting, logging, fire, etc. 	<ul style="list-style-type: none"> Careful site selection and siting of all project components, with advice from biodiversity authorities/wildlife specialists to avoid remote and previously inaccessible areas where possible. Restrictions on access to all temporary access roads, and their removal after construction. Access controls on permanent access roads required for operation and maintenance. <p>See also Bushmeat Hunting below.</p>
<p>Direct Impacts on Flora and Fauna</p> <ul style="list-style-type: none"> Positive: protection of key habitats should result in maintenance or improvement of the integrity of protected and surrounding areas, with positive impacts for the species supported by these habitats. Earthworks and clearance during development of land may lead to loss of plant and animal species. Introduction of related infrastructure and development could displace animals and disturb their habitats, by direct disturbance during construction and operation (e.g. from noise, general human presence). 	<ul style="list-style-type: none"> Careful site selection and siting of all project components, with advice from biodiversity authorities/wildlife specialists. Careful planning of phasing and timing of construction activities. Demarcation and avoidance of areas of conservation interest (high value species, feeding or breeding sites, migration routes, etc.) where possible, with expert advice. Also see measures under Soils, Run-off and Flooding, Pollution of Soils and Water, Noise /Vibration and Induced Access above.

Impacts	Mitigation
<p>Physical and Economic Displacement of People, Property, Assets and Resources</p> <ul style="list-style-type: none"> • Positive: consideration of all land and water uses and users within management plan should result in more equitable use of resources, and reduce potential for less powerful users to experience economic displacement. • Development activities and introduction of related infrastructure may physically displace people, or lead to loss of assets, e.g. loss of agricultural land. • Changes in balance of allocation between users may result in losses to some users. 	<ul style="list-style-type: none"> • Careful site selection and siting of all project components, avoiding occupation of areas which are inhabited or regarded as of high value by communities (e.g. horticulture, community orchards) where possible. • Early development and sensitive implementation of resettlement planning, in accordance with national regulations and international good practice to compensate for any losses (both physical and economic). • Clearly define rights, fees and conditions in consultation with affected groups. • Develop corrective/compensation measures for affected parties where required (e.g. vulnerable groups, individuals or groups experiencing reductions in land/water allocations). • Create a user organisation to effectively manage resources and ensure equitable access among users.
<p>Economic Development and Employment</p> <ul style="list-style-type: none"> • Positive: better management of resources, resulting in improved yields and water supply will support economic development. • Positive: direct employment of local population in workforce, and stimulation of local economy through improved infrastructure and demand for goods and services will enhance livelihoods and economic activity. • Potential for adverse effects if expectations not met and community relations are not well managed. 	<ul style="list-style-type: none"> • Development of an Employment Plan, with clear employment requirements and procedures for the construction and operational/maintenance workforce. • Transparent and culturally appropriate communication with communities regarding employment opportunities. • Fair and transparent hiring and staff management procedures. • Local capacity building to foster community resilience.
<p>Cultural Heritage</p> <ul style="list-style-type: none"> • Displacement or damage to cultural heritage sites by construction activities, harm to local setting, amenity value, etc. 	<ul style="list-style-type: none"> • Careful site selection and siting of all project components, taking account of community consultation/specialist surveys. • Development of a Cultural Heritage Management Plan covering tangible and intangible (e.g. local traditions and practices) cultural heritage. • Implementation of a "Chance Finds" procedure during construction. See also Guidance Note on Physical Cultural Heritage.
<p>Community Health, Safety and Security</p> <ul style="list-style-type: none"> • Positive: better management of land and water resources, resulting in improved supply and quality of food and water, will result in improved community health. • Poor construction management practices may lead to adverse effects on safety, human health and wellbeing. • Interaction between workforce and local communities may increase occurrence of communicable diseases, including HIV/AIDS and sexually transmitted diseases (STDs). • Changes in exposure to water-borne and water-related diseases (e.g. those associated with wastewater, or with presence of wetland habitats). 	<ul style="list-style-type: none"> • Good construction site "housekeeping" and management procedures (including site access). • Risk assessments and emergency response planning to consider impacts on local communities. • Implementation of a health management system for workforce, to ensure it is fit for work and that it will not introduce disease into local communities. • Training and awareness raising for workforce and their dependents on HIV/AIDS and other STDs, and communicable diseases including malaria; health awareness raising campaigns for communities on similar topics. • Provide information, education and communication about safe uses of water and hygienic behaviour. • Implement environmental management measures for vector control: e.g. monitoring for key vectors; focal insecticide and molluscicide application. • Establish regular controls and maintenance activities to protect quality of local water supply (e.g. through education and training, measures to limit contamination with wastewater). • Facilitate programmes/measures to ensure appropriate sanitary and medical facilities are available. <p>See also control of pollution under Physical Impacts heading.</p>
<p>Workforce-Community Interactions</p> <ul style="list-style-type: none"> • Real or perceived disruption to normal community life, through the physical presence of a workforce. 	<ul style="list-style-type: none"> • Adoption of a Stakeholder Engagement Plan, as a framework for early and ongoing community consultation. • Implementation of a Grievance Procedure (see Grievance Procedure and Redress Mechanisms guidance note). • Works procedures, defining a Code of Appropriate Conduct for all workers, including acceptable behaviour with respect to community interactions.

Impacts	Mitigation
<p>In-migration</p> <ul style="list-style-type: none"> Local development and improved infrastructure may encourage migration into the area, which may cause conflict with existing resident communities, and put pressure on resources and infrastructure. 	<ul style="list-style-type: none"> Careful site selection and siting of all project components, after consultation with communities and local authorities. Preparation and implementation of an Influx/In-migration Management Plan, in consultation with local authorities. <p>See also Economic Development and Employment and Induced Access above.</p>
<p>Labour and Working Conditions</p> <ul style="list-style-type: none"> Poor management of occupational health and safety leading to accidents, injuries and illnesses among workers. Differences in nationality, ethnicity, religion, etc. may lead to discrimination and harassment, and differences (perceived or real) in working conditions between workers may lead to resentment. 	<ul style="list-style-type: none"> Employment practices and working conditions should conform to International Labour Organisation (ILO) Standards and national regulations. Rest and recreational facilities and time should be provided, and rules on alcohol and drugs defined and clearly communicated to workers. The basis for differences in the standard of accommodation should be non-discriminatory; it should be documented and communicated transparently to the workforce. Clear and comprehensive health and safety reporting and grievance procedure system should be established, and be freely available to the entire workforce. <p>See also Employment and Economic Development.</p>

AGRICULTURE / AGRIBUSINESS SECTOR: WETLAND RECLAMATION

Investment in wetland reclamation contributes to economic development and quality of life through creating usable reclaimed land for a range of purposes, including residential, agricultural, industrial or infrastructural developments. However, during construction, rehabilitation and maintenance, wetland reclamation projects can result in significant direct and indirect impacts on the environment, including disruption of hydrology and drainage, contamination of water, soil destabilization, destruction and fragmentation of key habitats, and loss or disturbance of fauna and flora. Wetland reclamation may also be a source of adverse impacts on the human environment, particularly the displacement and resettlement of affected families and businesses, and health and safety.

Scope and structure

This keysheet provides a summary of the activities, typical environmental and social impacts, and potential mitigation and management measures relating to projects that involve reclamation of land within areas of wetland (areas characterised by constant or periodic shallow inundation/saturation by marine, brackish or fresh water, e.g. swamps, marshes, mangroves). The types of projects covered are construction and extension of, and major maintenance programmes for, land reclamation projects within wetland habitats.

This keysheet should be used specifically to help with drafting ToRs for ESIA of wetland reclamation projects and with scoping and conducting ESIA and preparing ESMPs. It can also help in reviewing ESIA. It should be used in conjunction with the Bank's Guidance Notes on ESIA (including coverage of cumulative impacts) and with the Guidance Notes on specific safeguard topics including transboundary projects.

The keysheet is organised under the following headings, with substantive information provided in table form:

- Project components and activities.
- Sources of impact and receptors/resources.
- Mitigation and management options.

The phases of wetland reclamation projects considered are: design and planning, including site selection; construction; maintenance; and where appropriate restoration.

Project components and activities

The components of wetland reclamation projects are provided in Table 1, along with the activities involved in reclaiming land within undeveloped wetland, and extending and maintaining areas of reclaimed wetland, broken down by project phase.

Sources of impact, receptors/ resources, and mitigation

Table 2 summarizes the main aspects of wetland reclamation activities that lead to typical impacts, the receptors and resources affected, and options for mitigation. It considers impacts on the physical, biological and socioeconomic environment. The mitigation measures described assume that higher level design and site planning measures, as described in Table 1, have already been implemented.

The guidance on impacts and options for their mitigation can be used to help discussions with the borrower or client and improve their understanding of the Bank's requirements. They should also be used to assist preparation of ToRs for an ESIA so that they are tailored to the particular circumstances of the wetlands reclamation project under consideration.

Table 1: Summary of Activities Associated with Wetland Reclamation

Components	Mitigation
<p>Wetland Reclamation</p> <ul style="list-style-type: none"> • Drainage systems and equipment. • Fill material (e.g. sand, rock, clay, cut or dredged sediments, concrete). • Embankments/barriers to fold fill material in place and prevent water ingress or saturation. • Drainage and erosion control structures. • Safety and security measures (e.g. barriers, fencing). 	<p>Ancillary facilities</p> <ul style="list-style-type: none"> • Temporary construction facilities (e.g. workshops, laydown areas, workers' accommodation, quarries and borrow pits). • Access roads within and between temporary facilities and the working area, permanent access roads. • Landscaping features, etc.
Activity	
Design – Site Selection and Planning	<p>Screening , Scoping and ESIA</p> <p>Preparation of ESMP</p> <p>Agreement of loan covenants</p>
<p>Strategic planning (options analysis, cost-benefit analysis, strategic site selection, initial design), and for major wetland reclamation programmes, strategic environmental and social assessment (SESA), to establish:</p> <ul style="list-style-type: none"> • Major environmental and social constraints and alternatives (e.g. with respect to major settlements, watersheds and areas of biodiversity conservation importance). • Design procedures such that environmental and social considerations are given equal weight to engineering and financial ones. 	
<p>Site-specific planning (detailed design), taking account of environmental and social sensitivities and consultation with communities, drawing upon the following environmental and socioeconomic documentation, all of which should comply with national regulations and international good practice:</p> <ul style="list-style-type: none"> • Environmental and Social Impact Assessment (ESIA). • Environmental and Social Management Plan (ESMP). • Stakeholder Engagement Plan (SEP). • Resettlement Action Plan (RAP). 	
Construction	<p>Monitoring of ESMP performance</p> <p>Monitoring of compliance with loan covenants</p> <p>Monitoring of sub-contractor contract provisions</p>
<p>Construction activities will include:</p> <ul style="list-style-type: none"> • Establishing temporary access to work and ancillary areas, demarcating clearance zones, establishing access control. • Clearance of the reclamation area. • Major earthworks to instate embankments, barriers etc., and to introduce fill material within areas to be reclaimed. • Location and development of quarries, areas to be dredged etc. to source fill material. • Introduction of new drainage systems and improvement of existing drainage. • Establishment or improvement of safety arrangements e.g. exclusion areas, signposting. • Landscaping, as required. 	
<p>The equipment required will include heavy mobile plant (e.g. graders, bulldozers, excavators) and temporary fixed plant such as concrete batching plant and power generators.</p>	
Operation and Maintenance	Project implementation: Compliance Monitoring
<p>During the 'operational' phase, the presence of reclaimed land, including the presence of the materials used as fill and in construction, may contribute to direct and indirect impacts described in Table 2.</p>	
<p>Maintenance of reclaimed wetland will entail many of the activities described above for the construction phase, although in general they are likely to be smaller in scale and spatial extent. In particular, the maintenance of embankments and drainage structures will be important to ensure the integrity of reclaimed land.</p>	
Decommissioning / Restoration	Project Completion: Compliance Report
<p>Where temporary roads and facilities used in construction are no longer required (if, for example, they are not required for maintenance) they should be decommissioned and rehabilitated in accordance with a site-specific closure plan developed in consideration of international good practice. The decommissioning process will include site clearance, removal of all equipment, and appropriate disposal of waste materials, soil ripping and re-grading where necessary.</p>	
<p>Areas of reclaimed land are normally intended to remain in place permanently, and so consideration of decommissioning/wetland restoration is not normally relevant.</p>	

Table 2: Wetland Reclamation: Impacts and Mitigation

Impacts	Mitigation
<p>Geology /Hydrology</p> <ul style="list-style-type: none"> Disruption and interruption of surface and groundwater distribution and flows, which may cause loss of supply to surrounding areas of wetland habitat. 	<ul style="list-style-type: none"> Water study conducted prior to activities, to inform design and avoid/reduce impacts to upstream/downstream areas. Limit creation of sealed or compacted surfaces in the surrounding area as much as possible, to maintain natural recharge of the water table.
<ul style="list-style-type: none"> Increased turbidity from runoff and settling of fill material; changes to water quality, e.g. introduction of saline water within fill material. 	<ul style="list-style-type: none"> Development of a management plan for infilling activities, taking into account local hydrology, sediment characteristics, timing of activity (consider e.g. tides, low flow periods), including use of appropriate modern techniques and equipment, monitoring of fill material, containment and treatment of runoff from fill material.
<p>Soils, Run-off and Flooding</p> <ul style="list-style-type: none"> Loss, damage or disruption of soil/sediments, especially desaturation of soils. 	<ul style="list-style-type: none"> Careful design: e.g. minimal diversion, timing of works (overall duration and seasonality). Minimisation of cleared areas and soil disturbance, with revegetation as soon as feasible, with native species. Early installation and regular maintenance of drainage and diversion structures, silt traps, etc; drainage outlets to discharge into vegetated areas if possible; vegetation along watercourses and drainage lines to be retained if possible. Avoidance of areas liable to flooding and instability at site selection stage, where possible. Retention of topsoil for restoration (including tilling and revegetation) as soon as practicable. Development of flood risk management plan, including measures such as flood defences and introduction of replacement flood storage areas to offset lost capacity.
<ul style="list-style-type: none"> Introduction of sediments to watercourses as a result of ground clearance, earthworks and infilling. 	
<ul style="list-style-type: none"> Increased risk of flooding at reclamation site and in surrounding area, due to interruption of drainage patterns and loss of water retention capacity. 	
<p>Pollution of Soils and Water</p> <ul style="list-style-type: none"> Discharge of construction workforce sewage effluent polluting watercourses. 	<ul style="list-style-type: none"> Implementation of standard good wastewater management procedures. Installation of sewage treatment to meet required standards; hygiene training for workforce.
<ul style="list-style-type: none"> Introduction of hazardous substances during construction (e.g. runoff/seepage from contaminated fill material, accidental spills/leaks, especially large spills to aquatic environment) leading to soil, surface or groundwater contamination. 	<ul style="list-style-type: none"> Testing of fill material for contamination prior to use, and development of management plan for contaminated material. Materials handling and control procedures. Control of construction vehicle movements and prohibition of vehicle washing in watercourses, and similar practices. Development of emergency response plan during construction (by contractors and local authorities) to manage major incidents if they should occur.
<p>Air Quality</p> <ul style="list-style-type: none"> Emissions and dust from construction and maintenance activities affecting sensitive receptors (human, flora, fauna). 	<ul style="list-style-type: none"> Sensitive site selection and siting of construction facilities. Dust control and suppression measures, such as use of dampening and proper containment. Use of modern equipment meeting appropriate emissions standards, and regular preventative maintenance. No use of ozone depleting substances during construction.
<p>Noise and Vibration</p> <ul style="list-style-type: none"> Noise and vibration from construction and maintenance equipment, traffic and activities, may disturb sensitive noise receptors (human, fauna). 	<ul style="list-style-type: none"> Sensitive local access route selection, and siting of construction facilities, accompanied where necessary by noise attenuation measures and noise barriers. Use of modern, well maintained equipment fitted with abatement devices (e.g. mufflers, noise enclosures) Strict control of timing of activities (e.g. blasting and other high noise emissions); prohibition on night working if possible. Observance of seasonal sensitivities (e.g. breeding seasons), and alteration of activity to reduce noise levels at that time.
<ul style="list-style-type: none"> Underwater noise, e.g. from piling, infilling or dredging for fill material, may disturb sensitive aquatic species. 	<ul style="list-style-type: none"> Use of best practicable means to reduce noise and vibration impacts, e.g. soft starts, effective equipment maintenance and the use of enclosures.

Impacts	Mitigation
Resources and Waste	<ul style="list-style-type: none"> Water study prior to any activities, to inform a Sustainable Water Management Plan. If loss of habitat found to support priority ecosystem services is inevitable, development/implementation of mitigation, with a focus on maintaining functionality in local area.
<ul style="list-style-type: none"> Loss of wetland may affect supply and quality of water in surrounding area, as well as other resources supported by this habitat type (e.g. fish, timber), and ecosystem services supplied by it. Inefficient waste management during construction, operation and maintenance leading to excess consumption of materials, generation of wastes/emissions, pollution of soils and water 	<ul style="list-style-type: none"> Preparation of Waste Management Plan following the waste hierarchy, supported by staff training. Use of authorised contractors for hazardous and any other wastes which the project cannot dispose of safely.
<p>Loss, fragmentation and degradation of habitat, and severance of animal migration routes and pathways</p> <ul style="list-style-type: none"> Land clearance, drainage and infilling, causing loss or fragmentation of habitats (primarily wetland habitats; especially protected or ecologically sensitive areas and other areas of conservation interest), and degradation following poorly managed rehabilitation. Impacts on habitats and species from habitat alteration and degradation (e.g. changes in drainage, soil erosion, smothering by suspended sediment, pollution of water, soils or air, introduction of invasive species, changes in nutrient inputs to downstream habitats). 	<ul style="list-style-type: none"> Careful site selection and siting of all project components, with advice from biodiversity authorities/wildlife specialists. Wherever feasible, establishment of buffer zones around conservation areas, watercourses, and other locations identified as ecologically sensitive and avoidance or minimisation of activity within these zones. Rehabilitation of cleared areas with native species, and ecosystem restoration in habitats of conservation value, using specialist advice and input, backed up by a long-term monitoring programme and corrective actions as necessary. <p>Where development in sensitive areas cannot be avoided, mitigation may include:</p> <ul style="list-style-type: none"> Minimisation of area impacted, clear demarcation of remaining intact areas of habitat, and prohibition of activity into those areas for any purpose; maintenance of wildlife corridors between fragmented areas wherever possible. No clearance or infilling upstream of sensitive areas unless appropriately engineered drainage installed. Habitat rehabilitation and ecosystem restoration of areas no longer required after construction, as soon as possible. If loss of Critical Habitat is inevitable, development/implementation of an Offsets Programme. <p>Also see measures under Hydrology, Soils, Run-off and Flooding, Pollution of Soils and Water above, and Induced Access and Invasive Species below.</p>
<ul style="list-style-type: none"> Severance of aquatic routes and watercourses used for migration or for access to feeding and breeding areas; loss of or damage to stopover sites used by migratory birds. 	<ul style="list-style-type: none"> Sensitive site selection and siting of all project components, with advice from biodiversity authorities/wildlife specialists. Use of fish passes, retention of channels etc. to avoid impacts on animal movement. If loss of Critical Habitat is inevitable, development/implementation of an Offsets Programme.
<p>Impacts from Induced Access</p> <ul style="list-style-type: none"> Land reclamation in remote areas will encourage development and facilitate access, increasing disturbance and pressure on natural resources through bushmeat hunting, logging, fire, etc. 	<ul style="list-style-type: none"> Careful site selection and siting of all project components, with advice from biodiversity authorities/wildlife specialists to avoid remote and previously inaccessible areas where possible. Development of a construction camp siting strategy to avoid attracting people towards more remote areas, where possible. Restrictions on access to all temporary access roads, and their removal after construction. <p>See also Bushmeat Hunting below.</p>
<p>Bushmeat Hunting</p> <ul style="list-style-type: none"> Development and improved access within remote areas could lead to greater demand for bushmeat (from workforce and wider community), stimulate the wildlife trade and facilitate access to hunting areas. 	<ul style="list-style-type: none"> Bushmeat Hunting and Wildlife Trade Management Plan, agreed with government authorities and implemented jointly. Prohibition on workforce hunting, selling, or purchasing bushmeat, and training to support this requirement. Prohibition on workforce (except security personnel) having guns in work areas or accommodation. Sensitisation and public awareness campaigns against hunting and bushmeat the trade amongst local communities.

Impacts	Mitigation
<p>Direct Impacts on Flora and Fauna</p> <ul style="list-style-type: none"> • Clearance and draining of wetland habitat may lead to loss of plant and animal species. • Land reclamation could displace animals and disturb their habitats, by direct disturbance during construction and operation (e.g. from noise – including underwater noise, light disturbance at night, general human presence). 	<ul style="list-style-type: none"> • Careful site selection and siting of all project components, with advice from biodiversity authorities/wildlife specialists. • Careful planning of phasing and timing of construction activities, in particular drainage and infilling. • Demarcation and avoidance of areas of conservation interest (high value species, feeding or breeding sites, migration routes, etc.) where possible, and wildlife rescue and translocation where appropriate, under expert supervision. <p>Also see measures under Hydrology, Soils, Run-off and Flooding, Pollution of Soils and Water, and Induced Access above, and Invasive Species below.</p>
<p>Invasive Species</p> <ul style="list-style-type: none"> • Movement of plant and workforce into areas, deposition of fill material and rehabilitation activities could introduce invasive species which adversely impact fauna, flora, ecosystems, and crops. • Change in habitat type (increased occurrence of dry land) could encourage the spread of invasive pioneer species which may colonise surrounding wetland habitats. 	<ul style="list-style-type: none"> • Invasive Species Management Plan, which should be developed and implemented in consultation with authorities, including plans for monitoring in surrounding habitats and appropriate eradication measures for different species/groups of species. • Staff training and awareness raising in communities. • No introduction of exotic species (e.g. for site rehabilitation) without specialist vetting and government approval.
<p>Physical and Economic Displacement of People, Property, Assets and Resources</p> <ul style="list-style-type: none"> • Development or extension of areas of reclaimed land may physically displace people, or lead to the loss of assets or income, e.g. from fishing grounds, agricultural land. 	<ul style="list-style-type: none"> • Careful site selection and siting of all project components, and avoid occupation of areas which are inhabited or regarded as of high value by communities (e.g. fishing grounds, areas of high agricultural value) where possible. • Early development and sensitive implementation of resettlement planning, in accordance with national regulations and international good practice to compensate for any losses (both physical and economic).
<p>Economic Development and Employment</p> <ul style="list-style-type: none"> • Direct employment of local population in workforce, and stimulation of local economy through demand for goods and services will enhance livelihoods and economic activity in local communities, but potential for adverse effects if expectations not met and community relations are not well managed. 	<ul style="list-style-type: none"> • Development of an Employment Plan, with clear employment requirements and procedures for the construction and operational/maintenance workforce; fair and transparent hiring and staff management procedures. • Transparent and culturally appropriate communication with communities regarding employment opportunities. • Employment requirements and vocational training plan to be agreed with local institutions, so that local people can be trained to meet the project's needs in a timely fashion. • Development of measures to manage the transition after construction is complete, including SME development, ongoing opportunities for the workforce in land management and maintenance, reskilling and alternative employment.
<p>Cultural Heritage</p> <ul style="list-style-type: none"> • Displacement or damage to cultural heritage sites, harm to the setting, amenity value, etc. of the site during construction or operation. • Change to intangible cultural heritage due to increased access, and interaction with workforce. 	<ul style="list-style-type: none"> • Careful site selection and siting of all project components, taking account of community consultation/specialist surveys. • Development of a Cultural Heritage Management Plan covering tangible and intangible (e.g. local traditions and practices) cultural heritage. • Implementation of a "Chance Finds" procedure during construction. <p>See also Guidance Note on Physical Cultural Heritage.</p>
<p>Community Health, Safety and Security</p> <ul style="list-style-type: none"> • Poor construction management practices may lead to adverse effects on safety, human health and wellbeing. • Interaction between workforce and local communities may increase occurrence of communicable diseases, including HIV/AIDS and sexually transmitted diseases (STDs). • Drainage of wetland may reduce local incidence of water-related and water-borne diseases, e.g. malaria. 	<ul style="list-style-type: none"> • Good construction site "housekeeping" and management procedures (including site access, disease control measures). • Risk assessments and emergency response planning to consider impacts on local communities. <p>Also see measures under Pollution of Soils and Water above.</p> <ul style="list-style-type: none"> • Implementation of a health management system for the construction workforce, to ensure it is fit for work and that it will not introduce disease into local communities. • Training and awareness training for workforce and their dependents on HIV/AIDS and other STDs, and communicable diseases; health awareness raising campaigns for communities on similar topics.

Impacts	Mitigation
<p>Workforce-Community Interactions</p> <ul style="list-style-type: none"> Real or perceived disruption to normal community life, through the physical presence of a workforce. 	<ul style="list-style-type: none"> Adoption of a Stakeholder Engagement Plan, as a framework for early and ongoing community consultation. Implementation of a Grievance Procedure (see Grievance Procedure and Redress Mechanisms guidance note). Works procedures, defining a Code of Appropriate Conduct for all workers. Training for all staff in acceptable behaviour with respect to community interactions.
<p>In-migration</p> <ul style="list-style-type: none"> Individuals are likely to migrate into the area which may cause conflict with resident communities, and put pressure on resources and infrastructure. 	<ul style="list-style-type: none"> Careful site selection and siting of all project components, after consultation with communities and local authorities. Preparation and implementation of an Influx/In-migration Management Plan, in consultation with local authorities. <p>See also Economic Development and Employment, and Induced Access above</p>
<p>Labour and Working Conditions</p> <ul style="list-style-type: none"> Poor management of occupational health and safety leading to accidents, injuries and illnesses among workers; mental health issues due to remote or enclosed living. Differences in nationality, ethnicity, religion, etc. may lead to discrimination and harassment, and differences (perceived or real) in working conditions between workers may lead to resentments. 	<ul style="list-style-type: none"> Employment practices and working conditions should conform to International Labour Organisation (ILO) Standards and national regulations. Rest and recreational facilities and time should be provided, and rules on alcohol and drugs defined and clearly communicated to workers. The basis for differences in the standard of accommodation should be non-discriminatory; it should be documented and communicated transparently to the workforce. Clear and comprehensive health and safety reporting and grievance procedure system should be established, and be freely available to all of the workforce. <p>See also Employment and Economic Development.</p>

AGRICULTURE / AGRIBUSINESS SECTOR: FORESTRY

Investment in forestry supports the production of goods that contribute to economic development and enhance quality of life. However, development, expansion and operation of forestry projects have often caused widespread adverse impacts on natural and human environments. Environmental damage may include disruption or contamination of water courses and drainage systems, soil destabilization, habitat fragmentation and destruction, disturbance and loss of fauna and flora, and opening up frontier areas containing pristine landscapes. Forestry development may also be a source of adverse impacts on the human environment, particularly the displacement and resettlement of affected families and businesses, and health and safety.

Scope and structure

This keysheet provides a summary of the activities, typical environmental and social impacts, and potential mitigation and management measures relating to the development of forestry projects. It includes development, expansion or improvement of projects involving exploitation and management of natural forests and forest plantations for the purpose of ensuring supplies of goods (e.g. wood, non-wood forest products) or services (e.g. erosion control, watershed protection), and the maintenance of livelihoods dependent on them. It does not cover subsequent off-site timber processing or manufacture of goods from wood or other forest products.

This keysheet should be used specifically to help with drafting ToRs for ESIA's of forestry projects and with scoping and conducting ESIA's and preparing ESMPs. It can also help in reviewing ESIA's. It should be used in conjunction with the Bank's Guidance notes on ESIA's (including coverage of cumulative impacts) and with the Guidance Notes on specific safeguard topics including transboundary projects.

The keysheet is organised under the following headings, with substantive information provided in table form:

- Project components and activities.
- Sources of impact and receptors/resources.
- Mitigation and management options.

The phases of forestry projects considered are: design and planning, including site selection; project development; operation and maintenance; and where appropriate decommissioning (closure).

Project components and activities

The components of forestry projects are provided in Table 1, along with the activities involved in developing and implementing new projects or improving existing projects, broken down by project phase.

Sources of impact, receptors/ resources, and mitigation

Table 2 summarizes the main aspects of forestry projects that lead to typical impacts, the receptors and resources they affect, and options for mitigation. It considers impacts on the physical, biological and socioeconomic environment. The mitigation measures described assume that higher level design and planning measures, as described in Table 1, have already been implemented.

The guidance on impacts and options for their mitigation can be used to help discussions with the borrower or client and improve their understanding of the Bank's requirements. They should also be used to assist preparation of ToRs for an ESIA so that they are tailored to the particular circumstances of the forestry project under consideration.

Table 1: Summary of Activities associated with Forestry Projects

Components	Mitigation
<p>Forestry</p> <ul style="list-style-type: none"> Forest or plantation area, including associated watershed, or area of land to be planted. Seed stands/orchards, nursery areas. Inputs, including fertilisers, pesticides, herbicides etc. Related infrastructure (e.g. irrigation systems). Access roads into forest/plantation areas and connecting to processing facilities and markets. 	<p>Ancillary facilities</p> <ul style="list-style-type: none"> Temporary construction facilities (e.g. workshops, laydown areas, workers' accommodation, quarries and borrow pits). Access roads within and between temporary facilities and the working area, permanent access roads. Landscaping features, etc.
Activity (1)	
Design – Site Selection and Planning	<p>Screening , Scoping and ESIA</p> <p>Preparation of ESMP</p> <p>Agreement of loan covenants</p>
<p>Strategic planning (options analysis, cost-benefit analysis, strategic site selection, initial design), and for major forestry programmes, strategic environmental and social assessment (SESA), to establish:</p> <ul style="list-style-type: none"> Major constraints and alternatives (e.g. with respect to major settlements, watersheds and areas of biodiversity conservation importance). Design procedures such that environmental and social considerations are given equal weight to forestry production and financial ones. <p>Site-specific planning (detailed design), taking account of environmental and social sensitivities and consultation with communities, draw upon the following environmental and socioeconomic documentation, all of which should comply with national regulations and international good practice:</p> <ul style="list-style-type: none"> Environmental and Social Impact Assessment (ESIA); Environmental and Social Management Plan (ESMP). Stakeholder Engagement Plan (SEP); Resettlement Action Plan (RAP). 	
Construction/Project Development	<p>Monitoring of ESMP performance</p> <p>Monitoring of compliance with loan covenants</p> <p>Monitoring of sub-contractor contract provisions</p>
<p>Construction/project development activities will include:</p> <ul style="list-style-type: none"> For all forestry operations (timber extraction and plantation development), preparation for and construction of access roads and other infrastructure (e.g. staff accommodation, workshops, log-yards, cable winch locations for timber harvesting, etc.). For plantations, site preparation (e.g. clearance, ploughing, slash and burn). Planting of seeds, transplanting of young plants. Establishing temporary access to work and ancillary areas, demarcating clearance zones, establishing access control. Import of relatively small quantities of building materials. Sourcing and establishing water supply from surface and/or groundwater, where necessary for irrigation. 	
Activity (2)	
<p>The equipment required will include heavy mobile plant (e.g. graders, bulldozers, excavators, cable winches) and temporary fixed plant such as concrete batching plant and power generators.</p>	
Operation and Maintenance	Project implementation: Compliance Monitoring
<p>Operation and maintenance of forestry projects will entail many of the activities described above for the project development phase. It will include activities such as breeding, planting, cultivation and management (e.g. pruning, thinning, controlled burns, pest management) of trees and other plants, and the harvesting and primary processing of wood and non-wood forest products. Forestry projects may entail varying levels of intervention, involving control of environmental conditions such as water quality, nutrient supply, and pest and disease prevalence.</p> <p>These activities may contribute to direct and indirect impacts described in Table 2.</p>	
Decommissioning (Closure)	Project Completion: Compliance Report
<p>Where temporary roads and facilities are no longer required (if, for example, they are not required for maintenance or harvesting of timber or other products) they should be decommissioned and rehabilitated in accordance with a site-specific closure plan developed in consideration of international good practice. The decommissioning process will include site clearance, removal of all equipment, appropriate disposal of waste materials, soil ripping and re-grading where necessary.</p> <p>Forestry projects are normally intended to operate for a prolonged period, and so it would not be appropriate for closure or decommissioning plans to be prepared until a few years prior to this occurring.</p>	

Table 2: Forestry Development: Impacts and Mitigation

Impacts	Mitigation
<p>Geology/Hydrogeology</p> <ul style="list-style-type: none"> • Interruption of hydrogeology and groundwater flows from ground clearance, construction of access roads, haul roads and other works, and from increased water retention in newly forested areas. 	<ul style="list-style-type: none"> • Take account of local hydrological conditions in site/route selection and design (e.g. avoid interrupting permanent waterways, do not hamper natural drainage of water bodies and watercourses, avoid or restrict operations in areas prone to flooding especially during rainy season). • See Pollution of Soils and Water below.
<p>Soils, Run-off and Flooding</p> <ul style="list-style-type: none"> • Loss, damage or disruption of soil from ground clearance or construction works for access roads and other facilities, or during harvesting; may lead to introduction of soils to waterbodies. • Changes in drainage patterns and water retention in newly forested areas leading to altered patterns of soil erosion and flooding. 	<ul style="list-style-type: none"> • Minimisation of cleared areas and soil disturbance, retention of any topsoil removed for restoration following activities in an area, revegetation as soon as feasible with native species. • Early installation and regular maintenance of drainage and diversion structures to maintain natural drainage patterns. • Use of silt traps, etc; drainage outlets to discharge into vegetated areas if possible; vegetation along watercourses and drainage lines to be retained if possible. • Use of modern cable-yarding and aerial timber extraction methods, e.g. "skyline" systems, to reduce soil disturbance and compaction and "channelling" • Careful consideration of location (areas of instability etc.) and timing (overall duration and seasonality) of works, and design to reduce erosion and facilitate maintenance.
<p>Pollution of Soils and Water</p> <ul style="list-style-type: none"> • Pollution of watercourses from wastewater (e.g. pesticides, herbicides, fertilisers), as well as waste from sawmilling, etc. and workforce sewage. 	<ul style="list-style-type: none"> • Reduce nutrient and chemical inputs (e.g. through use of biological pest and weed control methods, appropriate choice and siting of plantations). • Ensure that waste and drainage water complies with discharge standards and treat accordingly. • Implementation of standard good wastewater management and disposal procedures. • Installation of sewage treatment to meet required standards; hygiene training for workforce.
<ul style="list-style-type: none"> • Release of hazardous substances (e.g. accidental diesel spills and leaks) leading to soil, surface or groundwater contamination. 	<ul style="list-style-type: none"> • Materials handling and control procedures, use of storage and containment equipment meeting international standards. • Control of construction movements and prohibition of vehicle washing in watercourses, and other similar practices. • Emergency response plans during construction (contractors and local authorities) and operation (local authorities).
<p>Air Quality</p> <ul style="list-style-type: none"> • Dust and emissions from construction, maintenance and operational activities, could affect human health, vegetation and wildlife. 	<ul style="list-style-type: none"> • Sensitive site selection and siting of project components. • Use of modern equipment meeting appropriate emissions standards, and regular preventative maintenance. • Dust control and suppression measures around cleared or logged areas and construction, e.g. dampening, use of vegetation hedges. • No use of ozone depleting substances during construction. • Use of appropriate solid waste disposal facilities (including prohibition on burning of waste materials).
<p>Noise and Vibration</p> <ul style="list-style-type: none"> • Noise and vibration from equipment, traffic and activities, and from tree felling, primary processing and from traffic may disturb sensitive noise receptors (human, fauna). 	<ul style="list-style-type: none"> • Sensitive local siting of components and construction sites, accompanied where necessary by noise attenuation measures. • Use of modern equipment fitted with abatement devices (e.g. mufflers, noise enclosures); good maintenance regime. • Strict controls of timing of noisy activities e.g. tree felling; prohibition on night working if possible. • Observance of seasonal sensitivities (e.g. breeding seasons), and alteration of activity to reduce noise levels at that time.

Impacts	Mitigation
<p>Resources and Waste</p> <ul style="list-style-type: none"> Excessive or unregulated harvest of a small range of target tree species and other forest products, and accidental loss of other non-targeted species, may deplete populations and place pressure on local supply. Abstraction of water from surface or ground water sources for use in forest plantation areas may affect supply for human communities and ecosystems. 	<ul style="list-style-type: none"> Institute measures to ensure sustainability of forestry activities, through use of quotas, regular and sufficient re-planting, designation of reserve areas etc. Education and awareness-raising around the consequences of over-extraction and deforestation. Include consideration of local resource needs within forestry planning. Water study prior to any abstraction, to inform a Sustainable Water Management Plan. No abstraction without prior approval of relevant authorities at all locations. Promotion of water efficiency (including leak detection, preventative maintenance of equipment) and water recycling.
<ul style="list-style-type: none"> Inefficient waste management during construction, operation and maintenance leading to excess consumption of materials, generation of wastes/emissions, pollution of soils and water. 	<ul style="list-style-type: none"> Preparation of Waste Management Plan following the waste hierarchy, supported by training and awareness-raising around topic of waste for workforce and for local community. Earthworks to be designed to achieve a balance between cut and fill wherever possible. Use of authorised contractors for hazardous and any other wastes which the project cannot dispose of safely.
<p>Loss, fragmentation and degradation of habitat, and severance of animal migration routes and pathways</p> <ul style="list-style-type: none"> Logging of native forest cover, clearance of plantation areas and introduction of newly forested areas and associated infrastructure such as access roads, causing loss, degradation or fragmentation of protected or ecologically sensitive areas (e.g. forest, wetlands, migration routes), and other areas of conservation interest. 	<ul style="list-style-type: none"> Careful siting of all project components, with advice from biodiversity authorities/wildlife specialists. Wherever feasible, establishment of buffer zones around conservation areas, watercourses, and other locations identified as ecologically sensitive, and avoidance or minimisation of activity within these zones. Rehabilitation of cleared areas with native species where possible, and ecosystem restoration in habitats of conservation value, using specialist advice and input so as to maintain the integrity of the habitat, backed up by a long-term monitoring programme and corrective actions as necessary.
<ul style="list-style-type: none"> Excessive or unregulated harvests, especially for small number of target species, and introduction of low diversity forest plantations, causing loss and degradation of forest habitat, and loss of biodiversity within forest habitats. 	<p>Where development in sensitive areas cannot be avoided, mitigation may include:</p> <ul style="list-style-type: none"> Minimisation of area impacted, clear demarcation of remaining intact areas of habitat, and prohibition of activity in those areas for any purpose; maintenance of wildlife corridors between fragmented areas wherever possible. No logging or ground clearance upstream of sensitive areas unless appropriately engineered drainage installed. Habitat rehabilitation and ecosystem restoration of areas no longer required after construction, as soon as possible. Wildlife crossings for terrestrial animals, and design of culverts/crossing structures to avoid impacts on animal movement. If loss of Critical Habitat is inevitable, development/implementation of an Offsets Programme. Education of workforce and local communities as to the potential damage deforestation may cause to ecosystems, and on methods for avoiding damage (e.g. selective logging, re-planting, and maintenance of diversity through species selection).
<ul style="list-style-type: none"> Impacts on habitats and species from habitat alteration and degradation during construction and operation (e.g. changes in water flow and drainage, soil erosion, pollution of water, soils or air, loss of tree species diversity). 	<p>See also Pollution of Soils and Water above, and Induced Access and Invasive Species below.</p>
<p>Impacts from Induced Access</p> <ul style="list-style-type: none"> Development of forestry projects in remote or undeveloped areas, especially construction of roads into forests and plantations, may lead to further development, increased disturbance and pressure on natural resources through bushmeat hunting, logging, fire, etc. 	<ul style="list-style-type: none"> Careful site selection, with advice from biodiversity authorities/wildlife specialists to avoid remote and previously inaccessible areas where possible. Where possible, instate access controls on roads leading to project facilities (e.g. plantations, processing facilities) in otherwise undeveloped or remote areas. <p>See also Bushmeat Hunting below.</p>

Impacts	Mitigation
<p>Bushmeat Hunting</p> <ul style="list-style-type: none"> Increased development and access into remote areas could lead to greater demand for bushmeat (from workforce and wider community), stimulate the wildlife trade and facilitate access to hunting areas. 	<ul style="list-style-type: none"> Bushmeat Hunting and Wildlife Trade Management Plan, agreed with government authorities and implemented jointly. Prohibition on workforce hunting, selling, or purchasing bushmeat, and training to support this requirement. Prohibition on workforce (except security personnel) having guns in work areas or accommodation. Sensitisation and public awareness campaigns against hunting and bushmeat the trade amongst local communities.
<p>Direct Impacts on Flora and Fauna</p> <ul style="list-style-type: none"> Clearance of vegetation may lead to loss of plant species and habitat of conservation interest; direct loss of plant species through harvesting. Clearance, construction, and operational activities (e.g. planting, tree felling, traffic, and increased human presence) may displace/ disturb animals. 	<ul style="list-style-type: none"> Careful site selection and siting of all project components, with advice from biodiversity authorities/wildlife specialists. Careful planning of phasing and timing of activities. Demarcation and avoidance of areas of conservation interest (high value species, feeding or breeding sites, migration routes, etc.) where possible, and wildlife rescue and translocation where appropriate, under expert supervision. Institute measures to ensure sustainability of forestry projects, e.g. use of quotas and size thresholds, regular and sufficient re-planting, designation of reserve areas, monitoring of forest health, specific protection of species of conservation or ecological importance. <p>Also see measures under Soils, Run-off and Flooding, Pollution of Soils and Water, and Induced Access above, and Invasive Species below</p>
<p>Invasive Species</p> <ul style="list-style-type: none"> Movement of plant and workforce into areas (especially more remote areas), and of road traffic, could introduce invasive species which adversely impact fauna, flora, ecosystems, and crops. Cultivation of non-native species may result in establishment of wild populations, or genetic mixing with wild populations, leading to negative impacts on local flora and fauna. 	<ul style="list-style-type: none"> Invasive Species Management Plan, developed and implemented in consultation with authorities, including appropriate eradication measures for different species/groups of species Staff training and awareness raising in communities on potential impacts of invasive species Encourage use of indigenous species in forest plantations No introduction of exotic species (e.g. for culture) without comprehensive study and government approval Where exotic species are cultured, monitor status of native species in surrounding area Where possible, clearance of invasive species during routine maintenance
<p>Physical and Economic Displacement of People, Property, Assets and Resources</p> <ul style="list-style-type: none"> Development of forestry projects may physically displace people, or lead to loss of assets (e.g. agricultural land). Potential for economic displacement of specific individuals or groups with existing reliance on forests and forest products if they are excluded from projects. 	<ul style="list-style-type: none"> Careful site selection and siting of project facilities, avoiding occupation of areas which are inhabited or regarded as having high value by communities where possible. Early development and sensitive implementation of resettlement planning, in accordance with national regulations and international good practice to compensate for any losses (both physical and economic). Put in place employment plan, giving preference to employment within local communities. Develop detailed baseline of existing reliance on forest resources in the project area, both within and outside local communities; from this, identify specific groups that may not benefit from the project and adopt corrective measures as required; develop compensation measures for affected parties.
<p>Economic Development and Employment</p> <ul style="list-style-type: none"> Direct employment of local population in workforce, and stimulation of local economy through export of and demand for goods and services will enhance livelihoods and economic activity in local communities; potential for adverse effects if expectations not met and community relations are not well managed. Procurement of local goods and services for development of related facilities and equipment, and for the workforce, could deplete resources available for local communities. 	<ul style="list-style-type: none"> A community-based approach is encouraged: the workforce should as much as possible be sourced from the local area or region; further skills required for forestry, processing or maintenance activities to be included in local training programs and developed within the community, in order to retain value in local community. Development of an Employment Plan, with clear employment requirements and procedures for the workforce. Transparent and culturally appropriate communication with communities regarding employment opportunities. Fair and transparent hiring and staff management procedures. Procedures for sustainable local procurement, in consultation with local authorities and community leaders. Local capacity building to foster community resilience. Monitoring of local prices, and exploration of corrective measures (e.g. alternative sourcing) if appropriate.

Impacts	Mitigation
<p>Cultural Heritage</p> <ul style="list-style-type: none"> Displacement or damage to cultural heritage sites by ground clearance and other activities; exclusion of community from areas of cultural importance; harm to the setting, amenity value, etc. of the site due to road construction, tree felling and siting of facilities. Changes to intangible cultural heritage due to increased access, and interaction with non-local workforce. 	<ul style="list-style-type: none"> Careful site selection and siting of all project components, taking account of community consultation/specialist surveys. Development of a Cultural Heritage Management Plan covering tangible and intangible (e.g. local traditions and practices) cultural heritage. Implementation of a "Chance Finds" procedure during construction. <p>See also Guidance Note on Physical Cultural Heritage</p>
<p>Community Health, Safety and Security</p> <ul style="list-style-type: none"> Poor management practices may lead to adverse effects on safety, human health and wellbeing. 	<ul style="list-style-type: none"> Good site "housekeeping" and management procedures (including site access). Disease control measures, e.g. no pools of standing water, rodent control, treatment of water. Risk assessments and emergency response planning to consider impacts on local communities. Awareness raising campaigns for communities. <p>See also control of pollution under Physical Impacts heading.</p>
<ul style="list-style-type: none"> Changes to local food availability, due to export of increased proportion of forest products and exclusion from forest areas used for foraging, may lead to malnutrition. 	<ul style="list-style-type: none"> Provision of community support and development mechanisms for subsistence agriculture.
<ul style="list-style-type: none"> Interaction between workforce and local communities may increase occurrence of communicable diseases, including HIV/AIDS and sexually transmitted diseases (STDs). 	<ul style="list-style-type: none"> Implementation of a health management system for the workforce, to ensure it is fit for work and that it will not introduce disease into local communities. Training and awareness training for workforce and their dependents on HIV/AIDS and other STDs, and communicable diseases including malaria; health awareness raising campaigns for communities on similar topics.
<p>Workforce-Community Interactions</p> <ul style="list-style-type: none"> Real or perceived disruption to normal community life, through the physical presence of a workforce. 	<ul style="list-style-type: none"> Adoption of a Stakeholder Engagement Plan, as a framework for early and ongoing community consultation. Implementation of a Grievance Procedure (see Grievance Procedure and Redress Mechanisms guidance note). Works procedures, defining a Code of Appropriate Conduct for all workers. Training for all staff in acceptable behaviour with respect to community interactions.
<p>In-migration</p> <ul style="list-style-type: none"> Local development and improved access may encourage migration into the area, causing conflict with resident communities, and putting pressure on resources and infrastructure. 	<ul style="list-style-type: none"> Careful site selection and siting of all project components, after consultation with communities and local authorities. Preparation and implementation of an Influx/In-migration Management Plan, in consultation with local authorities. <p>See also Economic Development and Employment, and Induced Access above</p>
<p>Labour and Working Conditions</p> <ul style="list-style-type: none"> Poor management of occupational health and safety could lead to accidents, injuries and illnesses among workers (e.g. during tree felling, processing); mental health issues may arise due to remote or enclosed living. Differences in nationality, ethnicity, religion, etc. may lead to discrimination and harassment, and differences (perceived or real) in working conditions between workers may lead to resentments. 	<ul style="list-style-type: none"> Employment practices and working conditions should conform to International Labour Organisation (ILO) Standards and national regulations. Rest and recreational facilities and time should be provided, and rules on alcohol and drugs defined and clearly communicated to workers. The basis for differences in the standard of accommodation should be non-discriminatory; it should be documented and communicated transparently to the workforce. Clear and comprehensive health and safety reporting and grievance procedure system should be established, and be freely available to all of the workforce. <p>See also Employment and Economic Development and Human Rights</p>

WATER SUPPLY AND SANITATION SECTOR: URBAN WATER SUPPLY AND SANITATION

Investment in urban water supply and sanitation projects contributes to economic development, livelihoods and enhanced quality of life. However, the construction, rehabilitation, maintenance and operation of urban water supply and sanitation systems have often caused widespread adverse impacts on natural and human environments. Environmental damage may include disruption or contamination of water courses and drainage systems, soil destabilization and erosion and sedimentation. These developments may also be a source of adverse impacts on the human environment, particularly conflicts over water use, the displacement and resettlement of affected families and businesses, and health and safety.

Scope and structure

This keysheet provides a summary of the activities, typical environmental and social impacts, and potential mitigation and management measures relating to the development of urban water supply and sanitation projects for meeting the water requirements of urban inhabitants, administrations, businesses and industries. Projects considered include construction, improvement or expansion of surface or ground water fed systems, involving water harvesting or abstraction, storage and distribution; collection, treatment and disposal of wastewater; and the construction and maintenance of the structures necessary for these processes.

This keysheet should be used specifically to help with drafting ToRs for ESIs of urban water supply and sanitation projects and with scoping and conducting ESIs and preparing ESMPs. It can also help in reviewing ESIs. It should be used in conjunction with the Bank's Guidance Notes on ESIs (including coverage of cumulative impacts) and with the Guidance Notes on specific safeguard topics.

The keysheet is organised under the following headings, with substantive information provided in table form:

- Project components and activities.
- Sources of impact and receptors/resources.
- Mitigation and management options.

The phases of urban water supply and sanitation projects considered are: design and planning, including site selection; construction; operation and maintenance; and where appropriate decommissioning (closure).

Project components and activities

The components of urban water supply and sanitation projects are provided in Table 1, along with the activities involved in developing new or upgraded systems, and in operating systems, broken down by project phase.

Sources of impact, receptors/ resources, and mitigation

Table 2 summarizes the main aspects of urban water supply and sanitation project activities that lead to typical impacts, the receptors and resources they affect, and options for mitigation. It considers impacts on the physical, biological and socioeconomic environment. The mitigation measures described assume that higher level design and alignment planning measures, as described in Table 1, have already been implemented.

The guidance on impacts and options for their mitigation can be used to help discussions with the borrower or client and improve their understanding of the Bank's requirements. They should also be used to assist preparation of ToRs for an ESI so that they are tailored to the particular circumstances of the urban water supply and/or sanitation project under consideration.

Table 1: Summary of Activities associated with Urban Water Supply and Sanitation

Components	Mitigation
<p>Water Supply and Sanitation</p> <ul style="list-style-type: none"> Intake structures, wells/boreholes etc. Surface water impoundments, water storage areas (e.g. reservoirs, tanks). Water distribution pipelines. Wastewater collection and storage systems. Water and wastewater treatment. Drainage and water recovery systems; control structures, e.g. erosion control. 	<p>Ancillary Works</p> <ul style="list-style-type: none"> Temporary construction facilities (e.g. workshops, laydown areas, working corridor outside the footprint, workers' accommodation, quarries). Access roads within and between temporary facilities and construction sites, permanent access and maintenance roads.
Activity	
Design – Site Selection and Planning	<p>Screening, Scoping and ESIA</p> <p>Preparation of ESMP</p> <p>Agreement of loan covenants</p>
<p>Strategic planning (options analysis, cost-benefit analysis, strategic site selection, initial design), to establish:</p> <ul style="list-style-type: none"> Major environmental and social constraints and alternatives (e.g. with respect to high density settlement, areas of biodiversity conservation or cultural, recreational or aesthetic importance importance). Design procedures such that environmental and social considerations are given equal weight to engineering and financial ones. 	
<p>Site-specific planning (detailed design), taking account of environmental and social sensitivities and consultation with communities, drawing upon the following environmental and socioeconomic documentation, all of which should comply with national regulations and international good practice:</p> <ul style="list-style-type: none"> Environmental and Social Impact Assessment (ESIA). Environmental and Social Management Plan (ESMP). Stakeholder Engagement Plan (SEP). Resettlement Action Plan (RAP). 	
Construction	<p>Monitoring of ESMP performance</p> <p>Monitoring of compliance with loan covenants</p> <p>Monitoring of sub-contractor contract provisions</p>
<p>Construction activities will include:</p> <ul style="list-style-type: none"> Establishing temporary access to work and ancillary areas, demarcating clearance zones, establishing access control. Clearance and levelling of some areas and major earthworks (e.g. creating impoundments, laying distribution pipelines, introducing ditches and other control structures) where required. Sourcing and establishing water supply from surface/groundwater (e.g. creating diversions, digging wells). Building control /distribution/ impoundment structures for water supply (e.g. reservoirs, pipeline systems), collection and storage facilities for wastewater (e.g. tanks, ponds, treatment works). Location and development of quarries, import of materials, e.g. aggregate/ballast. Improvement of existing drainage and introduction of new drainage, including culverts if required. 	
<p>The equipment required will include heavy mobile plant (e.g. graders, bulldozers, excavators) and temporary fixed plant such as concrete batching plant and power generators.</p>	
Operation and Maintenance	Project implementation: Compliance Monitoring
<p>During operation activities will include the abstraction of water from a local water source; water storage in containment areas such as reservoirs; treatment of water; distribution of water to collection points via a piped network; and collection, treatment and disposal of wastewater. These activities may contribute to direct and indirect impacts described in Table 2.</p>	
<p>Maintenance of urban water supply and sanitation systems will entail many of the activities described above for the construction phase, although in general they are likely to be smaller in scale and spatial extent. It will include activities such as clearing and maintaining water collection and storage systems, and servicing mechanical components such as pumps.</p>	
Decommissioning (Closure)	Project Completion: Compliance Report
<p>Where temporary roads and facilities used in the construction phase are no longer required (if, for example, they are not required for maintenance) they should be decommissioned and rehabilitated in accordance with a site-specific closure plan developed in consideration of international good practice. The decommissioning process will include site clearance, removal of all equipment, appropriate disposal of waste materials, soil ripping and re-grading where necessary.</p>	
<p>Water supply and sanitation systems are normally intended to operate for a prolonged period, and so it would not be appropriate for closure or decommissioning plans to be prepared until a few years prior to this occurring.</p>	

Table 2: Urban Water Supply and Sanitation (WSS) Projects: Impacts and Mitigation

Impacts	Mitigation
<p>Geology/Hydrogeology</p> <ul style="list-style-type: none"> • Interruption or disruption of surface and groundwater flows from construction, excavation and ground clearance, and reduced flows during operation. • Lowering of water table due to excessive abstraction; this may result in salinization, especially in coastal areas. 	<ul style="list-style-type: none"> • Design to take account of local hydrological conditions (e.g. avoid crossing permanent waterways, do not hamper drainage of surface water, avoid works in areas prone to flooding especially during rainy season). • Minimise the loss of water caused by leaks, evaporation and infiltration (e.g. use of appropriate materials to construct piped network and regular maintenance of the system, appropriate containment of all water storage areas). • Ensure proper water management by adjusting abstracted volumes annually depending on aquifer recharge, establishing fees for water users, controlling access to water for other purposes (e.g. industry).
<p>Soils, Run-off and Flooding</p> <ul style="list-style-type: none"> • Loss, damage or disruption of soil/sediments. • Introduction of sediments to watercourses or interruption of drainage patterns, as a result of ground clearance, earthworks and the introduction of drainage structures. 	<ul style="list-style-type: none"> • Minimisation of cleared areas and soil disturbance, revegetation as soon as feasible (with native species if not crops). • Early installation and regular maintenance of drainage and diversion structures, silt traps, etc; drainage outlets to discharge into vegetated areas if possible; vegetation along watercourses and drainage lines to be retained if possible. • Retention of topsoil for restoration (including tilling and revegetation) as soon as practicable. • Careful consideration of timing of works (overall duration and seasonality). • Design systems so as to reduce sedimentation and facilitate drainage and maintenance.
<p>Pollution of Soils and Water</p> <ul style="list-style-type: none"> • Contamination of water within water supply network; pollution of watercourses due to wastewater inputs, especially accidental releases and inadequately treated wastewater; potential contamination of soils as a result of wastewater leaks from treatment basins and sludge mismanagement. 	<ul style="list-style-type: none"> • Ensure that drainage and discharged wastewater complies with discharge standards and treat wastewater accordingly; plan discharge of wastewater in accordance with the absorbing capacity of receiving water bodies. • Implementation of standard good wastewater and sewage sludge management procedures, including appropriate treatment and monitoring quality of receiving waters and soils. • Conserve vegetation along water bodies and near wetlands, especially at wastewater discharge points. • Provide education to workforce on hygienic conditions and behaviours. • Use of appropriate materials to construct piped network and regular maintenance of the system, appropriate containment of all water storage areas.
<ul style="list-style-type: none"> • Release of hazardous substances during construction or maintenance (e.g. accidental spills and leaks) and during operation (e.g. chemicals used in water and wastewater treatment) leading to soil, surface or groundwater contamination. 	<ul style="list-style-type: none"> • Materials handling and control procedures, use of storage and containment equipment meeting international standards. • Control of construction/maintenance vehicle movements and prohibition of vehicle washing in watercourses, and similar practices. • Emergency response plans during construction (contractors and local authorities) and operation (local authorities).
<p>Air Quality</p> <ul style="list-style-type: none"> • Dust and emissions from construction and maintenance activities, and noxious gases or odours from sewage treatment and sludge disposal, could affect human health, vegetation and wildlife, and may have nuisance value for nearby receptors. 	<ul style="list-style-type: none"> • Sensitive site selection and siting of project components. • Use of modern equipment meeting appropriate emissions standards, and regular preventative maintenance. • Dust control and suppression measures such as dampening, use of vegetation hedges etc. • No use of ozone depleting substances during construction. • Ensure sewage storage and treatment facilities are appropriately contained; cover sludge with lime/earth at disposal sites.
<p>Noise and Vibration</p> <ul style="list-style-type: none"> • Noise and vibration from construction and maintenance equipment, traffic and activities, may disturb sensitive noise receptors (i.e. humans). 	<ul style="list-style-type: none"> • Sensitive local access road route selection and siting of construction facilities, accompanied where necessary by noise attenuation measures. • Use of modern, well maintained equipment fitted with abatement devices (e.g. mufflers, noise enclosures). • Strict controls of timing of activities, e.g. blasting and other high noise emissions; prohibition on night working.

Impacts	Mitigation
<p>Resources and Waste</p> <ul style="list-style-type: none"> Abstraction of significant volume of water from surface or ground water sources may affect supply for other water users and ecosystems, and result in conflicts over water use. 	<ul style="list-style-type: none"> Abstraction to take place with approval of relevant authorities at all locations. Water study prior to any abstraction, to inform a Sustainable Water Management Plan. Regular preventative maintenance of all system components to ensure that water wastage is as far as possible limited. Promotion of water efficiency and water recycling: implement water fees/tariffs and other demand management measures to avoid the wastage of water or over-consumption. Clearly define water rights and water user fees and conditions in consultation with affected groups.
<ul style="list-style-type: none"> Inefficient waste management during construction, operation and maintenance leading to excess consumption of materials, generation of wastes/emissions, pollution of soils and water. 	<ul style="list-style-type: none"> Preparation of Waste Management Plan following the waste hierarchy, supported by staff training. Earthworks to be designed to achieve a balance between cut and fill wherever possible. Use of authorised contractors for hazardous and any other wastes which the project cannot dispose of safely. Implementation of standard good wastewater and sewage sludge management procedures.
<p>Loss, fragmentation and degradation of habitat, and severance of animal migration routes and pathways</p> <ul style="list-style-type: none"> Earthworks and construction causing loss, degradation or fragmentation of protected or ecologically sensitive areas (e.g. wetlands, urban natural areas and open spaces), and other areas of conservation interest, and degradation following poorly managed rehabilitation. 	<ul style="list-style-type: none"> Careful siting of all project components. Wherever feasible, establishment of buffer zones around conservation areas, watercourses, and other locations identified as ecologically sensitive and avoidance or minimisation of activity within these zones. Rehabilitation of cleared areas with native species, and ecosystem restoration in habitats of conservation value, using specialist advice and input so as to maintain the integrity of the habitat, backed up by a long-term monitoring programme and corrective actions as necessary. <p>Where development in sensitive areas cannot be avoided, mitigation may include:</p> <ul style="list-style-type: none"> Minimisation of area impacted, clear demarcation of remaining intact areas of habitat, and prohibition of activity into those areas for any purpose; prohibit or minimise activities in vicinity of sensitive areas, e.g. upstream. Habitat rehabilitation and ecosystem restoration of areas no longer required to occur as soon as possible after construction. See also Pollution of Soils and Water above
<ul style="list-style-type: none"> Impacts on habitats and species from habitat alteration and degradation (e.g. reduction in water supply, changes in water flow and drainage, soil erosion, pollution of water, soils or air, introduction of invasive species). 	
<p>Direct Impacts on Flora and Fauna</p> <ul style="list-style-type: none"> Earthworks and clearance may lead to loss of plant species and habitats of conservation interest. Development could displace animals and disturb their habitats, by direct disturbance during construction and operation (e.g. from noise, light disturbance at night). 	<ul style="list-style-type: none"> Careful site selection and siting of all project components, with advice from biodiversity authorities/wildlife specialists. Careful planning of phasing and timing of construction activities. Demarcation and avoidance of areas of conservation interest (high value species, feeding or breeding sites, migration routes, etc.) where possible, and wildlife rescue and translocation where appropriate, under expert supervision. <p>Also see measures under soils, run-off and flooding, pollution of soils and water, noise / vibration and induced access above, and invasive species below</p>
<p>Physical and Economic Displacement of People, Property, Assets and Resources</p> <ul style="list-style-type: none"> Development or upgrading of WSS systems may physically displace small numbers of people, or lead to loss of assets e.g. loss of vegetable plots or livestock grazing land. Water flow reduction downstream causing adverse effects on water supply for other water users. Disruption of economic activities, particularly if they represent potential sources of water contamination. 	<ul style="list-style-type: none"> Careful site selection and siting of all project components, avoiding occupation of areas which are inhabited or regarded as of high value by communities (e.g. horticulture, community orchards) where possible. Early development and sensitive implementation of resettlement planning, in accordance with national regulations and international good practice to compensate for any losses (both physical and economic). Develop corrective/compensation measures for affected parties where required (e.g. vulnerable groups). Create a water user organisation to effectively manage water resources and ensure equitable access among users.

Impacts	Mitigation
<p>Economic Development and Employment</p> <ul style="list-style-type: none"> • Direct employment of local population in workforce, and stimulation of local economy through improved infrastructure and demand for goods and services will enhance livelihoods and economic activity; potential for adverse effects if expectations not met and community relations are not well managed. 	<ul style="list-style-type: none"> • Development of an Employment Plan, with clear employment requirements and procedures for the construction and operational/ maintenance workforce. • Transparent and culturally appropriate communication with communities regarding employment opportunities. • Fair and transparent hiring and staff management procedures. • Employment requirements and vocational training plan to be agreed with local institutions, so that local people can be trained to meet the project's needs in a timely fashion.
<p>Cultural Heritage</p> <ul style="list-style-type: none"> • Displacement or damage to cultural heritage sites by construction activities, harm to local setting, amenity value, etc. • Change to intangible cultural heritage due to increased access, and interaction with workforce. 	<ul style="list-style-type: none"> • Careful site selection and siting of all project components, taking account of community consultation/specialist surveys. • Development of a Cultural Heritage Management Plan covering tangible and intangible (e.g. local traditions and practices) cultural heritage. • Implementation of a "Chance Finds" procedure during construction. <p>See also Guidance Note on Physical Cultural Heritage.</p>
<p>Community Health, Safety and Security</p> <ul style="list-style-type: none"> • Poor construction management practices may lead to adverse effects on safety, human health and wellbeing. 	<ul style="list-style-type: none"> • Good construction site "housekeeping" and management procedures (including site access). • Risk assessments and emergency response planning to consider impacts on local communities. <p>See also Pollution of Soils and Water above.</p>
<ul style="list-style-type: none"> • Interaction between workforce and local communities may increase occurrence of communicable diseases, including HIV/AIDS and sexually transmitted diseases (STDs). 	<ul style="list-style-type: none"> • Implementation of a health management system for workforce, to ensure it is fit for work and that it will not introduce disease into local communities. • Training and awareness raising for workforce and their dependents on HIV/AIDS and other STDs, and communicable diseases including malaria; health awareness raising campaigns for communities on similar topics.
<ul style="list-style-type: none"> • Changes in exposure to water-borne and water-related diseases, especially those associated with water-dwelling disease vectors (new areas of standing water created) and with wastewater (if not properly treated). • Improved health through better access to drinking water; potential for adverse effects if water quality or availability is poor or unreliable. 	<ul style="list-style-type: none"> • Provide information, education and communication about safe uses of water and hygienic behaviour. • Implement environmental management measures for vector control: e.g. monitoring for key vectors; contact avoidance via site selection; focal insecticide and molluscicide application. • Ensure adequate water supply for addressing the effective demands of the local community. • Establish regular controls and maintenance activities to improve reliability and quality of water supply (e.g. through education and training, measures to limit contamination of source and equipment). • Facilitate programmes/measures to ensure appropriate sanitary and medical facilities are available.
<p>Workforce-Community Interactions</p> <ul style="list-style-type: none"> • Real or perceived disruption to normal community life, through the physical presence of a workforce; in particular, potential for conflicts to occur over water use. 	<ul style="list-style-type: none"> • Adoption of a Stakeholder Engagement Plan, as a framework for early and ongoing community consultation. • Implementation of a Grievance Procedure (see Grievance Procedure and Redress Mechanisms guidance note). • Works procedures, defining a Code of Appropriate Conduct for all workers, including acceptable behaviour with respect to community interactions. • Adoption of a Sustainable Water Management Plan, which takes existing community usage into consideration.
<p>Labour and Working Conditions</p> <ul style="list-style-type: none"> • Poor management of occupational health and safety leading to accidents, injuries and illnesses among workers (e.g. risks of working close to water); mental health issues due to remote or enclosed living. • Differences in nationality, ethnicity, religion, etc. may lead to discrimination and harassment, and differences (perceived or real) in working conditions between workers may lead to resentment. 	<ul style="list-style-type: none"> • Employment practices and working conditions should conform to International Labour Organisation (ILO) Standards and national regulations. • Rest and recreational facilities and time should be provided, and rules on alcohol and drugs defined and clearly communicated to workers. • The basis for differences in the standard of accommodation should be non-discriminatory; it should be documented and communicated transparently to the workforce. • Clear and comprehensive health and safety reporting and grievance procedure system should be established, and be freely available to all of the workforce. <p>See also Employment and Economic Development.</p>



WATER SUPPLY AND SANITATION PROJECTS SECTOR: RURAL WATER SUPPLY AND SANITATION

Investment in rural water supply and sanitation projects contributes to economic development, livelihoods, improved health and enhanced quality of life. However, the construction, rehabilitation, maintenance and operation of water supply and sanitation systems have often caused widespread adverse impacts on natural and human environments. Environmental damage may include disruption or contamination of water courses and drainage systems, soil destabilization, habitat fragmentation and destruction. These developments may also be a source of adverse impacts on the human environment, particularly conflicts over water use, the displacement and resettlement of affected families and businesses, and health and safety.

Scope and structure

This keysheet provides a summary of the activities, typical environmental and social impacts, and potential mitigation and management measures relating to the development of rural water supply and sanitation projects for human use, excluding consideration of water supply for use in irrigated agriculture, livestock production, forestry or aquaculture. Projects considered include construction, improvement or expansion of surface, ground or rain water fed systems, involving water harvesting or abstraction, storage and distribution; collection, treatment and disposal of wastewater; and the construction and maintenance of the structures necessary for these processes.

This keysheet should be used specifically to help with drafting ToRs for ESIA's of rural water supply and sanitation projects and with scoping and conducting ESIA's and preparing ESMPs. It can also help in reviewing ESIA's. It should be used in conjunction with the Bank's Guidance on ESIA's (including coverage of cumulative impacts), with the Guidance Notes on specific safeguard topics and the keysheet on hydroelectric power projects. The keysheet is organised under the following headings, with substantive information provided in table form:

- Project components and activities.
- Sources of impact and receptors/resources.
- Mitigation and management options.

The phases of rural water supply and sanitation projects considered are: design and planning, including site selection; construction; operation and maintenance; and where appropriate decommissioning (closure).

Project components and activities

The components of rural water supply and sanitation projects are provided in Table 1, along with the activities involved in developing new or upgraded systems, and in operating systems, broken down by project phase.

Sources of impact, receptors/ resources, and mitigation

Table 2 summarizes the main aspects of rural water supply and sanitation project activities that lead to typical impacts, the receptors and resources they affect, and options for mitigation. It considers impacts on the physical, biological and socioeconomic environment. The mitigation measures described assume that higher level design and alignment planning measures, as described in Table 1, have already been implemented.

The guidance on impacts and options for their mitigation can be used to help discussions with the borrower or client and improve their understanding of the Bank's requirements. They should also be used to assist preparation of ToRs for an ESIA so that they are tailored to the particular circumstances of the rural water supply and/or sanitation project under consideration.

Table 1: Summary of Activities associated with Rural Water Supply and Sanitation

Components	
<p>Water Supply and Sanitation</p> <ul style="list-style-type: none"> Intake structures, wells/boreholes etc. Surface water impoundments, water storage areas (e.g. dams, tanks, cisterns). Water conveyance to consumption points. Wastewater collection and storage systems. Water and wastewater treatment. Drainage and water recovery systems; control structures e.g. erosion control. 	<p>Ancillary Works</p> <ul style="list-style-type: none"> Temporary construction facilities (e.g. workshops, laydown areas, working corridor outside the footprint, workers' accommodation, quarries). Access roads within and between temporary facilities and areas under development, permanent access and maintenance roads. Land grading.
Activity (1)	
Design – Site Selection and Planning	<p>Screening, Scoping and ESIA</p> <p>Preparation of ESMP</p> <p>Agreement of loan covenants</p>
<p>Strategic planning (options analysis, cost-benefit analysis, strategic site selection, initial design), and for major rural water supply and sanitation programmes, strategic environmental and social assessment (SESA), to establish:</p> <ul style="list-style-type: none"> Major environmental and social constraints and alternatives (e.g. with respect to settlements, watersheds and areas of biodiversity conservation importance). Design procedures such that environmental and social considerations are given equal weight to engineering and financial ones. 	
<p>Site-specific planning (detailed design), taking account of environmental and social sensitivities and consultation with communities, drawing upon the following environmental and socioeconomic documentation, all of which should comply with national regulations and international good practice:</p> <ul style="list-style-type: none"> Environmental and Social Impact Assessment (ESIA); Environmental and Social Management Plan (ESMP); Stakeholder Engagement Plan (SEP); and Resettlement Action Plan (RAP). 	
Construction	<p>Monitoring of ESMP performance</p> <p>Monitoring of compliance with loan covenants</p> <p>Monitoring of sub-contractor contract provisions</p>
<p>Construction activities will include:</p> <ul style="list-style-type: none"> Establishing temporary access to work and ancillary areas, demarcating clearance zones, establishing access control Clearance and levelling of some areas and major earthworks (e.g. creating impoundments, introducing ditches and other control structures) where required Sourcing and establishing water supply from surface/groundwater (e.g. creating diversions, digging wells) Building control /distribution/ impoundment structures for water supply (e.g. channels, dams, tanks), collection and storage facilities for wastewater (e.g. tanks, ponds, treatment works) Location and development of quarries, import of materials, e.g. aggregate/ballast Improvement of existing drainage and introduction of new drainage, including culverts if required <p>The equipment required will include heavy mobile plant (e.g. graders, bulldozers, excavators) and temporary fixed plant such as concrete batching plant and power generators.</p>	
Operation and Maintenance	Project implementation: Compliance Monitoring
<p>During operation activities will include the abstraction of water from a local water source; water storage in containment areas such as tanks or reservoirs; distribution of water to collection points; collection, treatment and disposal of wastewater. These activities may contribute to direct and indirect impacts described in Table 2.</p> <p>Maintenance of rural water supply and sanitation systems will entail many of the activities described above for the construction phase, although in general they are likely to be smaller in scale and spatial extent. It will include activities such as clearing and maintaining water collection and storage systems, and servicing mechanical components such as pumps.</p> <p>For larger water supply schemes with storage reservoirs, reservoir management (including maintenance of the reservoir margins) will also be required, and catchment protection and maintenance is also a standard part of good practice for environmental management of projects involving reservoirs.</p>	
Activity (2)	
Decommissioning (Closure)	Project Completion: Compliance Report
<p>Where temporary roads and facilities used in the construction phase are no longer required (if, for example, they are not required for maintenance) they should be decommissioned and rehabilitated in accordance with a site-specific closure plan developed in consideration of international good practice. The decommissioning process will include site clearance, removal of all equipment, appropriate disposal of waste materials, soil ripping and re-grading where necessary.</p> <p>Water supply and sanitation systems are normally intended to operate for a prolonged period, and so it would not be appropriate for closure or decommissioning plans to be prepared until a few years prior to this occurring.</p>	

Table 2: Rural Water Supply and Sanitation (WSS) Projects: Impacts and Mitigation

Impacts	Mitigation
<p>Geology/Hydrogeology</p> <ul style="list-style-type: none"> • Interruption or disruption of surface and groundwater flows from construction, excavation and ground clearance, and reduced flows during operation. • Lowering of water table due to excessive abstraction; this may result in salinization, especially in coastal areas. 	<ul style="list-style-type: none"> • Design to take account of local hydrological conditions (e.g. avoid crossing permanent waterways, do not hamper drainage of surface water, avoid works in areas prone to flooding especially during rainy season). • Minimise the loss of water caused by leaks, evaporation and infiltration (e.g. maintain vegetation along water canals). • Ensure proper water management by adjusting abstracted volumes annually depending on aquifer recharge, establishing fees for water users, controlling access to water for other purposes (e.g. agriculture, industry).
<p>Soils, Run-off and Flooding</p> <ul style="list-style-type: none"> • Loss, damage or disruption of soil/sediments. • Introduction of sediments to watercourses or interruption of drainage patterns, as a result of ground clearance, earthworks and the introduction of drainage structures. 	<ul style="list-style-type: none"> • Minimisation of cleared areas and soil disturbance, revegetation as soon as feasible (with native species if not crops). • Early installation and regular maintenance of drainage and diversion structures, silt traps, etc; drainage outlets to discharge into vegetated areas if possible; vegetation along watercourses and drainage lines to be retained if possible. • Retention of topsoil for restoration (including tilling and revegetation) as soon as practicable. • Careful consideration of timing of works (overall duration and seasonality). • Design systems so as to reduce sedimentation and facilitate drainage and maintenance.
<p>Pollution of Soils and Water</p> <ul style="list-style-type: none"> • Pollution at water collection points; pollution of watercourses due to wastewater inputs, especially accidental releases and inadequately treated wastewater; potential contamination of soils as a result of wastewater leaks from treatment basins and sludge mismanagement. • Release of hazardous substances during construction or maintenance (e.g. accidental spills and leaks) and during operation (e.g. chemicals used in water and wastewater treatment) leading to soil, surface or groundwater contamination. 	<ul style="list-style-type: none"> • Ensure that drainage and discharged wastewater complies with discharge standards and treat wastewater accordingly; plan discharge of wastewater in accordance with the absorbing capacity of receiving water bodies. • Installation of sewage treatment to meet required standards. • Implementation of standard good wastewater and sewage sludge management procedures, including monitoring quality of receiving waters and soils. • Conserve vegetation along water bodies and near wetlands, especially at wastewater discharge points. • Provide education to local communities and workforce on hygienic conditions and behaviours. • Materials handling and control procedures, use of storage and containment equipment meeting international standards. • Control of construction/maintenance vehicle movements and prohibition of vehicle washing in watercourses, and similar practices. • Emergency response plans during construction (contractors and local authorities) and operation (local authorities).
<p>Air Quality</p> <ul style="list-style-type: none"> • Dust and emissions from construction and maintenance activities, and noxious gases or odours from sewage treatment and sludge disposal, could affect human health, vegetation and wildlife, and may have nuisance value for nearby receptors. 	<ul style="list-style-type: none"> • Sensitive site selection and siting of project components. • Use of modern equipment meeting appropriate emissions standards, and regular preventative maintenance. • Dust control and suppression measures such as dampening, use of vegetation hedges etc. • No use of ozone depleting substances during construction. • Ensure sewage storage and treatment facilities are adequately contained; cover sludge with lime/earth at disposal sites.
<p>Noise and Vibration</p> <ul style="list-style-type: none"> • Noise and vibration from construction and maintenance equipment, traffic and activities, may disturb sensitive noise receptors (human, fauna). 	<ul style="list-style-type: none"> • Sensitive local access road route selection and siting of construction facilities, accompanied where necessary by noise attenuation measures. • Use of modern, well maintained equipment fitted with abatement devices (e.g. mufflers, noise enclosures). • Strict controls of timing of activities, e.g. blasting and other high noise emissions; prohibition on night working. • Observance of seasonal sensitivities (e.g. breeding seasons), and alteration of activity to reduce noise levels at that time.

Impacts	Mitigation
<p>Resources and Waste</p> <ul style="list-style-type: none"> Abstraction of significant volume of water from surface or ground water sources may affect supply for other water users and ecosystems, and result in conflicts over water use. 	<ul style="list-style-type: none"> Abstraction to take place with approval of relevant authorities at all locations. Water study prior to any abstraction, to inform a Sustainable Water Management Plan. Regular preventative maintenance of all system components to ensure that water wastage is as far as possible limited. Promotion of water efficiency and water recycling: implement water fees/tariffs and other demand management measures to avoid the wastage of water or over-consumption. Clearly define water rights and water user fees and conditions in consultation with affected groups.
<ul style="list-style-type: none"> Inefficient waste management during construction, operation and maintenance leading to excess consumption of materials, generation of wastes/emissions, pollution of soils and water. 	<ul style="list-style-type: none"> Preparation of Waste Management Plan following the waste hierarchy, supported by staff training. Earthworks to be designed to achieve a balance between cut and fill wherever possible. Use of authorised contractors for hazardous and any other wastes which the project cannot dispose of safely. Implementation of standard good wastewater and sewage sludge management procedures.
<p>Loss, fragmentation and degradation of habitat, and severance of animal migration routes and pathways</p> <ul style="list-style-type: none"> Earthworks and construction causing loss, degradation or fragmentation of protected or ecologically sensitive areas (e.g. wetlands, migration routes), and other areas of conservation interest, and degradation following poorly managed rehabilitation. 	<ul style="list-style-type: none"> Careful siting/route selection for all project components, with advice from biodiversity authorities/wildlife specialists. Wherever feasible, establishment of buffer zones around conservation areas, watercourses, and other locations identified as ecologically sensitive and avoidance or minimisation of activity within these zones. Rehabilitation of cleared areas with native species, and ecosystem restoration in habitats of conservation value, using specialist advice and input so as to maintain the integrity of the habitat, backed up by a long-term monitoring programme and corrective actions as necessary. <p>Where development in sensitive areas cannot be avoided, mitigation may include:</p>
<ul style="list-style-type: none"> Impacts on habitats and species from habitat alteration and degradation (e.g. reduction in water supply, changes in water flow and drainage, soil erosion, pollution of water, soils or air, introduction of invasive species). 	<ul style="list-style-type: none"> Minimisation of area impacted, clear demarcation of remaining intact areas of habitat, and prohibition of activity into those areas for any purpose; prohibit or minimise activities in vicinity of sensitive areas, e.g. upstream. Habitat rehabilitation and ecosystem restoration of areas no longer required to occur as soon as possible after construction. If loss of Critical Habitat is inevitable, development/implementation of an Offsets Programme. <p>See relevant sections re: control of impacts from Pollution of Soils and Water above, and Invasive Species and Induced Access below.</p>
<p>Direct Impacts on Flora and Fauna</p> <ul style="list-style-type: none"> Earthworks and clearance for project infrastructure may lead to loss of plant species and habitats of conservation interest. Construction of project infrastructure could displace animals and disturb their habitats, by direct disturbance during construction and operation (e.g. from noise, light disturbance at night, general human presence). 	<ul style="list-style-type: none"> Careful site/route selection for all project components, with advice from biodiversity authorities/wildlife specialists. Careful planning of phasing and timing of construction activities. Demarcation and avoidance of areas of conservation interest (high value species, feeding or breeding sites, migration routes, etc.) where possible, and wildlife rescue and translocation where appropriate, under expert supervision. <p>Also see measures under Soils, Run-off and Flooding, Pollution of Soils and Water, and Noise / Vibration above, and Invasive Species below.</p>
<p>Invasive Species</p> <ul style="list-style-type: none"> Movement of plant and workforce into areas could introduce invasive species which adversely impact fauna, flora, ecosystems, and crops; particular risk for aquatic vegetation likely to proliferate within standing water. 	<ul style="list-style-type: none"> Invasive Species Management Plan, which should be developed and implemented in consultation with authorities, including appropriate eradication measures for different species/groups of species. Staff training and awareness raising in communities. No introduction of exotic species (e.g. for site rehabilitation) without specialist vetting and government approval. Where possible, clearance of invasive species during routine maintenance of water storage and distribution systems.

Impacts	Mitigation
<p>Physical and Economic Displacement of People, Property, Assets and Resources</p> <ul style="list-style-type: none"> • Development or upgrading of WSS systems may physically displace small numbers of people, or lead to loss of assets, e.g. loss of traditional agricultural or livestock grazing land. • Water flow reduction downstream, or exclusion of specific groups from benefits of project, causing adverse effects on water supply for other water users. • Disruption of economic activities, particularly if they represent potential sources of water contamination. 	<ul style="list-style-type: none"> • Careful site selection and siting of all project components, avoiding occupation of areas which are inhabited or regarded as of high value by communities (e.g. horticulture, community orchards) where possible. • Early development and sensitive implementation of resettlement planning, in accordance with national regulations and international good practice to compensate for any losses (both physical and economic). • Identify why specific groups are not benefiting from the project and develop corrective/compensation measures for affected parties where required (e.g. downstream water users, vulnerable groups). • Create a water user organisation to effectively manage water resources and ensure equitable access among users.
<p>Economic Development and Employment</p> <ul style="list-style-type: none"> • Direct employment of local population in workforce, and stimulation of local economy through demand for goods and services will enhance livelihoods and economic activity in local communities; potential for adverse effects if expectations not met and community relations are not well managed. 	<ul style="list-style-type: none"> • Development of an Employment Plan, with clear employment requirements and procedures for the construction and operational/maintenance workforce. • Transparent and culturally appropriate communication with communities regarding employment opportunities. • Fair and transparent hiring and staff management procedures. • Employment requirements and vocational training plan to be agreed with local institutions, so that local people can be trained to meet the project's needs in a timely fashion.
<p>Cultural Heritage</p> <ul style="list-style-type: none"> • Displacement or damage to cultural heritage sites by construction activities, harm to local setting, amenity value, etc. • Change to intangible cultural heritage due presence of and interaction with workforce. 	<ul style="list-style-type: none"> • Careful site selection and siting of all project components, taking account of community consultation/specialist surveys. • Development of a Cultural Heritage Management Plan covering tangible and intangible (e.g. local traditions and practices) cultural heritage. • Implementation of a "Chance Finds" procedure during construction. <p>See also Guidance Note on Physical Cultural Heritage.</p>
<p>Community Health, Safety and Security</p> <ul style="list-style-type: none"> • Poor construction management practices may lead to adverse effects on safety, human health and wellbeing. 	<ul style="list-style-type: none"> • Good construction site "housekeeping" and management procedures (including site access). • Risk assessments and emergency response planning to consider impacts on local communities. <p>See also control of pollution under Physical Impacts heading.</p>
<ul style="list-style-type: none"> • Interaction between workforce and local communities may increase occurrence of communicable diseases, including HIV/AIDS and sexually transmitted diseases (STDs). 	<ul style="list-style-type: none"> • Implementation of a health management system for workforce, to ensure it is fit for work and that it will not introduce disease into local communities. • Training and awareness raising for workforce and their dependents on HIV/AIDS and other STDs, and communicable diseases; health awareness raising campaigns for communities on similar topics.
<ul style="list-style-type: none"> • Changes in exposure to water-borne and water-related diseases, especially those associated with water-dwelling disease vectors (new areas of standing water created) and with wastewater (if not properly treated). • Improved health through better access to drinking water; potential for adverse effects if water quality or availability is poor or unreliable. 	<ul style="list-style-type: none"> • Provide information, education and communication about safe uses of water and hygienic behaviour. • Implement environmental management measures for vector control: e.g. monitoring for key vectors; contact avoidance via site selection; focal insecticide and molluscicide application. • Ensure adequate water supply for addressing the effective demands of the local community. • Establish regular controls and maintenance activities to improve reliability and quality of water supply (e.g. through education and training, measures to limit contamination of source and equipment). • Facilitate programmes/measures to ensure appropriate sanitary and medical facilities are available.
<p>Workforce-Community Interactions</p> <ul style="list-style-type: none"> • Real or perceived disruption to normal community life, through the physical presence of a workforce 	<ul style="list-style-type: none"> • Adoption of a Stakeholder Engagement Plan, as a framework for early and ongoing community consultation. • Implementation of a Grievance Procedure (see Grievance Procedure and Redress Mechanisms guidance note). • Works procedures, defining a Code of Appropriate Conduct for all workers, including acceptable behaviour with respect to community interactions. • Adoption of a Sustainable Water Management Plan, which takes existing community usage into consideration.

Impacts	Mitigation
<p>In-migration</p> <ul style="list-style-type: none"> Individuals are likely to migrate into the area which may cause conflict with resident communities, and put pressure on resources and infrastructure. 	<ul style="list-style-type: none"> Careful site selection and siting of all project components, after consultation with communities and local authorities. Preparation and implementation of an Influx/In-migration Management Plan, in consultation with local authorities. <p>See also Economic Development and Employment, and Induced Access above</p>
<p>Labour and Working Conditions</p> <ul style="list-style-type: none"> Poor management of occupational health and safety leading to accidents, injuries and illnesses among workers (e.g. risks of working close to water); mental health issues due to remote or enclosed living. Differences in nationality, ethnicity, religion, etc. may lead to discrimination and harassment, and differences (perceived or real) in working conditions between workers may lead to resentment. 	<ul style="list-style-type: none"> Employment practices and working conditions should conform to International Labour Organisation (ILO) Standards and national regulations. Rest and recreational facilities and time should be provided, and rules on alcohol and drugs defined and clearly communicated to workers. The basis for differences in the standard of accommodation should be non-discriminatory; it should be documented and communicated transparently to the workforce. Clear and comprehensive health and safety reporting and grievance procedure system should be established, and be freely available to all of the workforce. <p>See also Employment and Economic Development</p>

WATER SUPPLY AND SANITATION SECTOR: INTEGRATED WATER RESOURCE MANAGEMENT (IWRM)

Integrated water resource management (IWRM) is defined by the Global Water Partnership as an approach to managing and developing water resources that is sustainable and balanced, and that identifies and takes into account the full range of interests (social, economic and environmental) with a reliance on water (GWP & INBO 2009). Investment in IWRM contributes to economic development, livelihoods, improved community health and safety, enhanced quality of life and environmental protection. However, IWRM may also accidentally cause adverse impacts on natural and human environments. Environmental damage associated with construction works may include disruption or contamination of water courses and natural drainage systems, soil destabilization, habitat fragmentation and destruction, and disturbance and loss of fauna and flora. Adverse impacts on the human environment may also result from construction, as well as changes in the balance of rights and responsibilities between water users, including displacement and resettlement of affected families and businesses, and impacts on health and safety.

Scope and structure

This keysheet provides a summary of the activities, typical environmental and social impacts, and potential mitigation and management measures relating to the development of IWRM projects, i.e. projects, ranging in scale from local to international, that involve the co-ordination of water resource management across sectors and interest groups with the intention of improving the efficiency, equity and sustainability of water use (UNESCO 2009).

This keysheet should be used specifically to help with drafting ToRs for ESIA of IWRM projects and with scoping and conducting ESIA and preparing ESMPs. It can also help in reviewing ESIA. It should be used in conjunction with the Bank's Guidance Notes on ESIA (including coverage of cumulative impacts) and with the Guidance Notes on specific safeguard topics including transboundary projects.

The keysheet is organised under the following headings, with substantive information provided in table form:

- Project components and activities.
- Sources of impact and receptors/resources.
- Mitigation and management options.

The phases of IWRM projects considered are: design and planning, including site selection; project development; operation and maintenance; and where appropriate decommissioning (closure).

Project components and activities

The components of IWRM are provided in Table 1, along with the activities involved in developing and implementing new projects or improving existing projects, broken down by project phase.

Sources of impact, receptors/ resources, and mitigation

Table 2 summarizes the main aspects of IWRM activities that lead to typical impacts, the receptors and resources they affect, and options for mitigation. It considers impacts on the physical, biological and socioeconomic environment. The mitigation measures described assume that higher level design and alignment planning measures, as described in Table 1, have already been implemented.

The guidance on impacts and options for their mitigation can be used to help discussions with the borrower or client and improve their understanding of the Bank's requirements. They should also be used to assist preparation of ToRs for an ESIA so that they are tailored to the particular circumstances of the HEP development under consideration.

Table 1: Summary of Activities associated with Integrated Water Resource Management

Components	
IWRM <ul style="list-style-type: none"> Enabling environment (i.e. policies and legislation relevant to management of water resources). Institutional context and capacity (i.e. bodies responsible for implementing legislation and strategy). Aspects or areas of the natural environment associated with water resources (e.g. surface and ground water networks, catchment areas, receiving waters, riparian habitats). Water users (e.g. water supply – local community and wider area, agriculture, industry). Management instruments (e.g. assessment, monitoring, stakeholder engagement, allocation instruments). Water related infrastructure (e.g. abstraction points, irrigation systems, water and wastewater storage, distribution and treatment systems). 	Ancillary Components <ul style="list-style-type: none"> Temporary construction facilities (e.g. workshops, laydown areas, working corridor outside the footprint, workers' accommodation). Access roads within and between temporary facilities and areas being developed, permanent access roads.
Activity (1)	
Design – Site Selection and Planning	Screening, Scoping and ESIA Preparation of ESMP Agreement of loan covenants
Strategic planning (options analysis, cost-benefit analysis, strategic site selection, initial design), and for regional or larger scale IWRM programmes, strategic environmental and social assessment (SESA), to establish: <ul style="list-style-type: none"> Major environmental and social features (e.g. with respect to major settlements, agricultural areas, watersheds and areas of biodiversity conservation importance). Design procedures such that environmental and social considerations are given equal weight to engineering and financial ones. 	
Site-specific planning (detailed design), taking account of environmental and social sensitivities and consultation with communities, drawing upon the following environmental and socioeconomic documentation, all of which should comply with national regulations and international good practice: <ul style="list-style-type: none"> Environmental and Social Impact Assessment (ESIA); Environmental and Social Management Plan (ESMP). Stakeholder Engagement Plan (SEP); Resettlement Action Plan (RAP). 	
Activity (2)	
Project Development	Monitoring of ESMP performance Monitoring of compliance with loan covenants Monitoring of sub-contractor contract provisions
During project development activities will include: <ul style="list-style-type: none"> Preparation of policies, laws and regulations focused on enabling IWRM; creation of or capacity building within institutions responsible for water resource management. Assessment of water availability and quality, and stakeholder/user requirements; followed by allocation of rights and responsibilities for water management, and establishment of any fees for use or pollution of water. Construction or improvement of water related infrastructure and associated works (e.g. earthworks during creation of reservoirs, ground clearance for establishment of water treatment areas). Identification of key areas of natural habitat with importance for safeguarding of water resources; protection and/or restoration of these areas. 	
Operation and Maintenance	Project implementation: Compliance Monitoring
During the operational phases of IWRM projects, key activities will include protection of important natural habitats; negotiation and partitioning of water usage rights; water abstraction, treatment and supply; wastewater conveyance, treatment and disposal; monitoring of IWRM performance indicators; and collection of water usage fees. These activities may contribute to direct and indirect impacts described in Table 2.	
Maintenance of water related infrastructure will entail similar activities to those described above for the construction phase, although in general they are likely to be smaller in scale and spatial extent. It will include activities such as clearing and maintaining water and wastewater collection, storage and treatment systems.	
Decommissioning (Closure)	Project Completion: Compliance Report
Where temporary facilities necessary to the project are no longer required (if, for example, they are not required after the completion of construction) they should be decommissioned and rehabilitated in accordance with a site-specific closure plan prepared in consideration of international good practice. The decommissioning process will include site clearance, removal of all equipment, appropriate disposal of waste materials, soil ripping and re-grading where necessary. IWRM approaches are normally intended to remain in place for an indefinite or prolonged period, and so it would not be appropriate for closure or decommissioning plans to be prepared until a few years prior to this occurring.	

Table 2: Integrated Water Resource Management (IWRM): Impacts and Mitigation

Impacts	Mitigation
<p>Geology/Hydrogeology</p> <ul style="list-style-type: none"> Positive: maintenance of natural flows and water table level through control of water usage. 	<ul style="list-style-type: none"> Design infrastructure to take account of local hydrological conditions (e.g. avoid interrupting permanent waterways, do not hamper natural drainage of water bodies and watercourses, avoid works in areas prone to flooding especially during rainy season).
<p>Soils, Run-off and Flooding</p> <ul style="list-style-type: none"> Loss, damage or disruption of soil/sediments. 	
<p>Soils, Run-off and Flooding</p> <ul style="list-style-type: none"> Positive: protection of riparian and upstream habitats leading to reduced erosion, sediment input and flood risk. Loss, damage or disruption of soil from construction, excavation and ground clearance during introduction of water related infrastructure. 	<ul style="list-style-type: none"> Minimisation of cleared areas and soil disturbance in key upstream habitats, retention of topsoil for restoration following construction activities, revegetation of cleared areas as soon as feasible with native species. Early installation and regular maintenance of drainage around construction areas, silt traps, etc; outlets to discharge into vegetated areas if possible; vegetation along watercourses and drainage lines to be retained if possible. Careful consideration of timing of works (overall duration and seasonality), and design to reduce sedimentation and facilitate maintenance.
<p>Pollution of Soils and Water</p> <ul style="list-style-type: none"> Positive: improvement in water quality due to protection of sensitive habitats and control of polluting activities. Release of hazardous substances during construction or maintenance activities (e.g. accidental spills and leaks) and during operation (e.g. chemicals used in wastewater treatment) leading to soil, surface or groundwater contamination. 	<ul style="list-style-type: none"> Implementation of standard good wastewater management procedures, including appropriate treatment to international standards and monitoring quality of receiving waters and soils; plan discharge of wastewater in accordance with the absorbing capacity of receiving water bodies. Conserve vegetation along water bodies and near wetlands, especially at wastewater discharge points. Use of appropriate materials to construct water related infrastructure and regular maintenance. Materials handling and control procedures, use of storage and containment equipment meeting international standards. Control of construction/maintenance vehicle movements and prohibition of vehicle washing in watercourses, and similar practices. Emergency response plans during construction (contractors and local authorities) and operation (local authorities).
<p>Air Quality</p> <ul style="list-style-type: none"> Dust and emissions from construction and maintenance activities could affect human health, vegetation and wildlife. 	<ul style="list-style-type: none"> Sensitive site selection and siting of project components. Use of modern equipment meeting appropriate emissions standards, and regular preventative maintenance. Dust control and suppression measures such as dampening, use of vegetation hedges etc. No use of ozone depleting substances during construction.
<p>Noise and Vibration</p> <ul style="list-style-type: none"> Noise and vibration from construction and maintenance equipment, traffic and activities, may disturb sensitive noise receptors (human, fauna). 	<ul style="list-style-type: none"> Sensitive local siting of components and construction sites, accompanied where necessary by noise attenuation measures. Use of modern, well maintained equipment fitted with abatement devices (e.g. mufflers, noise enclosures). Strict controls of timing of activities, e.g. blasting and other high noise emissions; prohibition on night working. Observance of seasonal sensitivities (e.g. breeding seasons), and alteration of activity to reduce noise levels at that time.

Impacts	Mitigation
<p>Resources and Waste</p> <ul style="list-style-type: none"> Positive: consideration of all water uses and users within management plan should result in more efficient and equitable use of water resources. Inefficient resource use and waste management during construction, operation and maintenance leading to excess consumption of materials, generation of wastes/emissions, pollution of soils and water. 	<ul style="list-style-type: none"> Any abstraction to take place with approval of relevant authorities at all locations, and within the IWRM framework. Plans for water usage to be informed by detailed study undertaken as part of project development, considering all water uses and users Regular preventative maintenance of all system components to ensure that water wastage is as far as possible limited. Promotion of water efficiency and water recycling: implement water fees/tariffs and other demand management measures to avoid the wastage of water or over-consumption. Clearly define water rights and water user fees and conditions in consultation with affected groups. Preparation of Waste Management Plan following the waste hierarchy, supported by staff training. Earthworks to be designed to achieve a balance between cut and fill wherever possible. Use of authorised contractors for hazardous and any other wastes which the project cannot dispose of safely. Implementation of standard good wastewater and sewage sludge management procedures.
<p>Loss, fragmentation and degradation of habitat, and severance of animal migration routes and pathways</p> <ul style="list-style-type: none"> Positive: assigning value to habitats linked to provisioning of water and related services should enable improvements in protection of these habitats (e.g. wetlands, riparian habitats, forests), and result in positive impacts for species reliant on these habitats. 	<ul style="list-style-type: none"> Careful siting of all project components, with advice from biodiversity authorities/wildlife specialists Wherever feasible, establishment of buffer zones around conservation areas, watercourses, and other locations identified as ecologically sensitive and avoidance or minimisation of activity within these zones Rehabilitation of cleared areas with native species, and ecosystem restoration in habitats of conservation value (especially those providing ecosystem services related to water resources), using specialist advice and input so as to maintain the integrity of the habitat, backed up by a long-term monitoring programme and corrective actions as necessary <p>Where development in sensitive areas cannot be avoided, mitigation may include:</p> <ul style="list-style-type: none"> Minimisation of area impacted, clear demarcation of remaining intact areas of habitat, and prohibition of activity into those areas for any purpose; prohibit or minimise activities in vicinity of sensitive areas, e.g. upstream Habitat rehabilitation and ecosystem restoration of areas no longer required to occur as soon as possible after construction If loss of Critical Habitat is inevitable, development/implementation of an Offsets Programme <p>See also Pollution of Soils and Water, Invasive Species, and Induced Access</p>
<ul style="list-style-type: none"> Construction/maintenance activities and wastewater inputs during operation causing loss, degradation or fragmentation of protected or ecologically sensitive areas, and other areas of conservation interest, and degradation following poorly managed rehabilitation; with resultant impacts on species supported by these habitats. 	
<p>Impacts from Induced Access</p> <ul style="list-style-type: none"> Development of water supply infrastructure may encourage or facilitate human access in remote or undeveloped areas, which can lead to further development, increased disturbance and pressure on natural resources through bushmeat hunting, logging, fire, etc. 	<ul style="list-style-type: none"> Careful site selection and siting of all project components, with advice from biodiversity authorities/wildlife specialists to avoid remote and previously inaccessible areas where possible. Restrictions on access to all temporary access roads, and their removal after construction. Access controls on permanent access roads required for operation and maintenance. <p>See also Bushmeat Hunting below</p>

Impacts	Mitigation
<p>Bushmeat Hunting</p> <ul style="list-style-type: none"> Increased development in remote areas could lead to greater demand for bushmeat (from workforce and wider community), stimulate the wildlife trade and facilitate access to hunting areas. 	<ul style="list-style-type: none"> Preparation of a Bushmeat Hunting and Wildlife Trade Management Plan, agreed with government authorities and implemented jointly. Prohibition on workforce hunting, selling, or purchasing bushmeat, and training to support this requirement. Prohibition on workforce (except security personnel) having guns in work areas or accommodation. Sensitisation and public awareness campaigns against hunting and bushmeat the trade amongst local communities.
<p>Direct Impacts on Flora and Fauna</p> <ul style="list-style-type: none"> Positive: protection of key habitats should result in maintenance or improvement of the integrity of protected and surrounding areas, with positive impacts for the species supported by these habitats. Earthworks and clearance during introduction of water related infrastructure may lead to loss of plant and animal species. Introduction of water related infrastructure and induced development could displace animals and disturb their habitats, by direct disturbance during construction and operation (e.g. from noise, general human presence). 	<ul style="list-style-type: none"> Careful site selection and siting of all project components, with advice from biodiversity authorities/wildlife specialists. Careful planning of phasing and timing of construction activities. Demarcation and avoidance of areas of conservation interest (high value species, feeding or breeding sites, migration routes, etc.) where possible, and wildlife rescue and translocation where appropriate, under expert supervision. Also see measures under soils, run-off and flooding, pollution of soils and water, noise / vibration and induced access above, and invasive species below
<p>Invasive Species</p> <ul style="list-style-type: none"> Movement of plant and workforce could introduce invasive species into new areas which adversely impact fauna, flora, ecosystems, and crops; particular risk for aquatic vegetation which may spread more easily within newly introduced areas of standing water. 	<ul style="list-style-type: none"> Invasive Species Management Plan, which should be developed and implemented in consultation with authorities, including appropriate eradication measures for different species/groups of species. Staff training and awareness raising in communities. No introduction of exotic species (e.g. for site rehabilitation) without specialist vetting and government approval. Where possible, clearance of invasive species during routine maintenance of water storage and distribution systems.
<p>Physical and Economic Displacement of People, Property, Assets and Resources</p> <ul style="list-style-type: none"> Positive: consideration of all water uses and users within management plan should result in more equitable use of water resources, and reduce potential for less powerful users to experience economic displacement. Introduction of water related infrastructure may physically displace people, or lead to loss of assets, e.g. loss of agricultural land. Changes in balance of allocation between water users may result in reduction of supply to some users, especially large scale and inefficient usage (e.g. some agriculture); where water fees are introduced, economic displacement of those previously accessing water without charge. 	<ul style="list-style-type: none"> Careful site selection and siting of all project components, avoiding occupation of areas which are inhabited or regarded as of high value by communities (e.g. horticulture, community orchards) where possible. Early development and sensitive implementation of resettlement planning, in accordance with national regulations and international good practice to compensate for any losses (both physical and economic). Clearly define water rights and water user fees and conditions in consultation with affected groups. Develop corrective/compensation measures for affected parties where required (e.g. downstream water users, vulnerable groups, those unable to afford water use fees). Create a water users organisation to effectively manage water resources and ensure equitable access among users.
<p>Economic Development and Employment</p> <ul style="list-style-type: none"> Positive: better management of water resources, resulting in improved supply and quality, will support economic development. Positive: direct employment of local population in workforce, and stimulation of local economy through improved infrastructure and demand for goods and services will enhance livelihoods and economic activity. Potential for adverse effects if expectations not met and community relations are not well managed. Procurement of local goods and services for development and workforce could deplete resources available for local communities. 	<ul style="list-style-type: none"> Development of an Employment Plan, with clear employment requirements and procedures for the construction and operational/maintenance workforce. Transparent and culturally appropriate communication with communities regarding employment opportunities. Fair and transparent hiring and staff management procedures. Employment requirements and vocational training plan to be agreed with local institutions, so that local people can be trained to meet the project's needs in a timely fashion. Procedures for sustainable local procurement, in consultation with local authorities and community leaders. Local capacity building to foster community resilience. Monitoring of local prices; exploration of corrective measures (e.g. alternative sourcing) if appropriate.
<p>Cultural Heritage</p> <ul style="list-style-type: none"> Positive: protected habitats may have cultural as well as environmental importance. Displacement or damage to cultural heritage sites by construction activities, harm to local setting, amenity value, etc. 	<ul style="list-style-type: none"> Careful site selection and siting of all project components, taking account of community consultation/specialist surveys. Development of a Cultural Heritage Management Plan covering tangible and intangible (e.g. local traditions and practices) cultural heritage. Implementation of a "Chance Finds" procedure during construction. <p>See also Guidance Note on Physical Cultural Heritage</p>

Impacts	Mitigation
<p>Community Health, Safety and Security</p> <ul style="list-style-type: none"> • Positive: better management of water resources, resulting in improved supply and quality, will result in improved community health. • Poor construction management practices may lead to adverse effects on safety, human health and wellbeing. • Interaction between workforce and local communities may increase occurrence of communicable diseases, including HIV/AIDS and sexually transmitted diseases (STDs). • Changes in exposure to water-borne and water-related diseases, especially those associated with water-dwelling disease vectors (potential to prevent formation of areas of standing water associated with flooding, but new areas may be created, e.g. ponds) and with wastewater (pollution of water bodies and ground water). 	<ul style="list-style-type: none"> • Good construction site “housekeeping” and management procedures (including site access). • Risk assessments and emergency response planning to consider impacts on local communities. • See also control of pollution under Physical Impacts heading • Implementation of a health management system for workforce, to ensure it is fit for work and that it will not introduce disease into local communities. • Training and awareness raising for workforce and their dependents on HIV/AIDS and other STDs, and communicable diseases including malaria; health awareness raising campaigns for communities on similar topics. • Provide information, education and communication about safe uses of water and hygienic behaviour. • Implement environmental management measures for vector control: e.g. monitoring for key vectors; focal insecticide and molluscicide application. • Establish regular controls and maintenance activities to protect quality of local water supply (e.g. through education and training, measures to limit contamination with wastewater). • Facilitate programmes/measures to ensure appropriate sanitary and medical facilities are available.
<p>Workforce-Community Interactions</p> <ul style="list-style-type: none"> • Real or perceived disruption to normal community life, through the physical presence of a workforce. 	<ul style="list-style-type: none"> • Adoption of a Stakeholder Engagement Plan, as a framework for early and ongoing community consultation. • Implementation of a Grievance Procedure (see Grievance Procedure and Redress Mechanisms guidance note). • Works procedures, defining a Code of Appropriate Conduct for all workers, including acceptable behaviour with respect to community interactions.
<p>In-migration</p> <ul style="list-style-type: none"> • Improved local water supply and infrastructure may encourage migration into the area, which may cause conflict with existing resident communities, and put pressure on resources and infrastructure. 	<ul style="list-style-type: none"> • Careful site selection and siting of all project components, after consultation with communities and local authorities. • Preparation and implementation of an Influx/In-migration Management Plan, in consultation with local authorities. <p>See also Economic Development and Employment, and Induced Access above.</p>
<p>Labour and Working Conditions</p> <ul style="list-style-type: none"> • Poor management of occupational health and safety leading to accidents, injuries and illnesses among workers. • Differences in nationality, ethnicity, religion, etc. may lead to discrimination and harassment, and differences (perceived or real) in working conditions between workers may lead to resentment. 	<ul style="list-style-type: none"> • Employment practices and working conditions should conform to International Labour Organisation (ILO) Standards and national regulations. • Rest and recreational facilities and time should be provided, and rules on alcohol and drugs defined and clearly communicated to workers. • The basis for differences in the standard of accommodation should be non-discriminatory; it should be documented and communicated transparently to the workforce. • Clear and comprehensive health and safety reporting and grievance procedure system should be established, and be freely available to the entire workforce. <p>See also Employment and Economic Development and Human Rights.</p>

WATER SUPPLY AND SANITATION PROJECTS SECTOR: SOLID WASTE MANAGEMENT

Investment in solid waste management (SWM) is required in most African cities. Unmanaged, the large quantities of solid waste generated in daily lives pollute the environment, create public health hazards and cause adverse aesthetic impacts. Appropriate management of solid waste helps create employment, has a positive effect on local populations and avoids water and soil pollution. Solid waste management problems can be particularly acute in coastal cities where dumping of waste into the sea, which is generally illegal, can pollute beaches and other coastal areas valued for their tourism potential or the biodiversity they support.

In simple financial terms, proper management of waste can be costly although in economic terms inadequate management of waste can be extremely expensive due to the adverse impacts on, for example, tourism and health as noted above. There are many steps in the process of managing waste from collection through transport and treatment to final disposal and each of these needs to be undertaken properly if the overall waste management system is to be efficient, cost-effective and not minimize adverse impacts. Intervening at the plan/programme/policy level is particularly effective in SWM to help ensure that there is a clear overall goal and that all the different steps and components of the SWM system are properly co-ordinated and aligned with this goal.

Environmental and Social Impact Assessment (ESIA) provides an opportunity to assess the potential negative environmental and social impacts associated with waste management projects and to mitigate these risks as well as maximizing positive impacts. Strategic Environmental and Social Assessment (SESA) provides similar opportunities for SWM plans and programmes.

Scope and structure

This keysheet provides a summary of the activities, typical environmental and social impacts, and potential mitigation and management measures relating to the development of SWM projects, plans, programmes or policies. The types of

SWM investments covered are: the construction, rehabilitation or expansion of waste disposal facilities, the construction, rehabilitation or expansion of solid waste collection/transport systems, as well as the development of new options for solid waste treatment. Given the very different nature of the different types of SWM project, this keysheet can provide only a very high level introduction to the subject and more detailed texts should be referred to for more specific details about any particular technology.

This keysheet should be used by Bank staff and borrowers or clients to help with: drafting terms of reference (ToRs) for ESIs of SWM operations and plans; scoping, conducting and reviewing ESIs (or SESA for SWM plans and programmes); and preparing and monitoring ESMPs.

It should be used in conjunction with the Bank's Guidance Notes on ESIs (including coverage of cumulative impacts) and with the Guidance Notes on specific safeguard topics including transboundary projects. The keysheet is organised under the following headings, with substantive information provided in table form:

- Project components and activities.
- Sources of impact and receptors/resources.
- Mitigation and management options.

The phases of SWM operations considered are: site identification, selection and; design/ engineering and site development; infrastructure construction; SWM system operation / maintenance; and, where appropriate, decommissioning (closure).

Project components and activities

It should be noted that SWM projects encompass a wide variety of very different technologies and hence they vary significantly in terms of their design, construction and operation.

The potential impacts therefore also vary significantly with, for example, the impacts associated with a large landfill site being very different from, say, a waste collection project. The components of a range of different types of SWM project are provided in Table 1, along with the activities involved in developing new or expanded waste collection, disposal/treatment sites, broken down by project phase.

Sources of impact, receptors/ resources, and mitigation

Table 2 summarizes the main aspects of SWM projects that

lead to typical impacts, the receptors and resources they affect, and options for mitigation. It considers impacts on the physical, biological and socioeconomic environment. The mitigation measures described assume that higher level waste management planning measures, as described in Table 1, have already been implemented.

The guidance on impacts and options for their mitigation can be used to help discussions with the borrower or client and improve their understanding of the Bank's requirements. It should also be used to assist preparation of ToRs for an ESIA so that they are tailored to the particular circumstances of the SWM development under consideration.

Table 1: Summary of Activities associated with Solid Waste Management Infrastructure Development

Components	
<p>Waste disposal/treatment</p> <ol style="list-style-type: none"> 1. Gate and fences; 2. Waste reception including: <ul style="list-style-type: none"> • Checking; • Weighing; and • Recording. 3. Waste processing/deposition 4. Emissions control and monitoring (1) including: <ul style="list-style-type: none"> • emissions to air • discharges to the ground/groundwater • discharges to surface waters 5. On site roads 6. Site supervision and management 7. Site closure and restoration (2) <p>in the case of landfill sites this will include very specific controls such as lining, leachate collection and treatment and landfill gas controls.</p> <p>in the case of landfill sites this will include capping of the waste deposits, restoration of the site surface and aftercare while the deposited waste continues to decompose.</p> <p>Waste collection</p> <ol style="list-style-type: none"> 1. Waste containers (e.g. bags, bins, skips) 2. Waste collection vehicles including <ul style="list-style-type: none"> • Refuse collection (compaction) vehicles; • Skip vehicles; • Roll-on/Roll-off (Ro-Ro) vehicles; and • Vacuum tankers. 3. Waste transfer note system and record keeping 4. Depots for storage/maintenance of vehicles 	<p>Ancillary facilities and systems</p> <ul style="list-style-type: none"> • Staff welfare facilities; • Equipment and vehicle storage; • Material stockpiles (for site roads, cover materials etc); • Quarantine area (for rejected waste inputs); • Access roads and tracks (from site to existing road network); • Vehicle and equipment cleaning facilities; and • Emergency services (e.g. fire-fighting equipment).

Components	
Activity (1)	
Site identification/selection/acquisition	Strategic Planning, Option Screening , Scoping, SESA for large projects, ESIA Terms of Reference
<ul style="list-style-type: none"> Strategic planning (waste management and minimisation options analysis, cost-benefit analysis, strategic site selection, initial design), and for major waste management developments, strategic environmental and social assessment (SESA), to establish: Major constraints and alternatives (e.g. with respect to the way in which different types of waste will be managed/types of technology that are appropriate for the socio-economic setting and taking account of the waste hierarchy) Design procedures such that environmental and social considerations are given equal weight to engineering and financial ones 	
<ul style="list-style-type: none"> Site-specific planning (detailed design), taking account of environmental and social sensitivities and consultation with national and regional regulators and communities, focusing on immediate neighbourhood of the future waste treatment plant, draw upon the following environmental and socioeconomic documentation, all of which should comply with national regulations and international good practice: Environmental and Social Impact Assessment (ESIA) ToRs 	
Activity (2)	
Design/ engineering and site development	ESIA Preparation of ESMP Agreement of loan covenants
<p>Design, detailed engineering and financial planning are done just before project approval; at that stage, the borrower or client should prepare an ESIA on the basis of the ToRs prepared during the previous phase and integrate into the ESIA:</p> <ul style="list-style-type: none"> Environmental and Social Management Plan (ESMP); Stakeholder Engagement Plan (SEP); and Resettlement Action Plan (RAP) if required. <p>Work with the local informal recycling sector (waste pickers and scavengers) to see how they may be involved in the operation of the new waste management arrangement/facilities so that they are not disadvantaged. Draft an Integration Plan.</p>	
Construction	Monitoring of ESMP performance Monitoring of compliance with loan covenants Monitoring of sub-contractor contract provisions
<p>Construction activities will include:</p> <ul style="list-style-type: none"> Establishing temporary access to work and ancillary areas, demarcating clearance zones, establishing access control. Clearance and levelling of the project sites, and major earthworks where required (e.g. grading and lining of area to be landfilled). Identifying existing housing and other land uses with a focus on: i) the area that needs to be acquired/leased and that will require population displacement; and ii) the surrounding area where environmental and social impacts (e. g. visual, odours) may be felt during plant operation. Managing the compensation/resettlement activities as required, and developing a Buffer Zone management plan. Import of materials, e.g. gravel, clay, plastic liner. Sourcing and establishing of a water supply from surface and/or groundwater. Improvement of existing drainage and creation of appropriate drainage as required including diversion of surface water and groundwater away from areas to be landfilled. Building and equipping the waste disposal/treatment site (grading, lining, installing leachate collection system, construction of workshop and office facilities, management plan, arrangements for leachate treatment and sludge disposal and landfill gas management), installation of groundwater and other environmental monitoring facilities. In case of incineration and any other thermal processes, focus on mitigating the impacts of air emissions. Communicate with the local public and local authorities to address any concerns about the waste facility's impacts. Engage the local informal waste recyclers to implement the plan for integrating them as much as legally possible and environmentally sensible into the waste plant operation. Landscaping, as required. 	
Operation and Maintenance	Project implementation: Compliance Monitoring
<p>During operation, the plant will receive waste from a variety of different types of vehicle and will process wastes which may contribute to the direct and indirect impacts described in Table 2.</p> <p>In the case of a landfill site, the site should be progressively filled in accordance with an operational plan designed to minimise the impact of the site on the surrounding environment (e.g by minimising the amount of waste that is exposed at any one time).</p>	

Components	
Activity (3)	
Decommissioning (Closure)	Project Completion: Compliance Report
<p>At the end of the useful life of a waste treatment plant, it and all ancillary components and facilities should be decommissioned and rehabilitated in accordance with a site-specific closure plan developed in consideration of international good practice.</p> <p>The closure process will include site clearance, de-contamination of the top soil and water table, removal of all infrastructure and equipment, appropriate disposal of rubble and waste materials, soil ripping and re-grading where necessary followed by landscaping. Any access roads which are not public roads should be returned to an appropriate alternative land use (e.g. farmland, or natural vegetation cover).</p> <p>In the case of a landfill site, the site should be progressively filled and restored in accordance with the operational plan. As soon as any area is filled to the agreed final contours for the waste deposits, it should be capped and the surface restored to allow the agreed after-use to commence. A period of aftercare, lasting several years, will be required as the deposited waste settles. During this period there will be an ongoing need for control and treatment of leachate, control of landfill gas and environmental monitoring (e.g groundwater quality and landfill gas migration/emissions).</p>	

Table 2: Solid Waste Management: Impacts and Mitigation

Impacts	Mitigation
<p>Land use</p> <ul style="list-style-type: none"> Loss of agricultural/livestock/other productive use land. 	<ul style="list-style-type: none"> Initial site selection taking into account original land use and search for land that had minimal value before being considered for use as a waste treatment plant/disposal site. Comparison of alternative locations. Assessment of the initial value of the land and compensation/support with resettlement.
<ul style="list-style-type: none"> Loss of housing and other local economic land use 	<ul style="list-style-type: none"> Develop a Compensation and Resettlement Plan.
<p>Soils, Run-off and Flooding</p> <ul style="list-style-type: none"> Interruption of drainage patterns and lack of water table replenishment, as a result of ground clearance and earthworks (including installation of low permeability liner in the case of landfill). 	<ul style="list-style-type: none"> Avoidance of areas liable to flooding, slope instability, and surface water flow (streams, rivers). Early installation and regular maintenance of drainage and diversion structures, silt traps, etc; drainage outlets to discharge into vegetated areas if possible; vegetation along watercourses and drainage lines to be retained if possible. Minimisation of cleared areas and soil disturbance, with revegetation as soon as feasible, with native species. No vehicle use to be permitted outside designated areas. Retention of topsoil for restoration (including tilling and revegetation) as soon as practicable.
<p>Pollution of Soils and Water</p> <ul style="list-style-type: none"> Construction works could lead to sediment and contaminant release. Operation of waste management facilities could result in the release of waste materials and/or degradation products (e.g. leachate). 	<ul style="list-style-type: none"> Appropriate design of containment features, including landfill liners and leachate management systems. Screening of all wastes brought to site and quarantine of inappropriate materials prior to arranging treatment/disposal at an appropriate site. Restrictions on work and other activities around water bodies (e.g. vehicle washing), and inclusion of protection measures around water crossings where this not possible. Careful location and design of the waste treatment plant and ancillary equipment. Careful chemical (including toxic waste) management. <p>See also Soils, Run-off and Flooding</p>
<p>Pollution of Soils and Water</p> <ul style="list-style-type: none"> Construction works could lead to sediment and contaminant release. Operation of waste management facilities could result in the release of waste materials and/or degradation products (e.g. leachate). 	<ul style="list-style-type: none"> Appropriate design of containment features, including landfill liners and leachate management systems. Screening of all wastes brought to site and quarantine of inappropriate materials prior to arranging treatment/disposal at an appropriate site. Restrictions on work and other activities around water bodies (e.g. vehicle washing), and inclusion of protection measures around water crossings where this not possible. Careful location and design of the waste treatment plant and ancillary equipment. Careful chemical (including toxic waste) management. <p>See also Soils, Run-off and Flooding</p>

Impacts	Mitigation
<ul style="list-style-type: none"> Discharge of construction site/camp sewage effluent polluting watercourses. Discharge of sewage effluent from site staff welfare facilities at operational sites polluting watercourses. 	<ul style="list-style-type: none"> Installation of sewage treatment to meet required standards. Hygiene training for workforce.
<ul style="list-style-type: none"> Release of hazardous substances during construction, or operation (e.g. vehicle spills) leading to soil, surface or groundwater contamination. 	<ul style="list-style-type: none"> Materials handling and control procedures. Control vehicle movements and prohibition of vehicle washing in watercourses, and similar practices. Containment measures to collect fluids from vehicle maintenance. Emergency response plans during construction (contractors and local authorities) and operation (local authorities).
<p>Air Quality</p> <ul style="list-style-type: none"> Dust and other emissions during construction and from operations (including emissions from thermal treatment facilities, e.g. incinerators, and emissions of landfill gas or combustion products from gas flares), could affect human health, crops and wildlife. 	<ul style="list-style-type: none"> Sensitive siting of facilities. Dust control and suppression measures. Modern waste management equipment fitted with appropriate pollution abatement technology meeting appropriate emissions standards, and regular preventative maintenance. No use of ozone depleting substances during construction or operation.
<ul style="list-style-type: none"> Emissions from waste collection vehicles during operation affecting sensitive receptors (human and flora/fauna). 	<ul style="list-style-type: none"> Modern, efficient vehicles fitted with appropriate air emissions controls (e.g. exhaust catalysts). Use of low sulphur fuels. Sensitive site and route selection, grading of inclines, etc. Speed controls and other traffic calming measures to reduce excessive acceleration around towns.
<p>Noise and Vibration</p> <ul style="list-style-type: none"> Noise and vibration from equipment, traffic and other construction activities may disturb sensitive noise receptors (human and fauna). 	<ul style="list-style-type: none"> Sensitive siting of facilities. Use of modern equipment fitted with abatement devices (e.g. mufflers, noise enclosures); good maintenance regime. Strict controls of timing of noisy activities including prohibition on night working if possible. Observance of seasonal sensitivities (e.g. breeding seasons), and alteration of activity to reduce noise levels at that time. Speed controls and other traffic calming measures to reduce excessive acceleration around settlements/sensitive receptors.
<ul style="list-style-type: none"> Noise and vibration from waste delivery traffic and operation of waste management facilities (including maintenance activities) may disturb sensitive noise receptors (human and fauna). 	<ul style="list-style-type: none"> Sensitive siting of facilities. Use of modern equipment fitted with noise abatement devices (e.g. mufflers, noise enclosures); good maintenance regime. Controls on operational hours including prohibition on night working if possible. Speed controls and other traffic calming measures to reduce excessive acceleration near settlements/sensitive receptors.
<p>Resources and Waste</p> <ul style="list-style-type: none"> Construction and operation will require supply of water from surface or groundwater, which could affect existing supply for human communities and ecosystems. 	<ul style="list-style-type: none"> Water study prior to any abstraction, to inform a Sustainable Water Management Plan. No abstraction without prior approval of relevant authorities at all locations. Promotion of water efficiency (including leak detection, preventative maintenance of equipment) and water recycling.
<ul style="list-style-type: none"> Inefficient waste management leading to excess materials consumption, generation of wastes/emissions, soils and water pollution. 	<ul style="list-style-type: none"> Preparation of Waste Management Plan for the facility/operations. Earthworks to be designed to achieve a balance between cut and fill wherever possible. Use of authorised contractors for hazardous and any other wastes which the project cannot dispose of safely.
<p>Loss, fragmentation and degradation of habitat, and severance of animal migration routes and pathways</p> <ul style="list-style-type: none"> Land clearance for the landfill or waste treatment plant, and associated facilities, and upgrading/expansion of existing plants may cause loss or fragmentation of protected areas and other areas of conservation interest, and degradation following poorly managed rehabilitation. 	<ul style="list-style-type: none"> Careful siting of all project components, with advice from biodiversity authorities/wildlife specialists. Wherever feasible, establishment of buffer zones around conservation areas, watercourses, and other locations identified as ecologically sensitive and avoidance or minimisation of activity within these zones. Rehabilitation of cleared areas with native species, and ecosystem restoration in habitats of conservation value, using specialist advice and input, backed up by a long-term monitoring programme and corrective actions as necessary. Restoration of completed landfill areas to appropriate afteruse in keeping with surrounding areas.

Impacts	Mitigation
<ul style="list-style-type: none"> Severance of terrestrial routes and watercourses used for migration or for access to feeding and breeding areas by waste collection routes. 	<ul style="list-style-type: none"> Sensitive planning of waste treatment plant facilities. Wildlife crossings for terrestrial animals, and design of culverts/crossing structures to avoid impacts on animal movement. Education and training of drivers to be aware of and take precautions to protect vulnerable species.
<ul style="list-style-type: none"> Construction impacts on habitats and species (e.g. from changes in drainage, soil erosion, pollution of water, soils or air, and general human disturbance). 	<p>Where development in sensitive areas cannot be avoided, mitigation may include:</p> <ul style="list-style-type: none"> Minimisation of area impacted, clear demarcation of remaining intact areas of habitat, and prohibition of activity into those areas for any purpose; maintenance of wildlife corridors between fragmented areas wherever possible. No ground clearance upstream of sensitive areas unless appropriately engineered drainage installed. Habitat rehabilitation and ecosystem restoration of areas no longer required after construction, as soon as possible. Progressive filling and restoration of landfill sites to reinstate original ecosystem as soon as possible. If loss of Critical Habitat is inevitable, development/implementation of an Offsets Programme. <p>See relevant sections re: control of impacts from pollution, invasive species, and induced access.</p>
<ul style="list-style-type: none"> Traffic disturbance and emissions affecting the integrity and viability of areas of conservation interest. 	<p>See measures under Soils, Run-off and Flooding, and Pollution of Soils and Water above, and Induced Access below.</p>
<p>Direct Impacts on Flora and Fauna</p> <ul style="list-style-type: none"> Clearance of vegetation may lead to loss of plant species and habitat of conservation interest 	<ul style="list-style-type: none"> Careful siting of all project facilities and waste transport route selection with advice from biodiversity authorities/wildlife specialists Demarcation and avoidance of species of conservation interest in work areas where possible, otherwise transfer to other suitable locations if possible, under expert supervision <p>Also see measures under Soils, Run-off and Flooding, Pollution of Soils and Water, and Induced Access above</p>
<ul style="list-style-type: none"> Waste management plant and transport of waste could displace animals and disturb their habitats, by direct disturbance during construction and operation (e.g. from noise, light disturbance at night, general human presence) 	<ul style="list-style-type: none"> Careful siting of all project components and transport routes, with advice from biodiversity authorities/wildlife specialists Careful planning of phasing and timing of construction activities Demarcation and avoidance of areas of conservation interest (high value species, feeding or breeding sites, migration routes, etc.) where possible, and wildlife rescue and translocation where appropriate, under expert supervision
<p>Physical and Economic Displacement of People, Property, Assets and Resources</p> <ul style="list-style-type: none"> Development or upgrading (expansion) of solid waste treatment or disposal facilities, especially larger ones, may physically displace people, or lead to the loss of assets, e.g. land used for agricultural or other beneficial use. 	<ul style="list-style-type: none"> Careful siting of all project components, avoiding occupation of areas which are inhabited or regarded as of high value by communities (e.g. horticulture, community orchards) where possible. Early development and sensitive implementation of resettlement planning, in accordance with national regulations and international good practice to compensate for any losses (both physical and economic).
<p>Economic Development and Employment</p> <ul style="list-style-type: none"> Direct employment of local population in workforce, and stimulation of local economy through demand for goods and services will enhance livelihoods and economic activity in local communities, but potentially adverse effects if community relations are not well managed and/or if prices of staple food is artificially increased. 	<ul style="list-style-type: none"> Development of an Employment Plan, with clear employment requirements and procedures for the workforce. Transparent and culturally appropriate communication with communities regarding employment opportunities. Fair and transparent hiring and staff management procedures. Employment requirements and vocational training plan to be agreed with local institutions, so that local people can be trained to meet the project's needs in a timely fashion. Development of measures to manage the transition to a smaller, more skilled workforce after construction is complete, including SME development, ongoing opportunities for the workforce in road management and maintenance, reskilling and alternative employment.

Impacts	Mitigation
<ul style="list-style-type: none"> Procurement of local goods and services for the waste treatment plant/disposal sites (e.g. earth, gravel) and workforce could deplete resources available for local communities. 	<ul style="list-style-type: none"> Procedures for sustainable local procurement, in consultation with local authorities and community leaders. Local capacity building to foster community resilience. Monitoring of local prices, and exploration of corrective measures (e.g. alternative sourcing to reduce local pressure) if appropriate.
<ul style="list-style-type: none"> Displacement of informal waste collectors and scavengers from waste collection or working on dump sites resulting in loss of income. 	<ul style="list-style-type: none"> Involve informal sector in operation of the new waste collection and management facilities. Consult with informal sector during design of project. Develop plan to integrate workers from the informal sector in the operation of the new facilities as far as is legal and practical.
<p>Cultural Heritage</p> <ul style="list-style-type: none"> Displacement or damage to cultural heritage sites by construction activities, harm to the setting, amenity value, etc. of the site due to waste treatment plant/disposal site construction or operation. 	<ul style="list-style-type: none"> Careful siting of all project components, taking account of community consultation/specialist surveys. Development of a Cultural Heritage Management Plan covering tangible and intangible (e.g. local traditions and practices) cultural heritage. Implementation of a "Chance Finds" procedure during construction/development of landfill. <p>See also Guidance Note on Physical Cultural Heritage.</p>
<p>Community Health, Safety and Security</p> <ul style="list-style-type: none"> Poor site management practices (during both construction and operation) may lead to adverse effects on safety, human health and wellbeing. 	<ul style="list-style-type: none"> Good site "housekeeping" and management procedures (including site access). Disease control measures, e.g. no pools of standing water, rodent control, treatment of water. Risk assessments and emergency response planning to consider impacts on local communities. <p>See measures under Soils, Run-off and Flooding, and Pollution of Soils and Water above.</p>
<ul style="list-style-type: none"> Risk of worker exposure to toxic and other hazardous waste. Other construction works and maintenance health hazards (e.g. accidents, exposure to toxic substances, casualties). 	<ul style="list-style-type: none"> Materials handling and control procedures, both during construction and for incoming wastes during operations. Workers who work inside a waste treatment area or on a landfill should be equipped with and required to wear appropriate personal protection equipment (PPE). Emergency response plans during construction (contractors and local authorities) and operation (local authorities).
<ul style="list-style-type: none"> Interaction between workforce and local communities may increase occurrence of communicable diseases, including HIV/AIDS and sexually transmitted diseases (STDs). 	<ul style="list-style-type: none"> Implementation of a health management system for the workforce, to ensure it is fit for work and that it will not introduce disease into local communities. Training and awareness training for workforce and their dependents on HIV/AIDS and other STDs, and communicable diseases including malaria; health awareness raising campaigns for communities on similar topics.
<p>Landscape and visual impacts</p> <ul style="list-style-type: none"> The waste treatment plant or landfill site, especially if large, can generate negative landscape impacts. 	<ul style="list-style-type: none"> Careful siting. Landscaping integration via the work of a landscape architect working closely with the local communities and national administration, e.g. Department of Tourism. Final contours of landfill site to be in keeping with local topography and agreed with local planning regulator.
<p>Workforce-Community Interactions</p> <ul style="list-style-type: none"> Real or perceived disruption to normal community life, through the physical presence of a construction workforce. 	<ul style="list-style-type: none"> Adoption of a Stakeholder Engagement Plan, as a framework for early and ongoing community consultation. Implementation of a Grievance Procedure (see Grievance Procedure and Redress Mechanisms guidance note). Works procedures, defining a Code of Appropriate Conduct for all workers. Training for all staff in acceptable behaviour with respect to community interactions.

<p>In-migration</p> <ul style="list-style-type: none"> Individuals are likely to migrate into the area of the project which may cause conflict with resident communities, and put pressure on resources and infrastructure. 	<ul style="list-style-type: none"> Careful siting of all project components, after consultation with communities and local authorities. Preparation and implementation of an Influx/In-migration Management Plan, in consultation with local authorities. <p>See also Economic Development and Employment, and Induced Access above.</p>
<p>Labour and Working Conditions</p> <ul style="list-style-type: none"> Poor management of occupational health and safety could lead to accidents, injuries and illnesses among workers; Differences in nationality, ethnicity, religion, etc. may lead to discrimination and harassment, and differences (perceived or real) in working conditions between workers may lead to resentments. 	<ul style="list-style-type: none"> Employment practices and working conditions should conform to International Labour Organisation (ILO) Standards and national regulations. Rest and recreational facilities and time should be provided, and rules on alcohol and drugs defined and clearly communicated to workers. The basis for differences in the standard of accommodation should be non-discriminatory; it should be documented and communicated transparently to the workforce. . Clear and comprehensive health and safety reporting and grievance procedure system should be established, and be freely available to all of the workforce. <p>See also Employment and Economic Development and Human Rights.</p>

WATER SUPPLY AND SANITATION SECTOR: URBAN DRAINAG

Investment in urban drainage projects contributes to improved community health and safety, and enhanced quality of life, through managing the risks associated with surface water runoff in urban areas. However, the construction, rehabilitation, maintenance and operation of urban drainage systems have often caused widespread adverse impacts on natural and human environments. Environmental damage may include disruption or contamination of water courses and natural drainage systems, soil destabilization, erosion and sedimentation and destruction, and disturbance and loss of fauna and flora. These developments may also be a source of adverse impacts on the human environment, particularly the displacement and resettlement of affected families and businesses, and health and safety.

Scope and structure

This keysheet provides a summary of the activities, typical environmental and social impacts, and potential mitigation and management measures relating to the development of urban drainage projects. Projects considered include construction, improvement or expansion of urban drainage systems, involving collection and discharge of surface waters in urban areas, including runoff from direct rainfall and from flooding of surface and ground water bodies; and the construction and maintenance of the necessary structures.

This keysheet should be used specifically to help with drafting ToRs for ESIs of urban drainage projects and with scoping and conducting ESIs and preparing ESMPs. It can also help in reviewing ESIs. It should be used in conjunction with the Bank's Guidance Notes on ESIs (including coverage of cumulative impacts) and with the Guidance Notes on specific safeguard topics.

The keysheet is organised under the following headings, with substantive information provided in table form:

- Project components and activities.
- Sources of impact and receptors/resources.
- Mitigation and management options.

The phases of urban drainage projects considered are: design and planning, including site selection; construction; operation and maintenance; and where appropriate decommissioning (closure).

Project components and activities

The components of urban drainage projects are provided in Table 1, along with the activities involved in developing new or upgraded systems, and in operating these systems, broken down by project phase.

Sources of impact, receptors/ resources, and mitigation

Table 2 summarizes the main aspects of urban drainage project activities that lead to typical impacts, the receptors and resources they affect, and options for mitigation. It considers impacts on the physical, biological and socioeconomic environment. The mitigation measures described assume that higher level design and alignment planning measures, as described in Table 1, have already been implemented.

The guidance on impacts and options for their mitigation can be used to help discussions with the borrower or client and improve their understanding of the Bank's requirements. They should also be used to assist preparation of ToRs for an ESI so that they are tailored to the particular circumstances of the urban drainage project under consideration.

Table 1: Summary of Activities associated with Urban Drainage Projects

Components	
Drainage <ul style="list-style-type: none"> Recovery and collection systems for runoff (e.g. gutters, storm drains). Distribution pipelines, channels, culverts etc., potentially linking to main sewer system. Water storage facilities (e.g. tanks). Discharge points (e.g. to watercourse or water body). 	Ancillary Works <ul style="list-style-type: none"> Temporary construction facilities (e.g. workshops, laydown areas, working corridor outside the footprint, workers' accommodation).
Activity	
Design – Site Selection and Planning	Screening, Scoping and ESIA Preparation of ESMP Agreement of loan covenants
Strategic planning (options analysis, cost-benefit analysis, strategic site selection, initial design), to establish: <ul style="list-style-type: none"> Major environmental and social constraints and alternatives (e.g. with respect to key residential or commercial areas, watersheds and areas of biodiversity conservation importance) Design procedures such that environmental and social considerations are given equal weight to engineering and financial ones 	
Site-specific planning (detailed design), taking account of environmental and social sensitivities and consultation with communities, drawing upon the following environmental and socioeconomic documentation, all of which should comply with national regulations and international good practice: <ul style="list-style-type: none"> Environmental and Social Impact Assessment (ESIA); Environmental and Social Management Plan (ESMP). Stakeholder Engagement Plan (SEP); Resettlement Action Plan (RAP). 	
Construction	Monitoring of ESMP performance Monitoring of compliance with loan covenants Monitoring of sub-contractor contract provisions
Construction activities will include: <ul style="list-style-type: none"> Establishing temporary access to work and ancillary areas, demarcating clearance zones, establishing access control. Clearance and major earthworks (e.g. laying distribution pipelines, introducing channels, etc.). Building collection and storage facilities for surface runoff (e.g. gutters, tanks, ponds). Location and development of quarries, import of materials, e.g. aggregate/ballast. Improvement of existing drainage to feed in to project system, e.g. drainage ditches, culverts. 	
The equipment required will include heavy mobile plant (e.g. graders, bulldozers, excavators) and temporary fixed plant such as concrete batching plant and power generators.	
Operation and Maintenance	Project implementation: Compliance Monitoring
During operation, urban drainage systems will collect water and convey it to discharge points. This could contribute to direct and indirect impacts described in Table 2.	
Maintenance of urban drainage systems will entail many of the activities described above for the construction phase, although in general they are likely to be smaller in scale and spatial extent. It will include activities such as clearing and maintaining the structures.	
Decommissioning (Closure)	Project Completion: Compliance Report
Where temporary facilities used in the construction phase are no longer required (if, for example, they are not required for maintenance) they should be decommissioned and rehabilitated in accordance with a site-specific closure plan developed in consideration of international good practice. The decommissioning process will include site clearance, removal of all equipment, appropriate disposal of waste materials, soil ripping and re-grading where necessary.	
Urban drainage systems are normally intended to operate for a prolonged period, and so it would not be appropriate for closure or decommissioning plans to be prepared until a few years prior to this occurring.	

Table 2: Urban Drainage Projects: Impacts and Mitigation

Impacts	Mitigation
<p>Geology/Hydrogeology</p> <ul style="list-style-type: none"> • Interruption or disruption of surface and groundwater flows from construction, excavation and ground clearance. • Changes to timing, volume and rate of rainwater input into surrounding bodies of water and watercourses. 	<ul style="list-style-type: none"> • Design to take account of local hydrological conditions (e.g. avoid interrupting permanent waterways, do not hamper natural drainage of water bodies and watercourses, avoid works in areas prone to flooding especially during rainy season). • As far as possible, design system so as to maintain natural drainage patterns in surrounding area.
<p>Soils, Run-off and Flooding</p> <ul style="list-style-type: none"> • Loss, damage or disruption of soil during construction and earthworks, and introduction of sediments associated with runoff to watercourses at discharge points. • If properly implemented, flood risk should be reduced; potential for flooding to be exacerbated if surface waters not adequately contained or system not designed with sufficient capacity. 	<ul style="list-style-type: none"> • Minimisation of cleared areas and soil disturbance, retention of topsoil for restoration, revegetation as soon as feasible with native species. • Early installation and regular maintenance of drainage around construction areas, silt traps, etc; outlets to discharge into vegetated areas if possible; vegetation along watercourses and drainage lines to be retained if possible. • Careful consideration of timing of works (overall duration and seasonality), and design to reduce sedimentation and facilitate maintenance. • System design to meet appropriate standards for management of surface waters and incorporate principles of sustainable drainage systems (SuDS), including consideration of extreme events
<p>Pollution of Soils and Water</p> <ul style="list-style-type: none"> • Introduction of contaminants associated with runoff (e.g. from road surfaces, roofs, other wastewaters held within sewerage networks) to water bodies and soils at discharge points, or to groundwater via leaks and infiltration. 	<ul style="list-style-type: none"> • Implementation of standard good wastewater management procedures, including appropriate treatment to international standards and monitoring quality of receiving waters and soils; plan discharge of wastewater in accordance with the absorbing capacity of receiving water bodies. • Incorporate principles of sustainable drainage systems (SuDS) into design, including use of permeable surfaces, sedimentation ponds, artificial wetlands etc. to capture sediments and contaminants and treat water prior to release. • Conserve vegetation along water bodies and near wetlands, especially at wastewater discharge points. • Use of appropriate materials to construct piped network and regular maintenance of the system, appropriate containment of all water storage areas.
<ul style="list-style-type: none"> • Release of hazardous substances during construction or maintenance (e.g. accidental spills and leaks) and during operation (e.g. chemicals used in wastewater treatment) leading to soil, surface or groundwater contamination. 	<ul style="list-style-type: none"> • Materials handling and control procedures, use of storage and containment equipment meeting international standards. • Control of construction/maintenance vehicle movements and prohibition of vehicle washing in watercourses, and similar practices. • Emergency response plans during construction (contractors and local authorities) and operation (local authorities).
<p>Air Quality</p> <ul style="list-style-type: none"> • Dust and emissions from construction and maintenance activities could affect human health, vegetation and wildlife. 	<ul style="list-style-type: none"> • Sensitive site selection and siting of project components. • Use of modern equipment meeting appropriate emissions standards, and regular preventative maintenance. • Dust control and suppression measures such as dampening, use of vegetation hedges etc. • No use of ozone depleting substances during construction.
<p>Noise and Vibration</p> <ul style="list-style-type: none"> • Noise and vibration from construction and maintenance equipment, traffic and activities, may disturb sensitive noise receptors (i.e. humans). 	<ul style="list-style-type: none"> • Sensitive local siting of components and construction sites, accompanied where necessary by noise attenuation measures. • Use of modern, well maintained equipment fitted with abatement devices (e.g. mufflers, noise enclosures). • Strict controls of timing of construction activities, e.g. blasting and other high noise emissions; prohibition on night working for construction and maintenance.

Impacts	Mitigation
<p>Resources and Waste</p> <ul style="list-style-type: none"> Inefficient resource use and waste management during construction, operation and maintenance leading to excess consumption of materials, generation of wastes/emissions, pollution of soils and water. 	<ul style="list-style-type: none"> Any abstraction to take place with approval of relevant authorities at all locations. Water study prior to any abstraction, to inform a Sustainable Water Management Plan. Preparation of Waste Management Plan following the waste hierarchy, supported by staff training. Earthworks to be designed to achieve a balance between cut and fill wherever possible. Use of authorised contractors for hazardous and any other wastes which the project cannot dispose of safely. Implementation of standard good wastewater and sewage sludge management procedures.
<p>Loss, fragmentation and degradation of habitat, and severance of animal migration routes and pathways</p> <ul style="list-style-type: none"> Construction and wastewater inputs during operation causing loss, degradation or fragmentation of protected or ecologically sensitive areas (e.g. wetlands, urban natural areas and open spaces) and other areas of conservation interest. 	<ul style="list-style-type: none"> Wherever feasible, establishment of buffer zones around conservation areas, watercourses, and other locations identified as ecologically sensitive and avoidance or minimisation of activity within these zones. Rehabilitation of cleared areas with native species, and ecosystem restoration in habitats of conservation value, using specialist advice and input so as to maintain the integrity of the habitat, backed up by a long-term monitoring programme and corrective actions as necessary. <p>Where development in sensitive areas cannot be avoided, mitigation may include:</p> <ul style="list-style-type: none"> Minimisation of area impacted, clear demarcation of remaining intact areas of habitat, and prohibition of activity into those areas for any purpose; prohibit or minimise activities in vicinity of sensitive areas, e.g. upstream. Habitat rehabilitation and ecosystem restoration of areas no longer required to occur as soon as possible after construction. <p>See also Pollution of Soils and Water above and Invasive Species below.</p>
<p>Impacts on habitats and species from habitat alteration and degradation (e.g. changes in flow and drainage patterns, soil erosion, pollution of water, soils or air, introduction of invasive species); especially aquatic species in receiving waters.</p>	
<p>Direct Impacts on Flora and Fauna</p> <ul style="list-style-type: none"> Earthworks and clearance may lead to loss of plant and animal species. Development could displace animals and disturb their habitats, by direct disturbance during construction and operation. 	<ul style="list-style-type: none"> Careful site selection and siting of all project components. Careful planning of phasing and timing of construction activities. Demarcation and avoidance of areas of conservation interest (high value species, feeding or breeding sites).
<p>Invasive Species</p> <ul style="list-style-type: none"> Movements of plant and workforce could introduce invasive species which adversely impact fauna, flora and habitats; particular risk for aquatic vegetation which may spread more easily within newly introduced channels and areas of standing water. 	<ul style="list-style-type: none"> Invasive Species Management Plan, which should be developed and implemented in consultation with authorities, including appropriate eradication measures for different species/groups of species. Staff training and awareness raising in communities. No introduction of exotic species (e.g. for site rehabilitation) without specialist vetting and government approval. Where possible, clearance of invasive species during routine maintenance of water storage and distribution systems.
<p>Physical and Economic Displacement of People, Property, Assets and Resources</p> <ul style="list-style-type: none"> Development or upgrading of urban drainage systems may physically displace small numbers of people, or lead to loss of assets, e.g. loss of vegetable plots. Changes in downstream flow and quality of water, causing adverse effects on supply for other water users. 	<ul style="list-style-type: none"> Careful site selection and siting of all project components, avoiding occupation of areas which are inhabited or regarded as of high value by communities (e.g. horticulture, community orchards) where possible. Early development and sensitive implementation of resettlement planning, in accordance with national regulations and international good practice to compensate for any losses (both physical and economic). Develop corrective/compensation measures for affected parties where required (e.g. vulnerable groups).
<p>Economic Development and Employment</p> <ul style="list-style-type: none"> <ul style="list-style-type: none"> Direct employment of local population in workforce, and stimulation of local economy through improved infrastructure and demand for goods and services will enhance livelihoods and economic activity; potential for adverse effects if expectations not met and community relations are not well managed. 	<ul style="list-style-type: none"> Development of an Employment Plan, with clear employment requirements and procedures for the construction and operational/ maintenance workforce. Transparent and culturally appropriate communication with communities regarding employment opportunities. Fair and transparent hiring and staff management procedures. Employment requirements and vocational training plan to be agreed with local institutions, so that local people can be trained to meet the project's needs in a timely fashion.

Impacts	Mitigation
<p>Cultural Heritage</p> <ul style="list-style-type: none"> Displacement or damage to cultural heritage sites by construction activities, harm to local setting, amenity value, etc. 	<ul style="list-style-type: none"> Careful site selection and siting of all project components, taking account of community consultation/specialist surveys. Development of a Cultural Heritage Management Plan covering tangible and intangible (e.g. local traditions and practices) cultural heritage. Implementation of a “Chance Finds” procedure during construction. <p>See also Guidance Note on Physical Cultural Heritage.</p>
<p>Community Health, Safety and Security</p> <ul style="list-style-type: none"> Poor construction management practices may lead to adverse effects on safety, human health and wellbeing. 	<ul style="list-style-type: none"> Good construction site “housekeeping” and management procedures (including site access). Risk assessments and emergency response planning to consider impacts on local communities. <p>See also Pollution of Soils and Water above.</p>
<ul style="list-style-type: none"> Interaction between workforce and local communities may increase occurrence of communicable diseases, including HIV/AIDS and sexually transmitted diseases (STDs). 	<ul style="list-style-type: none"> Implementation of a health management system for workforce, to ensure it is fit for work and that it will not introduce disease into local communities. Training and awareness raising for workforce and their dependents on HIV/AIDS and other STDs, and communicable diseases including malaria; health awareness raising campaigns for communities on similar topics.
<ul style="list-style-type: none"> Changes in exposure to water-borne and water-related diseases, especially those associated with water-dwelling disease vectors (potential to prevent formation of areas of standing water associated with flooding, but new areas may be created, e.g. ponds) 	<ul style="list-style-type: none"> Provide information, education and communication about safe uses of water and hygienic behaviour. Implement environmental management measures for vector control: e.g. monitoring for key vectors; focal insecticide and molluscicide application. Establish regular controls and maintenance activities to protect quality of local water supply (e.g. through education and training, measures to limit contamination with untreated drainage water). Facilitate programmes/measures to ensure appropriate sanitary and medical facilities are available.
<p>Workforce-Community Interactions</p> <ul style="list-style-type: none"> Real or perceived disruption to normal community life, through the physical presence of a workforce. 	<ul style="list-style-type: none"> Adoption of a Stakeholder Engagement Plan, as a framework for early and ongoing community consultation. Implementation of a Grievance Procedure (see Grievance Procedure and Redress Mechanisms guidance note). Works procedures, defining a Code of Appropriate Conduct for all workers, including acceptable behaviour with respect to community interactions.
<p>Labour and Working Conditions</p> <ul style="list-style-type: none"> Poor management of occupational health and safety leading to accidents, injuries and illnesses among workers. Differences in nationality, ethnicity, religion, etc. may lead to discrimination and harassment, and differences (perceived or real) in working conditions between workers may lead to resentment. 	<ul style="list-style-type: none"> Employment practices and working conditions should conform to International Labour Organisation (ILO) Standards and national regulations. Rest and recreational facilities and time should be provided, and rules on alcohol and drugs defined and clearly communicated to workers. The basis for differences in the standard of accommodation should be non-discriminatory; it should be documented and communicated transparently to the workforce. Clear and comprehensive health and safety reporting and grievance procedure system should be established, and be freely available to all of the workforce. <p>See also Employment and Economic Development</p>

HEALTH AND EDUCATION PROJECTS SECTOR: SOCIAL INFRASTRUCTURE

Investment in social infrastructure contributes to improved community health and safety, economic development, and enhanced quality of life. However, the construction, rehabilitation and maintenance of social infrastructure can result in significant direct and indirect impacts on the environment, including disruption or contamination of ground and surface waters, soil destabilization, habitat destruction, and loss or disturbance of fauna and flora. Social infrastructure development may also be a source of adverse impacts on the human environment, particularly the displacement and resettlement of affected families and businesses, and health and safety.

Scope and structure

This keysheet provides a summary of the activities, typical environmental and social impacts, and potential mitigation and management measures relating to the development of social infrastructure, including construction or rehabilitation and major maintenance programmes for projects within the health and education sectors (e.g. hospitals, health clinics, schools, universities, specialised colleges, research institutions).

This keysheet should be used specifically to help with drafting ToRs for ESIs of social infrastructure developments and with scoping and conducting ESIs and preparing ESMPs. It can also help in reviewing ESIs. It should be used in conjunction with the Bank's Guidance Notes on ESIs (including coverage of cumulative impacts) and with the Guidance Notes on specific safeguard topics.

The keysheet is organised under the following headings, with substantive information provided in table form:

- Project components and activities.
- Sources of impact and receptors/resources.

- Mitigation and management options.

The phases of social infrastructure development considered are: design and planning, including site selection; construction; operation and maintenance; and where appropriate decommissioning (closure).

Project components and activities

The components of social infrastructure developments are provided in Table 1, along with the activities involved in developing new or upgraded social infrastructure, and in the operation of social infrastructure, broken down by project phase.

Sources of impact, receptors/ resources, and mitigation

Table 2 summarizes the main aspects of social infrastructure development activities that lead to typical impacts, the receptors and resources they affect, and options for mitigation. It considers impacts on the physical, biological and socioeconomic environment. The mitigation measures described assume that higher level design and site planning measures, as described in Table 1, have already been implemented.

The guidance on impacts and options for their mitigation can be used to help discussions with the borrower or client and improve their understanding of the Bank's requirements. They should also be used to assist preparation of ToRs for an ESI so that they can be tailored to the particular circumstances of the social infrastructure project under consideration.

Table 1: Summary of Activities Associated with Social Infrastructure Development

Components	
<p>Social Infrastructure</p> <ul style="list-style-type: none"> • Health, education and other social infrastructure/facilities, e.g. courthouses: main buildings, as well as additional structures e.g. offices, accommodation, storage buildings and areas, car parks, etc. • Drainage and erosion control structures. • Safety and security measures (e.g. barriers, fencing). • Other elements (e.g. power supply, signage, lighting). 	<p>Ancillary facilities</p> <ul style="list-style-type: none"> • Temporary construction facilities (e.g. workshops, laydown areas, workers' accommodation, borrow pits). • Security posts and infrastructure. • Access roads within and between temporary facilities and the construction sites, permanent access roads and other transport links. • Landscaping features, etc.
Activity (1)	
Design – Site Selection and Planning	<p>Screening , Scoping and ESIA</p> <p>Preparation of ESMP</p> <p>Agreement of loan covenants</p>
<p>Strategic planning (options analysis, cost-benefit analysis, strategic site selection, initial design), and for major social infrastructure development programmes (such as those which are part of sector-wide programmes), strategic environmental and social assessment (SESA), to establish:</p> <ul style="list-style-type: none"> • Major environmental and social constraints and alternatives (e.g. with respect to major settlements, watersheds and areas of biodiversity conservation importance), • Design procedures such that environmental and social considerations are given equal weight to engineering and financial ones. 	
<p>Site-specific planning (detailed design), taking account of environmental and social sensitivities and consultation with communities, drawing upon the following environmental and socioeconomic documentation, all of which should comply with national regulations and international good practice:</p> <ul style="list-style-type: none"> • Environmental and Social Impact Assessment (ESIA). • Environmental and Social Management Plan (ESMP). • Stakeholder Engagement Plan (SEP). • Resettlement Action Plan (RAP). 	
Activity (2)	
Construction	<p>Monitoring of ESMP performance</p> <p>Monitoring of compliance with loan covenants</p> <p>Monitoring of sub-contractor contract provisions</p>
<p>Construction activities will include:</p> <ul style="list-style-type: none"> • Establishing temporary access to work and ancillary areas, demarcating clearance zones, establishing access control. • Clearance and levelling of the project footprint, and major earthworks where required. • Construction of buildings and associated facilities. • Location and development of borrow pits and possibly quarries, import of materials, e.g. aggregate/ballast. • Sourcing and establishing a water supply from surface and/or groundwater. • Improvement of existing drainage and introduction of new drainage, including culverts if required. • Establishment or improvement of safety arrangements e.g. barriers, lighting. • Landscaping, as required. 	
<p>The equipment required will include heavy mobile plant (e.g. graders, bulldozers, excavators) and temporary fixed plant such as concrete batching plant and power generators.</p>	
Operation and Maintenance	Project implementation: Compliance Monitoring
<p>During operation, social infrastructure will be used by people to access health services or education; regular use by small to large numbers of individuals will be associated with increased flow of traffic at the project site and in the surrounding area; loading, unloading and storage of equipment and goods, which may include hazardous materials; provision of water and energy supply, sewerage treatment and disposal etc. These activities may contribute to direct and indirect impacts described in Table 2.</p>	
<p>Maintenance will entail many of the activities described above for the construction phase, although in general will be smaller in scale and spatial extent.</p>	
Decommissioning (Closure)	Project Completion: Compliance Report
<p>Where temporary roads and facilities used in construction are no longer required (if, for example, they are not required for maintenance) they should be decommissioned and rehabilitated in accordance with a site-specific closure plan developed in consideration of international good practice. The decommissioning process will include site clearance, removal of all equipment, appropriate disposal of waste materials, soil ripping and re-grading where necessary.</p>	
<p>Social infrastructure is normally intended to remain in place and to operate for a prolonged period, and so it would not be appropriate for closure or decommissioning plans to be prepared until a few years prior to this occurring.</p>	

Table 2: Social Infrastructure Developments: Impacts and Mitigation

Impacts	Mitigation
<p>Geology/Hydrogeology</p> <ul style="list-style-type: none"> • Interruption of surface and groundwater flows from excavation, ground clearance and construction. 	<ul style="list-style-type: none"> • Site selection to take account of local hydrological conditions (e.g. avoid watercourses, springs, shallow water table). • Limit sealed or compacted areas as much as possible, to maintain natural recharge of the water table. • Avoid removing material below the water table.
<ul style="list-style-type: none"> • Changes to timing, volume and rate of rainwater input into surrounding bodies of water and watercourses. • Introduction of sediments to watercourses or interruption of drainage patterns, as a result of ground clearance, earthworks and the introduction of drainage structures. 	<ul style="list-style-type: none"> • Minimisation of cleared areas and soil disturbance, with revegetation as soon as feasible, with native species. • Early installation and regular maintenance of drainage and diversion structures, silt traps, etc; drainage outlets to discharge into vegetated areas if possible; vegetation along watercourses and drainage lines to be retained if possible. • Avoidance of areas liable to flooding, slope instability, and water crossings where possible. • Retention of topsoil for restoration (including tilling and revegetation) as soon as practicable. • Careful design: e.g. site selection, minimal diversion, timing of works (overall duration and seasonality).
<p>Pollution of Soils and Water</p> <ul style="list-style-type: none"> • Pollution of surface and ground water from sewage effluent discharged during construction (workforce) and operation (staff, patients, students, visitors etc.). 	<ul style="list-style-type: none"> • Implementation of standard good wastewater management procedures. • Installation of sewage treatment to meet required standards. • Hygiene training for workforce and operational staff.
<ul style="list-style-type: none"> • Release of hazardous substances during construction or operation (e.g. runoff during maintenance, accidental spills/leaks, medical waste) leading to soil, surface or groundwater contamination. 	<ul style="list-style-type: none"> • Materials handling, control and disposal procedures, especially for medical waste. • Control of construction vehicle movements and prohibition of vehicle washing in watercourses, and similar practices. • Development of emergency response plans during construction (contractors and local authorities) and operation (local authorities) to manage major incidents if they should occur.
<p>Air Quality</p> <ul style="list-style-type: none"> • Dust from construction activities could affect human health, vegetation and wildlife. • Emissions from construction and maintenance activities and exhausts from increased traffic levels, affecting sensitive receptors (human, flora, fauna). 	<ul style="list-style-type: none"> • Sensitive site selection and siting of construction facilities. • Dust control and suppression measures, such as use of dampening. • Use of modern equipment meeting appropriate emissions standards, and regular preventative maintenance. • Encourage increased fuel efficiency in project vehicles (e.g. selection of fuel in order to minimise harmful emissions). • No use of ozone depleting substances during construction.
<p>Noise and Vibration</p> <ul style="list-style-type: none"> • Noise and vibration from construction, operational and maintenance equipment, traffic and activities, may disturb sensitive noise receptors (human, fauna). 	<ul style="list-style-type: none"> • Sensitive local access route selection, and siting of project facilities, accompanied where necessary by noise attenuation measures. • Use of noise barriers to screen receptors, e.g. with berms or bunds. • Use of modern, well maintained equipment fitted with abatement devices (e.g. mufflers, noise enclosures). • Strict controls of timing of activities e.g. blasting and other high noise emissions; prohibition on night working if possible. • Observance of seasonal sensitivities (e.g. breeding seasons), and alteration of activity to reduce noise levels at that time.
<p>Resources and Waste</p> <ul style="list-style-type: none"> • Construction and operation will require supply of water (surface or groundwater), which could affect existing supply for human communities and ecosystems. 	<ul style="list-style-type: none"> • Water study prior to any abstraction, to inform a Sustainable Water Management Plan. • No abstraction without prior approval of relevant authorities at all locations. • Promotion of water efficiency (including leak detection, preventative maintenance of equipment) and water recycling.
<ul style="list-style-type: none"> • Inefficient waste management during construction, operation and maintenance leading to excess consumption of materials, generation of wastes/emissions, pollution of soils and water. 	<ul style="list-style-type: none"> • Preparation of Waste Management Plan following the waste hierarchy, supported by staff training. • Earthworks to be designed to achieve a balance between cut and fill wherever possible. • Use of authorised contractors for hazardous and any other wastes which the project cannot dispose of safely.

Impacts	Mitigation
<p>Loss, fragmentation and degradation of habitat, and severance of animal migration routes and pathways</p> <ul style="list-style-type: none"> Land clearance during construction and maintenance causing loss or fragmentation of protected or ecologically sensitive areas and other areas of conservation interest (including migration routes, feeding/breeding areas), and degradation following poorly managed rehabilitation. Impacts on habitats and species from habitat alteration and degradation (e.g. changes in drainage, soil erosion, pollution of water, soils or air, introduction of invasive species). 	<ul style="list-style-type: none"> Careful site selection and siting of all project components, with advice from biodiversity authorities/wildlife specialists. Wherever feasible, establishment of buffer zones around conservation areas, watercourses, and other locations identified as ecologically sensitive and avoidance or minimisation of activity within these zones. Rehabilitation of cleared areas with native species, and ecosystem restoration in habitats of conservation value, using specialist advice and input, backed up by a long-term monitoring programme and corrective actions as necessary. Observance of seasonal sensitivities (e.g. breeding seasons), and alteration of activity to reduce impacts at that time. <p>Where development in sensitive areas cannot be avoided, mitigation may include:</p> <ul style="list-style-type: none"> Minimisation of area impacted, clear demarcation of remaining intact areas of habitat, and prohibition of activity into those areas for any purpose; maintenance of wildlife corridors between fragmented areas wherever possible. No ground clearance upstream of sensitive areas unless appropriately engineered drainage installed. Habitat rehabilitation and ecosystem restoration of areas no longer required after construction, as soon as possible. If loss of Critical Habitat is inevitable, development/implementation of an Offsets Programme. <p>See relevant sections re. control of impacts relating to hydrology, pollution, invasive species, and induced access.</p>
<p>Impacts from Induced Access</p> <ul style="list-style-type: none"> Development of social infrastructure in more remote areas will encourage access, and may lead further development, and increased disturbance and pressure on natural resources through bushmeat hunting, logging, fire, etc. 	<ul style="list-style-type: none"> Careful site selection and siting of all project components, with advice from biodiversity authorities/wildlife specialists to avoid remote and previously inaccessible areas where possible. Development of a construction camp siting strategy to avoid attracting people towards more remote areas, where possible. Restrictions on access to all temporary access roads, and their removal after construction. <p>See also Bushmeat Hunting below.</p>
<p>Bushmeat Hunting</p> <ul style="list-style-type: none"> Construction activities and development in remote areas could lead to greater demand for bushmeat (from workforce and wider community), stimulate the wildlife trade and facilitate access to hunting areas. 	<ul style="list-style-type: none"> Bushmeat Hunting and Wildlife Trade Management Plan, agreed with government authorities and implemented jointly. Prohibition on workforce hunting, selling, or purchasing bushmeat, and training to support this requirement. Prohibition on workforce (except security personnel) having guns in work areas or accommodation. Sensitisation and public awareness campaigns against hunting and bushmeat the trade amongst local communities.
<p>Direct Impacts on Flora and Fauna</p> <ul style="list-style-type: none"> Clearance of vegetation may lead to loss of plant species and habitat of conservation interest. Development of social infrastructure could displace animals and disturb their habitats, by direct disturbance during construction and operation (e.g. from noise, light disturbance at night, general human presence). 	<ul style="list-style-type: none"> Careful site selection and siting of all project components, with advice from biodiversity authorities/wildlife specialists. Careful planning of phasing and timing of construction activities. Demarcation and avoidance of areas of conservation interest (high value species, feeding or breeding sites, migration routes, etc.) where possible, and wildlife rescue and translocation where appropriate, under expert supervision. Implementation of observation and avoidance procedures for sensitive flying species. <p>Also see measures under Hydrology, Soils, Run-off and Flooding, Pollution of Soils and Water, and Induced Access above, and Invasive Species below</p>
<p>Invasive Species</p> <ul style="list-style-type: none"> Movement of plant and workforce into areas could introduce invasive species which adversely impact fauna, flora, ecosystems, and crops. 	<ul style="list-style-type: none"> Invasive Species Management Plan, which should be developed and implemented in consultation with authorities, including appropriate eradication measures for different species/groups of species. Staff training and awareness raising in communities. No introduction of exotic species (e.g. for site rehabilitation) without specialist vetting and government approval.

Impacts	Mitigation
<p>Physical and Economic Displacement of People, Property, Assets and Resources</p> <ul style="list-style-type: none"> Development or upgrading of social infrastructure may physically displace people, or lead to the loss of assets (e.g. agricultural land). 	<ul style="list-style-type: none"> Careful site selection and siting of all project components, and avoid occupation of areas which are inhabited or regarded as of high value by communities (e.g. horticulture, community orchards) where possible. Early development and sensitive implementation of resettlement planning, in accordance with national regulations and international good practice to compensate for any losses (both physical and economic).
<p>Economic Development and Employment</p> <ul style="list-style-type: none"> Direct employment of local population in workforce, and stimulation of local economy through demand for goods and services will enhance livelihoods and economic activity in local communities, but potentially adverse effects if expectations not met and community relations are not well managed. 	<ul style="list-style-type: none"> Development of an Employment Plan, with clear employment requirements and procedures for the construction and operational/maintenance workforce. Transparent and culturally appropriate communication with communities regarding employment opportunities. Fair and transparent hiring and staff management procedures. Employment requirements and vocational training plan to be agreed with local institutions, so that local people can be trained to meet the project's needs in a timely fashion. Development of measures to manage the transition after construction is complete, including SME development, ongoing opportunities for the workforce in provision/support of health/education services, reskilling and alternative employment.
<p>Cultural Heritage</p> <ul style="list-style-type: none"> Displacement or damage to cultural heritage sites by construction activities, harm to the setting, amenity value, etc. of the site due to construction or operation. Change to intangible cultural heritage due to increased access, and interaction with workforce. 	<ul style="list-style-type: none"> Careful site selection and siting of all project components, taking account of community consultation/specialist surveys. Development of a Cultural Heritage Management Plan covering tangible and intangible (e.g. local traditions and practices) cultural heritage. Implementation of a "Chance Finds" procedure during construction. <p>See also Guidance Note on Physical Cultural Heritage.</p>
<p>Community Health, Safety and Security</p> <ul style="list-style-type: none"> Poor construction management practices may lead to adverse effects on safety, human health and wellbeing. 	<ul style="list-style-type: none"> Good construction site "housekeeping" and management procedures (including site access, disease control measures). Risk assessments and emergency response planning to consider impacts on local communities. <p>See also control of pollution under Physical Impacts heading.</p>
<ul style="list-style-type: none"> Interaction between workforce and local communities may increase occurrence of communicable diseases, including HIV/AIDS and sexually transmitted diseases (STDs). 	<ul style="list-style-type: none"> Implementation of a health management system for the construction workforce, to ensure it is fit for work and that it will not introduce disease into local communities. Training and awareness training for workforce and their dependents on HIV/AIDS and other STDs, and communicable diseases including malaria; health awareness raising campaigns for communities on similar topics.
<p>Workforce-Community Interactions</p> <ul style="list-style-type: none"> Real or perceived disruption to normal community life, through the physical presence of a workforce. 	<ul style="list-style-type: none"> Adoption of a Stakeholder Engagement Plan, as a framework for early and ongoing community consultation. Implementation of a Grievance Procedure (see Grievance Procedure and Redress Mechanisms guidance note). Works procedures, defining a Code of Appropriate Conduct for all workers. Training for all staff in acceptable behaviour with respect to community interactions.
<p>Labour and Working Conditions</p> <ul style="list-style-type: none"> Poor management of occupational health and safety leading to accidents, injuries and illnesses among workers; mental health issues due to remote or enclosed living. Differences in nationality, ethnicity, religion, etc. may lead to discrimination and harassment, and differences (perceived or real) in working conditions between workers may lead to resentments. 	<ul style="list-style-type: none"> Employment practices and working conditions should conform to International Labour Organisation (ILO) Standards and national regulations. Rest and recreational facilities and time should be provided, and rules on alcohol and drugs defined and clearly communicated to workers. The basis for differences in the standard of accommodation should be non-discriminatory; it should be documented and communicated transparently to the workforce. Clear and comprehensive health and safety reporting and grievance procedure system should be established, and be freely available to all of the workforce. <p>See also Employment and Economic Development and Human Rights.</p>



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