BAGAN DISASTER RISK MANAGEMENT PLAN (DRMP)

With support from the Japan-World Bank Program
for Mainstreaming Disaster Risk Management (DRM) and the Tokyo DRM Hub

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FOREWORD

Though it may be a part of history, the past can also be very much at risk. On August 24, 2016, we were forcefully reminded of this, when a magnitude-6.8 earthquake shook Myanmar, its people, and its cultural heritage. The Bagan Cultural Heritage Site saw the earthquake damage more than 350 monuments, and put our country on notice: we must act to safeguard our cultural heritage and the people inextricably linked to it.

We have acted to assess, respond, and restore the Bagan Site following the earthquake. More importantly, we have and will continue our efforts to manage and reduce the risks that remain: the risks to the integrity of the site, the risks to the cultural and economic activity connected to Bagan, and the risks to the well-being of local people and communities in and around Bagan.

That is why we have developed the Bagan Disaster Risk Management (DRMP) in our preparation of Bagan for submission as a UNESCO World Heritage Site. The DRMP presents a useful approach to understand the risks to Bagan, as well as the management frameworks and current DRM measures in place. It then presents an Action Plan for strengthening and implementing measures to better address the risks and drivers of risk to Bagan. These efforts must continue to be integrated into the management and protection of Bagan going forward.

We thank the World Bank, including the Tokyo World Bank Hub and the Japan-World Bank Program for Mainstreaming DRM, for their support for our efforts. Expert deployments from Japan, key workshops, and consensus-building among key stakeholders allowed us to shape our vision for a resilient Bagan.

We look forward to work with our colleagues in the Government of Myanmar, the communities and people of Bagan and Myanmar, and our development partners to make this vision of a resilient Bagan a reality.

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ABBREVIATIONS AND ACRONYMS

ADPC	Asian Disaster Preparedness Center
AGO	Attorney General's Office
Bagan DRMP	Bagan Disaster Risk Management Plan
BaganCOM	Bagan Committee for the Management of the Cultural Heritage Property and Buffer Zone
CDC	City Development Committee
CH	cultural heritage
DANM	Department of Archaeology and National Museum
DFID	U.K. Department for International Development
DFS	Department of Fire Services
DHUD	Department of Housing and Urban Development
DMH	Department of Meteorology and Hydrology
DOF	Department of Forestry
DRM	disaster risk management
DWIR	Directorate of Water Resources and Improvement of River Systems
ECD	Environmental Conservation Department
EIA	environmental impact assessment
EOC	Emergency Operations Center
EWS	Early Warning System
GAD	General Administration Department
GECD	General Environmental Conservation Department
GOM	Government of Myanmar
ha	hectare
ICOMOS	International Council on Monuments and Sites
IFRC	International Federation of Red Cross
JICA	Japan International Cooperation Society
km	kilometer
MAPDRR	Myanmar Action Plan on Disaster Risk Reduction
MDPA	Myanmar National Disaster Preparedness Agency
MEC	Myanmar Earthquake Committee
MES	Myanmar Engineering Society
MGS	Myanmar Geosciences Society
MIMU	Myanmar Information Management Unit
MMS	Mescal-Modified Scale
MNREC	Ministry of Natural Resources and Environmental Conservation
MOAI	Ministry of Agriculture and Irrigation
MOALI	Ministry of Agriculture, Livestock and Irrigation
MOC	Ministry of Construction
MOHA	Ministry of Home Affairs
MOHT	Ministry of Hotels and Tourism
MOI	Ministry of Information
MOSWRR	Ministry of Social Welfare, Relief and Resettlement
MOTC	Ministry of Transport and Communications
MPF	Myanmar Police Force
MRAC	Ministry of Religious Affairs and Culture
MRCS	Myanmar Red Cross Society
NMDC	National Disaster Management Committee
NNDMC	National Natural Disaster Management Committee
OUV	Outstanding Universal Value
PGA	peak ground acceleration
RRD	Department of Relief and Resettlement
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization

SECTION I
INTRODUCTION

The Bagan Disaster Risk Management Plan (Bagan DRMP) is an initiative of the Government of Myanmar (GOM) to:

- understand the risks facing the Bagan Cultural Heritage Site, especially in terms of the heritage attributes, visitors, and residents;
- clarify relevant management frameworks;
- capture the current measures pursued by Bagan's many stakeholders to manage and reduce those risks; and
- set out an Action Plan to enhance disaster risk management (DRM) at Bagan.

In recognition of the many features that make Bagan a complex cultural ecosystem, the Bagan DRMP seeks an integrated approach to manage risk in terms of:

- the risk to physical monuments and the integrity of the site,
- the risk to the cultural and economic activity in and around the site, and
- the risk to the well-being of local people and communities in and around Bagan.

Throughout, GOM seeks to protect the Outstanding Universal Value (OUV) of the Bagan Cultural Heritage Site.

1. Site Summary

The Bagan Cultural Heritage Site covers 180 square kilometers (km^2) (including the Bagan Cultural Heritage Property of 45 km^2) in the alluvial flat plain of Myanmar's central dry zone between the hills of Tankyi-taung and Tuyin-taung, and spans across the Irrawaddy River.[1] Tectonically, Myanmar is located on the eastern edge of the boundary between the India Plate and Burma Plate in what is believed to be a subduction zone (Shengji and Sieh 2016). It is home to 2 townships and 41 villages, with a total population of 81,505.[2] Because of its geographical location, Bagan is affected by geological, hydrological, and meteorological conditions, as well as human-induced hazards, which together significantly threaten the site.

2. Cultural Significance

Bagan was the heart of the largest Buddhist Empire of the medieval world and emerged as the capital of this empire in the 9th century CE. The site possesses 3,595 surviving tangible cultural assets, including stupas, temples, monasteries, ordination halls, a palace site and fortifications, and associated inscriptions, sculptures, murals and cloth paintings, archaeological deposits, and water management features.[3] It is a testimony to cultural traditions and expressions of the Myanmar practice of merit-making, as intangible assets. The majority of the structures date from the peak of the empire (11th to the 13th centuries CE) known as the Bagan Period. As a site of Outstanding Universal Value (OUV), Bagan meets the UNESCO World Heritage Centre's criteria (iii), (iv), and (vi) for inclusion in the World Heritage List.

3. Earthquake of August 24, 2016

On August 24, 2016, an earthquake of magnitude 6.8 struck near Chauk, Myanmar, (20.923°N94.569°E) at a depth of 82.0 km.[4] In response, GOM, with support from UNESCO, the World Bank, and other partners, ensured assessment of the site and recommendations for improvements and follow-up actions to structurally stabilize damaged monuments — at both the monument-by-monument and overall site level.[5] Key findings and recommendations from these reports included:

- **The site had more than 350 damaged monuments, which were classified by damage level and priority.**[6]
- **Bagan should prepare for much larger earthquakes:** "The earthquake of 24 August 2016; with its relatively low intensity (VI degree MCS scale) and acceleration (less than 0.1 g) should be compared with possible expected earthquake of intensity between VIII and IX degree and peak ground accelerations (PGA) of 0.3-0.4 g" (Gavrilovic et al. 2016, p. 71).
- **The 2016 earthquake provides insights on current structural vulnerability:** "(i) Seismic strengthened monuments after the 1975 earthquake withstood the 2016 earthquake without or with minimal damage; (ii) Heavy damage and partial collapse occurred on monuments where inappropriate interventions have been done and on partially rebuilt monuments (748 Sulamani Temple);[7] (iii) Damage occurred on monuments strengthened with appropriate methods and materials, for example with metal frames (1239 Nan Paya Temple) and buttresses (1587 Pitak-taik temple); (iv) Damage also occurred in monuments with masonry repair without strengthening and maintenance" (Gavrilovic et al. 2016, p. 71).
- **The damage from and response to the 2016 earthquake also suggest several institutional and wider measures that could enhance risk management of the Bagan site:** (i) increase number and capacity of the Department of Archaeology and National Museum (DANM) and related agency staff to ensure ability to implement DRM measures, (ii) establish and empower the government's committee structure to take advantage of the domestic expertise and institutional framework of Myanmar, and (iii) increase detailed understanding of seismic and other risks in Bagan to better inform future action.

These assessments and recommendations have been considered and integrated into this Bagan DRMP.

1 The area of nominated property is 4,987.88 hectares (ha); the buffer zone is 17,821.97 ha; the total area is 22,809.85 ha (GOM 2017c, Nomination Dossier, Vol. 1, p. 21).

2 Bagan township profile information (GAD informal communication, 2016).

3 Bagan Heritage Site Survey (DANM informal communication, 2016).

4 Data are from USGS, available at https://earthquake.usgs.gov/earthquakes/eventpage/us10006gbf#executive

5 Key reports included Gallinaro 2016 and Gavrilovic et al. 2016.

6 The assessment results classified and identified 50 monuments as "red" for severely damaged, 96 as "yellow" for moderately damaged, and 124 as "green" for lightly damaged (Gavrilovic et al. 2016, p. 13).

7 The monument numbers are those used by the World Heritage Centre.

4. Bagan's Disaster Risk Management Approach

The threats to Bagan require action to safeguard its unique heritage of world significance. The Bagan DRMP provides a path to mitigate and manage risks by preventing and reducing negative impacts of damaging events. It understands risks as a product of hazards, exposure, and vulnerabilities; these are addressed from a multi-stakeholder perspective to increase the resilience of the tangible and intangible assets, while at the same time protecting visitors as well as residents and their livelihoods.

In line with the UNESCO DRM cycle (Figure 1) (UNESCO 2010), which sets out DRM in cyclical time-based phases (i.e., before, during, and after), this DRMP captures current measures and proposes new action for: (i) risk identification, (ii) risk reduction and mitigation, (iii) preparedness and response, and (iv) recovery and rehabilitation.

5. Alignment with National and International Frameworks

Myanmar and the Bagan DRMP are aligned with national and international frameworks for cultural heritage and DRM.

In May 2014, Myanmar ratified the 2003 UNESCO "Convention for the Safeguarding of Intangible Cultural Heritage."

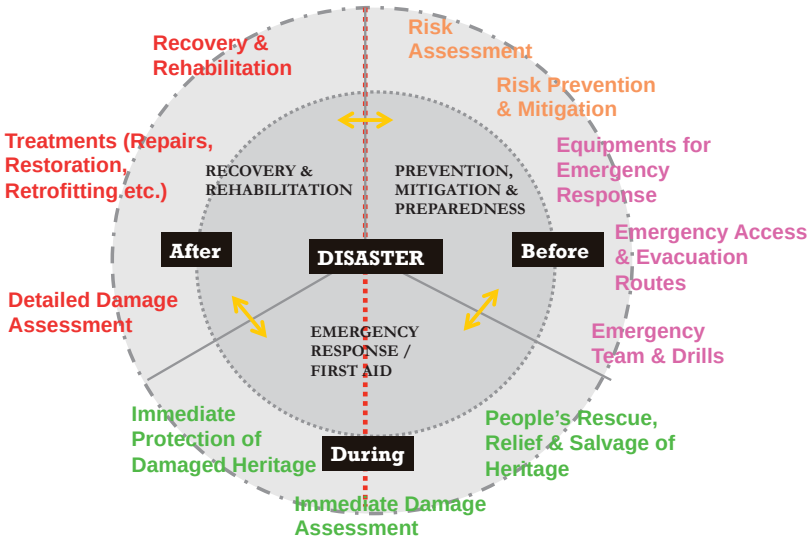
GOM has developed the nationwide *Myanmar Action Plan on Disaster Risk Reduction 2017* (MAPDRR), which includes four pillars, each of which has specific targets and priority actions. These pillars are:

- Pillar 1. Assessing disaster risk including extreme weather events and creating public awareness of DRR,
- Pillar 2. Strengthening disaster risk governance to reduce and manage risk,
- Pillar 3. Mainstreaming disaster risk reduction for resilient development, and
- Pillar 4. Enhancing disaster preparedness for effective response and reconstruction.

Under MAPDRR Pillar 4, GOM recognizes the importance of cultural heritage by committing to Priority Action 9: *Disaster and climate risk management of historical monuments and archaeological heritage in Myanmar*, led by the Ministry of Religious Affairs and Culture. Under MAPDRR Target 3 (T3) to *Reduce direct disaster economic loss in relation to GDP of Myanmar by 2030*, GOM aims to reduce the damage and destruction to cultural heritage (T3.5).

The MAPDRR provides a pathway to achieving targets under the *Sendai Framework for Disaster Risk Reduction 2015–2030*, which articulates the need for improved understanding of disaster risk in all its dimensions of exposure, vulnerability, and hazard characteristics; and focuses on preventing new risk, reducing existing risk, and strengthening resilience for cultural heritage (UNISDR 2015).

Figure 1. Disaster Risk Management Cycle for Cultural Heritage (UNESCO)



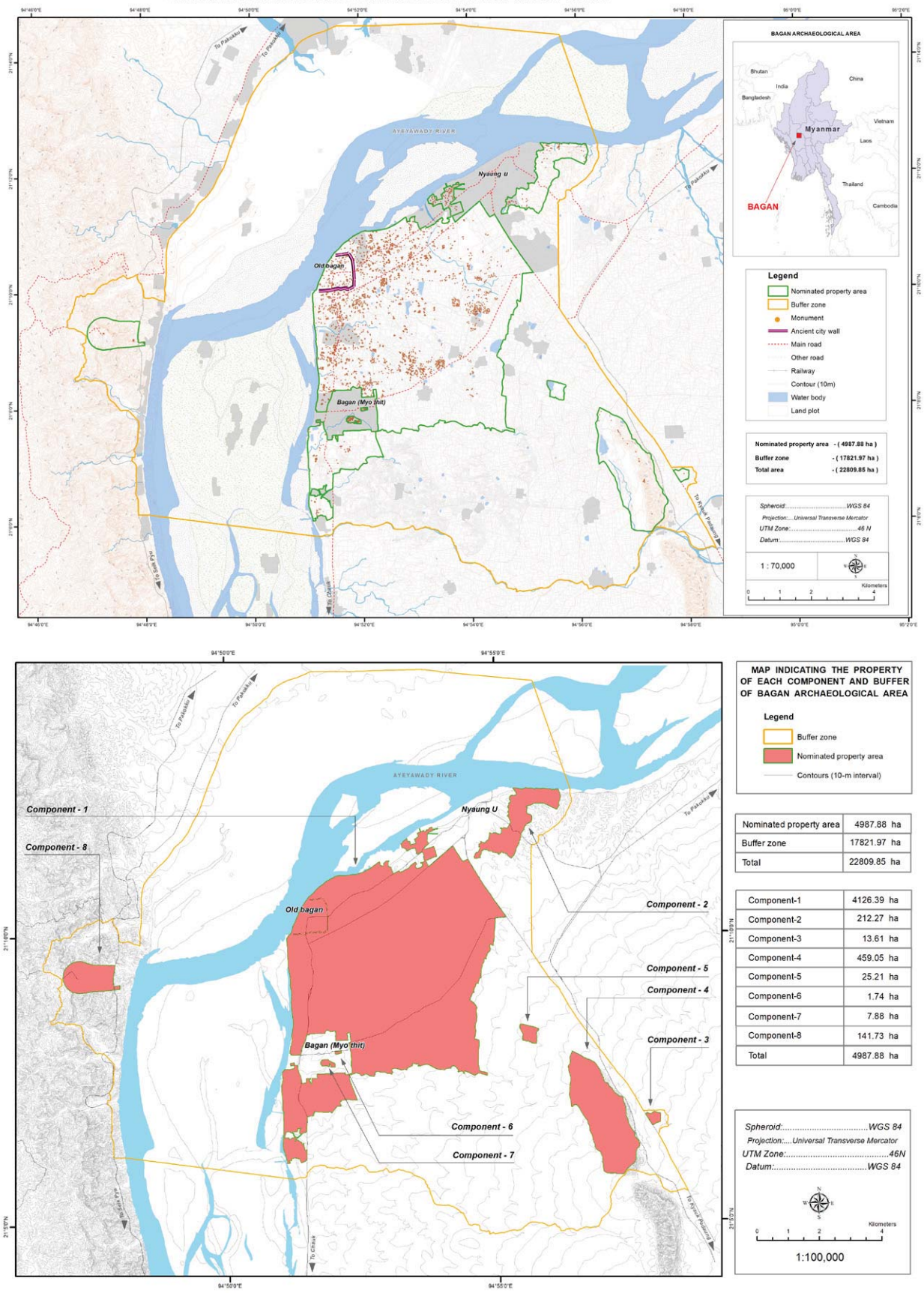
Source: Jigyasu 2016.

SECTION II
RISK IDENTIFICATION IN BAGAN

Bagan is a multi-hazard risk area (Figure 2) subject to many hazards and threats, with stakeholders and assets facing varying levels of exposure and vulnerability to these threats.

Working through a variety of ministries, stakeholders, and local and international partners, GOM identifies the risks to Bagan by (i) collecting relevant data and information on hazards, exposure, and vulnerability; (ii) looking at the current targeted use of risk assessment; and (iii) providing consultations to capture stakeholders' understanding and experience of risk at the site. Section IV of the Bagan DRMP lists current measures being taken to manage risk, including risk identification initiatives, and Section V lists measures that are planned or under consideration by GOM.

Figure 2. Boundaries of Nominated Property and Buffer Zone Boundaries of Bagan



Source: DANM GIS team report 2017.

Note: Boundaries of Nominated Property and Buffer Zone Boundaries of Bagan, as produced by the DANM GIS team and approved by Mandalay Region Government.

1. Exposure and Vulnerability

Exposure is the state or condition of being unprotected and open to damage, loss, or disruption. Measuring exposure entails capturing the assets, activities, and other elements of value that are subject to this state.

Vulnerability is the sum of the physical, social, economic, and environmental factors or processes that increase the likelihood of an individual, a community, assets, or systems suffering damage after a disaster occurs.

Below, exposure and vulnerability are analyzed for (i) monuments and the integrity of the site, (ii) cultural and economic activity in and around the site, and (iii) the well-being of local people and communities in and around Bagan. This approach applies a comprehensive lens that considers the site as a whole, including tangible and intangible cultural heritage, communities' well-being, and their livelihoods.

1.1 Exposure and Vulnerability of the Monuments and Integrity of the Site

The Ministry of Religious Affairs and Culture's Department of Archaeology and National Museum (DANM) manages an inventory of Bagan's tangible assets. An analysis of Bagan's OUV heritage assets against World Heritage Centre's criteria has been conducted (see Annexes 1 and 2).

In addition to the tangible assets of Bagan, the Buddhist tradition of merit-making — a powerful force of creation in Bagan — and patronage still infuses the daily life of local communities. The merit-making belief states that good deeds and positive actions will determine a better quality in the next life. Traditional merit-making includes festivals, celebrations, and rituals as well as contributions made to the maintenance and repair of monuments. In Bagan, the close relationship between communities and tangible heritage through the culture of merit-making is unique to this site. Bagan is a stunning and harmonious combination of buildings, traditions, landscape, and communities.

1.2 Exposure and Vulnerability of the Cultural and Economic Activity of the Site

Hazards can cause direct damage to buildings and monuments but can also indirectly impact economic activities and cultural traditions. Most of the economic activities in the area are related to tourism (such as hotels, restaurants, shops, and tour operators). Therefore, if that sector is affected, people could lose their major source of income.

1.3 Exposure and Vulnerability of Well-Being of Local People and Communities

The Bagan Cultural Heritage Site has a population of 81,500 inhabitants, of whom 10,900 are in the Property zone (6 villages) and 70,500 in the Buffer zone (2 towns and 35 villages). Hazards can cause direct losses to these communities, both in terms of lives and damage to residential buildings.

2. Hazards

Hazards are defined as dangers than can cause loss or damage to human life, activities, and property (e.g., cultural and physical). Hazards occur with different levels of frequency and severity.

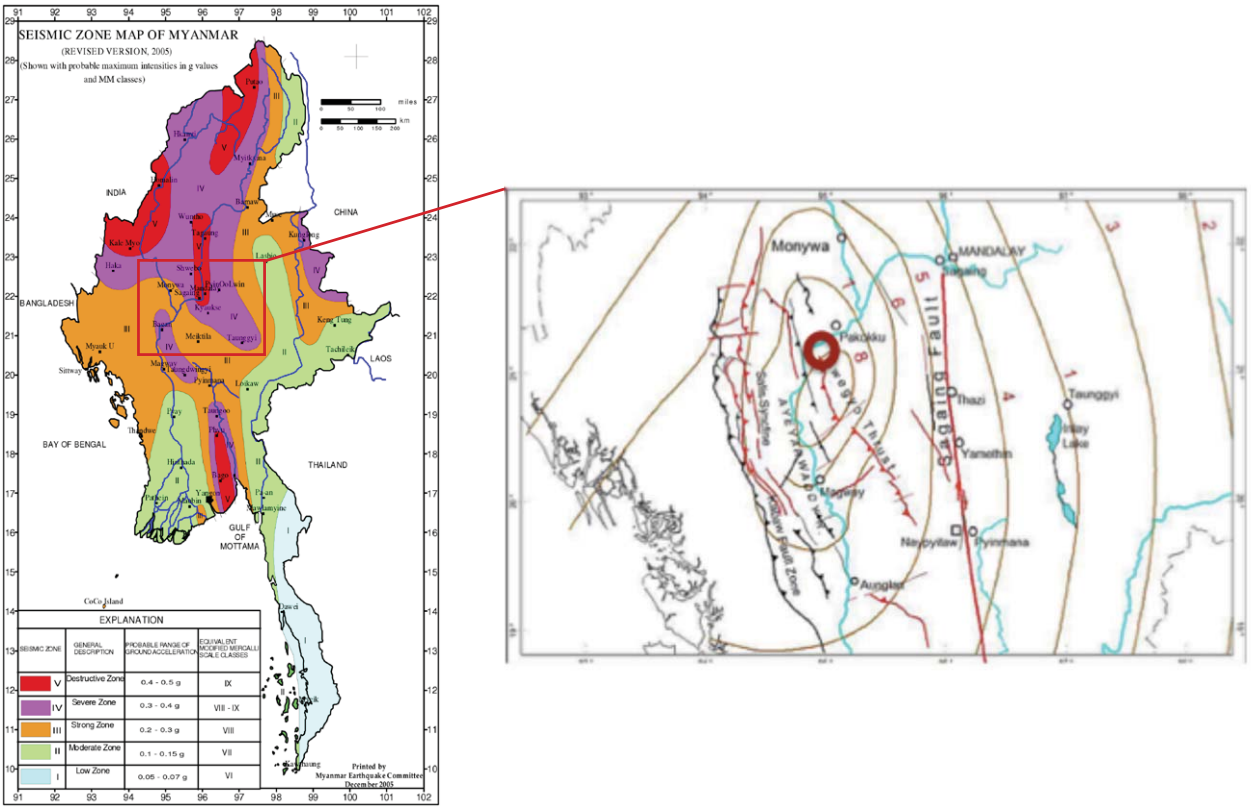
2.1 Threats from Natural Hazards

Bagan is subject to threats from natural hazards. Earthquakes present the most catastrophic threat to Bagan's cultural heritage and surrounding communities. Hazards from weather and climate also disrupt and damage Bagan, and are likely to increase as a result of climate change.

Geological and Seismic. Bagan is located in Myanmar's Seismic Zone IV ("Severe Zone") – as per Figure 3. Seismic Zone Map – with expected intensity of earthquake between VIII and IX on the Mescal-Modified Scale (MMS) and expected ground accelerations of 0.30-0.40 g.[8] Many shallow earthquakes occur within the region because of both strike-slip and reverse faults. It has been found that

8 *Seismic Zone Map of Myanmar (Myanmar Earthquake Committee, 2005)*

Figure 3. Seismic Zone Map of Myanmar and Mandalay Region



Source: MEC 2005; DFID 2009.

Figure 4. Sulamani Temple Damaged in 2016 Earthquake

Source: DANM.

the two main faults that affect Myanmar are the active Sunda "mega thrust" fault in the Indian Ocean and the strike-slip Sagaing Fault that cuts through the country.[9] Furthermore, the ancient city of Bagan is located at the convergence of the Bangal subduction zone (to the west) and the Sagaing Fault — which runs through Bagan City — (to the east). The site is lodged between two major active faults, Chauk-Yenanchaung Thrust Fault and Gwe-cho Thrust Fault (Figure 3).

Earthquakes have and will cause loss or damage to human life, activities, and the site itself (Figure 4).[10]

Hydrological and Meteorological. The site's proximity to the Irrawaddy River and its tributaries subjects it to flooding and riverbank erosion. Flooding of tributaries usually occurs three or more times during the monsoon season (May–October), affecting housing and livelihoods in low-lying communities as well as transportation through Bagan.

Figure 5. Shwe Nan Yin Taw Monastery during 2014 Flooding (2014)

Source: DANM.

Figures 6 and 7. Slope Stabilization Measures Completed by MOTC (Approximately 2005) and Rotation of the Façade at Thet Kya Muni, Bagan (December 2017)

Source: DANM.

9 T"Predictions for the maximum earthquake magnitude to occur along the mega thrust have varied to be between Mw 8.5-8.8 with a recurrence interval ranging from 190-1000 years. Wang et al has attempted to refine these predictions for the maximum magnitude that could occur along all active faults and the mega thrust based on fault lengths and historic magnitudes using empirical global relationships. Each active fault can generate events that are greater than Mw 7.0, with the mega thrust and the Sagaing fault having the ability to generate an earthquake of Mw 8.5 or greater every few hundred years" (Loos 2017).

10 The earliest records date (various inscriptions) from 729 CE with the years 1286, 1298, 1380, 1644, 1768, 1774, 1775, 1777, and 1848. Bagan suffered from more than 400 earthquakes between 1904 and 1975 (Thawbita 1976).

Heavy rain disrupts the normal functioning of the site, transportation, and cultural and economic activities.

River bank erosion and general slope stability issues threaten several monuments, such as Thet Kya Muni, where continued erosion could undermine the foundation of the monument (Figures 6 and 7).

A high-intensity seismic event that occurs during monsoon season could greatly complicate site evacuation and delay recovery. An earthquake could also exacerbate site vulnerabilities to slope instability and erosion.

Droughts and Fires. Bagan is located in a dry zone. Probably connected to climate change, a progressive desertification is taking place in the area, causing an average of five wildfires per year.[11] Urban and forest fires are major threats in the dry season (approximately November to May) for Bagan; fires have caused nearly 70 percent of registered disaster events. These could pose substantial health threats to residents and visitors and directly damage sites.

2.2 Threats from Human-Induced Hazards

Human presence and activities are necessary and desirable for maintaining Bagan as a "living" cultural site, but tourism activities, spatial development, and agricultural practices can create threats to Bagan.

Visitors. The Myanmar Tourism Master Plan 2013–2020 has set a target of 7.5 million visitors by 2020 — an increase of more than seven-fold from 2012.[12] Bagan is the largest tourist destination in the domestic and international visitors' market (27.5 percent, totaling nearly 500,000 visitors in 2015), and will draw a large portion of the targeted increase in arrivals.[13]

Figure 8. Tourists Climbing on a Monument to Watch the Sunset

Source: DANM.

11 Information from Nyaung U District Fire Department (December 2017).
12 MOHT 2013, Executive Summary, p. 4 (Table 1), and p. 9.
13 These data are based on the people who stay in hotels and guest houses in Bagan and the Nyaung Oo area. (Ministry of Hotel and Tourism)

The flow of visitors puts stress on Bagan's physical monuments as well as on infrastructure and services (e.g., roads, solid waste management, etc.). In the past, visitors have frequently climbed atop monuments with limited supervision or management, causing damage to the monuments themselves and increasing the occurrence and likelihood of accidents (Figure 8). This practice is now being prohibited at many monuments by GOM and local management. Because of Bagan's physical extent and the difficulty in monitoring it, there has also been theft and vandalism — artifacts and objects, mural paintings, glaze plaques, and sculptures have been stolen or damaged.

Local Management and Development Pressures. Bagan's stakeholders are aiming to preserve cultural heritage while boosting development and economic growth. The Ministry of Construction (MOC) estimates population growth of 1.5 percent per annum over at least the next 10 years. The extent of development pressures will need to be studied and monitored in relation to the growth of tourism and development planning. Threats to the viewshed and site attractiveness from development should be considered. Stakeholders should consider issues related to waste management, which affect the physical site, visitors' engagement with it, and residents' and local stakeholders' well-being.

Restoration and Building Practices. After previous disasters and rehabilitation campaigns, there have been varying levels of use of concrete, which has been judged by experts — including in the 2016 post-earthquake assessment report — to be detrimental to structural strength.[14] The current Conservation Guidelines for Monuments and Historic Buildings (2017) and the Rectification / Intervention Guidelines (2017) have explicitly addressed this issue. In terms of new vernacular constructions, the use of concrete is not necessarily synonymous with resistance and, when well designed, structures edified with local, lighter materials can be more resilient and cost effective. The Building Bylaws and the Development Guidelines provide very specific inputs on the topic.

Figures 9 and 10. Traditional vs. Tractor Plowing in the Land around Bagan

Source: DANM.

14 The main problem with the use of concrete following the 1975 post-earthquake recovery was that its mechanical and chemical properties are different and incompatible with local brick masonry. With the concrete additions, the weight (masses) and structural response of the different parts caused more damage than could have occurred without those retrofitted parts, which were the first to collapse and which fell on the underlying masonry structures and destroyed them.

Agricultural and Husbandry Practices. The intensive use of agricultural land and mechanical plowing may put the landscape and the archaeological subsurface at risk (Figures 9 and 10). Larger animals, such as cows and goats, graze near the monuments and can also damage archaeological ruins (Figures 13 and 14).

Flora and Fauna. Plants and trees are growing on and near several monuments (Figures 11 and 12). When roots penetrate masonry, cracks can diminish the mechanical strength of the structure. Animals can also affect monuments and the archaeological area (e.g., paintings and works on stucco and plaster).

Figures 11 and 12. Examples of Vegetation Growing on Monuments

Source: DANM.

Figure 13 and 14. Animals Grazing around the Monuments

Source: DANM.

3. Preliminary Risk Summary

An overall preliminary risk summary for Bagan is produced below, based on available hazard, exposure, and vulnerability information (Table 2). **Frequency** represents the average recurrence interval of an event of the same intensity. The Bagan DRMP classifies frequency as low (10 years or more between events), medium (2 years up to 10 years between events), and high (less than 2 years between events). **Severity** is the extent to which a hazard event is expected to cause loss or damage. The Bagan DRMP classifies three levels of severity as low, medium, and high.[15]

Combining frequency and severity, the Bagan DRMP sets thresholds for **low, medium,** and **high risk levels,** as shown in Table 1. For example, the Bagan DRMP would classify high-severity low-frequency hazards (e.g., earthquakes) as high risk — the same risk level as medium-severity high-intensity hazards (e.g., floods).

The Bagan DRMP approaches the threats from the risk levels as follows:

- ***High Risk:*** Stakeholders should be particularly aware of potentially severe damage from such hazards and prioritize actions to reduce and manage these risks. If no measures to mitigate the hazard and risk are taken, high levels of damage and loss from this threat can be expected to occur in Bagan during our lifetime.
- ***Medium Risk:*** Stakeholders should prioritize measures to reduce and manage the hazard and risk, particularly where exposure and vulnerability may be highest.
- ***Low Risk:*** Stakeholders should consider measures to reduce and manage the hazard and risk at critical locations, where exposure and vulnerability may be highest.

15 Because detailed intensity-frequency hazard curves and loss and damage data are not currently available, the severity levels used in the Bagan DRMP have been developed through interviews and workshops on December 7 and 29, 2017. See Annex 4 for a list of workshop participants.

Table 1. Bagan DRMP Risk Level Definition by Frequency and Severity

Frequency (return period)				
	High *(Less than 2 years between events)*	**Medium** Risk	**High** Risk	**High** Risk
	Medium *(2 to 10 years between events)*	**Low** Risk	**Medium** Risk	**High** Risk
	Low *(10 years or more between events)*	**Low** Risk	**Medium** Risk	**High** Risk
		Low Severity	**Medium** Severity	**High** Severity
		Identified **Severity**		

Table 2. Preliminary Risk Summary

Threat / Hazard		How is this a threat to Bagan?			Frequency	Severity	Risk	Monitoring
	What natural / factors threaten Bagan?	1. Monument/ site physical integrity	2. Cultural / economic activity	3. Well-being of local people /commu-nities	How frequently does this occur?	How severely does this threat affect Bagan?	Level of risk to Bagan?	Responsible agency
Natural Threats	Earthquake	•		•	Low (~50 years for 6.8 M earthquake)	High	High	DMH
	Floods	•	•	•	High (3 times/year)a	Medium	High	DMH
	Heavy rain/ flash floods	•	•	•	High (annual)	Medium	Medium	DMH
	Drought		•	•	High (annual)	Low	Medium	DWIR
	River bank erosion	•		•	High (progressive)	Medium	High	DMH
Human-Induced Threats	Fire	•	•	•	High (5 times/year)	Medium	High	Fire Dept.
	General Pollution	•		•	Medium (continuous)	Low	Low	City Develop. Comm.
	Waste management	•	•	•	Medium (continuous)	Medium	Medium	City Develop. Comm., DANM
	Building development	•	•	•	Medium (progressive)	Medium	Medium	DANM, DHUD
	Encroachment	•	•		Medium	Low	Low	DANM, DHUD
	Infrastructure development	•	•		Medium (progressive)	Low	Low	DANM, DHUD
	Population increase			•	Medium (progressive)	High	High	DHUD
	Animal grazing	•			High (continuous)	Low	Medium	DANM, site management
	Vegetation	•			High (continuous)	Low	Medium	DANM, site management
	Tourists	•	•		High (seasonal)	High	High	DANM, site management
	Theft/ Vandalism	•			High (continuous)	High	High	DANM, site management
	Vibrations	•			High (continuous)	Low	Medium	DANM, MOTC

Note: Dataset availability to be provided. DANM = Department of Archaeology and National Museum; DHUD = Department of Housing and Urban Development; DMH = Department of Meteorology and Hydrology; DWIR = Department of Inland Water Resources; MOTC = Ministry of Transport and Communications.
a Perceived frequency as described by DMH and DANM at the consultation workshop (December 2017).

SECTION III
MANAGEMENT FRAMEWORKS

Managing risk in Bagan relies on partnership and communication between stakeholders operating under the legal and institutional frameworks.

1. Legal Framework

Heritage Law. From a legal perspective, the safeguarding and protection of Bagan — designated a Cultural Heritage Region — is ensured by the Protection and Preservation of Cultural Heritage Regions Law 1998 (amended in 2009) and the 2015 Protection and Preservation of Ancient Monuments Law (Law No. 51, 2015). The Ministry of Religious Affairs and Culture of the Union Government has responsibility, with a provision to delegate the DANM, to *"carry out the functions and duties in respect of protection, preservation, return and acceptance of an ancient monument"* (Law No. 51, Chapter IV, Article 9). For the purposes of the Bagan DRMP, it is interesting to note that Article 6 (a) of Chapter IV states that *"the Ministry may for the perpetuation of any ancient monument, carry out as follows: protection and preservation of ancient monuments in coordination with the Union Ministries concerned, Region or State Government and regional administrative bodies, and if necessary, local and international government and non-government organizations."* Lastly, Article 20 of Chapter VIII prohibits several activities that may cause damage to the ancient monuments such as vibrations (b), gas emissions (d), and chemical and other waste (f) without written prior permission. In practical terms, the DANM is the agency officially responsible for the implementation of Rules and Regulations of the Cultural Heritage Region Law announced in 2011.

The Protection and Preservation of Antique Objects Law (Law No. 43/2015) essentially protects movable heritage from theft, vandalism, and looting. It also elaborates on permit processing for excavations and broadly defines the procedures in case of chance finds.

Natural Disaster Management Law. The legal framework of Myanmar also comprises a Natural Disaster Management Law (Law No. 21, 2013); and whereas cultural assets are not mentioned specifically,[16] the law foresees the same management process as this framework — that is, preventive measures, emergency response, and rehabilitation. In fact, the prioritized application of this law to humanitarian needs is further demonstrated by the fact that the National Natural Disaster Management Committee (NNDMC) does not include cultural stakeholders among its 12 working committees at either a national or regional level. Thus, despite the fact that GOM has been pro-active in addressing disaster risk reduction as witnessed by the MAPDRR 2017 that recognizes the importance of cultural heritage by including *"disaster and climate risk management of historical monuments and archaeological heritage in Myanmar"* (Priority Action 9) as part of its *"enhancing disaster preparedness for effective response and resilient rehabilitation and reconstruction"* (Pillar 4) and that the MAPDRR states that the lead agency in charge of the above will be the Ministry of Religious Affairs and Culture, none of its representatives are included in the Working Committee of the NNDMC.

The Myanmar National Building Code (2016) produced by the Myanmar Earthquake Commission, with the support of UN Habitat, elaborates on rules and regulations to be promulgated under the Urban and Regional Planning Act and the respective City Development Committee Laws. The provisions of the code are intended *"for application to the construction, alteration, movement, enlargement, replacement, repair, equipment, use and occupancy, location, maintenance, removal and demolition of every building or structure or any appurtenances connected or attached to such buildings or structures."* The code is expansive and detailed and many of its provisions could apply to the Bagan DRMP. However, it mostly addresses vernacular and utilitarian architecture; there are no specific provisions for monuments of culture, the restoration of which requires very specific skills and approaches. This is best evidenced by the fact that the zoning classification does not include monuments *per se*.[17] The "utilities zones" provide guidance for vehicular parking, which has been identified as a threat to the site and its assets.

Environmental Conservation Law. The stated objective of Law No. 9/2012 is to *"carry out the Myanmar national environmental policies and other environmental policies for conservation and*

16 *The law defines* natural disaster *as the "destructions to life and property, livelihood, infrastructures, safety education and health of the public or to the environment due to natural or man-made accidents or negligence..." (Chapter I, Article 2).*

17 *For example, Zone classification IV - Public, Educational and Social Use Zones includes: Galleries and Museums, places of religious worship (pagodas, temples, churches, etc.) only.*

enhancement of environment with the approval of the Union Government." It also provides a general mandate for the Ministry of Environmental Conservation and Forestry to prescribe environmental quality standards, hazardous waste and waste management and pollution control, and to produce an Environmental Assessment System. The 2012 Conservation Law also gives that Ministry the mandate to protect cultural resources. The environmental impact assessment (EIA) rules and procedures were approved on December 29, 2015.

Whereas the responsibility to ensure that the law is enforced lies with the Ministry of Environmental Conservation and Forestry, it delegates the implementation of work programs to relevant government departments depending on the context.[18] Among the Basic Principles: *"To permit freedom of crop selection and adoption of cultivation technologies in a way that will not negatively affect the environment"* is of relevance to the Bagan DRMP.[19]

The Republic of the Union of Myanmar National Land-Use Policy (2016). One of the objectives of the National Land Use Policy is to *"promote sustainable land use management and protection of cultural heritage areas, environment, and natural resources for the interest of all people in the country."* The law addresses land information management, zoning, and land acquisitions with a focus on tenure and resettlement. The National Land Use Council is in charge of monitoring effective land use management, land allocation, and quality control of land use planning processes, implementation.

2. Institutional Framework

At the national level, to ensure coordinated implementation of the provisions of the applicable laws, there are two committees: the Myanmar National Culture Central Committee headed by the Vice President and the Myanmar National Committee for World Heritage headed by the Minister of Culture. Furthermore, a Bagan Committee for the Management of the Cultural Heritage Property and Buffer Zone (BaganCOM) has been established to ensure the coordinated protection and management of Bagan, including the nominated property, as well as to integrate the property's management vision and objectives into local development planning at the national level. Such responsibilities at the regional level are delegated to the Bagan Regional Committees (Mandalay region and Magway region); district-level coordination is the responsibility of the Bagan Coordination Committees (Mandalay region and Magway region).

Because of the extensive nature of the Bagan Cultural Heritage Site, which covers a vast area weaving cultural, natural, and socioeconomic features and creates an indivisible whole, to ensure that the Bagan DRMP addresses all the key features needed to protect the authenticity and integrity of the site in case of disaster, as well as to minimize residual risks, numerous stakeholders have been taken into account. Table 3 lists the key relevant stakeholders.

18 The entities include, inter alia: Government departments, Government organizations, Nay Pyi Taw Council, Region or State Government, Self-administered Division or Self-administered Region, District General Administrator of the General Administration Department or Township General Administrator of the General Administration Department, Ward or Village-tract Administrator, Private organization and the Public. (Chapter III; Rule 15 of the Rules, Notification 50/2014).

19 Chapter III Basic Principles (l).

Table 3. Key Stakeholders

National Government	
Ministry	**Department / Agency**
MRAC Ministry of Religious Affairs and Culture	**DANM** Department of Archaeology and National Museum
MOTC Ministry of Transport and Communications	**DMH** Department of Meteorology and Hydrology
	DWIR Directorate of Water Resources and Improvement of River Systems
MOC Ministry of Construction	**DHUD** Department of Housing and Urban Development
MOSWRR Ministry of Social Welfare, Relief and Resettlement	**RRD** Department of Relief and Resettlement, including the Myanmar National Disaster Preparedness Agency (MDPA)
MNREC Ministry of Natural Resources and Environmental Conservation	**GECD** General Environmental Conservation Department **DOF** Department of Forestry[a]
	CDC City Development Committee
MOHT Ministry of Hotels and Tourism	
MOI Ministry of Information	
Regional Government & District Authorities	
GAD General / District Administration and Police	
ECD Environmental Conservation Department	
AGO Attorney General's Office	
MEC Myanmar Earthquake Committee	
Private Sector	
Myanmar Tourism Federation	
Civil Society	
Bagan Heritage Trust	
Bagan Development Organization	
Magakaryi Parahita	
Bunyashin Parahita	
Sake Satanar Free Clinic and Public Aids	
Regional Economic Development Association	
Myanmar Lacquerware Association	
MES Myanmar Engineering Society	

a. DOF project in districts of the Mandalay and Magwe regions promote greening within the arid Dry Zone of the middle reaches of the Irrawaddy River.

Other Institutions (Universities, Societies, Colleges, etc.)
Association of Myanmar Architects
MGS Myanmar Geosciences Society (Department of Architecture)
MRCS Myanmar Red Cross Society
Development Partners
UNESCO, UNDP, UN-Habitat, World Bank, Japan-JICA, Italy, Republic of Korea, and India, among others.

Despite its institutional complexity and wide range of stakeholders, DANM is making efforts to institutionalize a more collaborative planning system among different stakeholders, including public officials, conservation professionals, members of the community, and the media. In fact, DANM has supported BaganCOM to conduct regular meetings with political, religious, and other government authorities to inform them about the UNESCO World Heritage Centre nomination. Thus the main challenge of the Bagan DRMP Action Plan consists of ensuring proper communication, cooperation, and coordination with all the relevant authorities, organizations, institutions, and communities. This will require not only engagement and a shared vision, but also procedures for implementation and decision-making.

SECTION IV
CURRENT MEASURES TO MANAGE RISKS IN BAGAN

Addressing the risks identified and operating under its management framework, GOM has many disaster risk management measures now in place and that are ongoing to help safeguard Bagan and its cultural heritage attributes.

Each measure in Table 4 on Current Measures is described in terms of its **DRM Cycle Phase, Measure, Detail, Status, Stakeholder Agencies, Lead, Expected Result,** and **Expected Timeline.**

DRM Cycle Phase: This denotes the key function of this measure toward different phases of the DRM.

i. *Risk Identification*. Measures to increase understanding and communication of risk.
ii. *Risk Reduction*. Measures aimed at mitigating and reducing risk and creation of risk in the area.
iii. *Preparedness and Response*. Measures to increase the ability of site managers, government, residents, industries, and communities to prepare for the risks they face and respond to actual hazard events.
iv. *Recovery and Rehabilitation*. Measures to target a faster and more effective recovery, both of tangible and intangible heritage.

Measure and **Detail** describe the overall measure pursued by GOM to enhance DRM measures and provide additional detail and context.

Status describes whether the measure is complete or ongoing. In most cases, additional efforts are being pursued or are considered in Section V – Action Plan.

Stakeholder Agencies and **Lead** denote key implementers of the measures. As noted in Section III, managing risk in Bagan relies on partnership and communication between stakeholders. DANM's role in managing and overseeing cultural heritage attributes in Myanmar is fundamental and must engage additional technical and line ministries to complete key tasks for DRM, such as detailed risk assessment or preparedness and evacuation planning. Therefore, a list of key stakeholder agencies is provided for each task, as well as main lead agencies for the task and its implementation for the Bagan Cultural Heritage Site.

Expected Result provides a description of key outputs and outcomes to be achieved upon implementation of the measure.

Expected Timeline provides an indicative target for completion.

Table 4. Current Measures

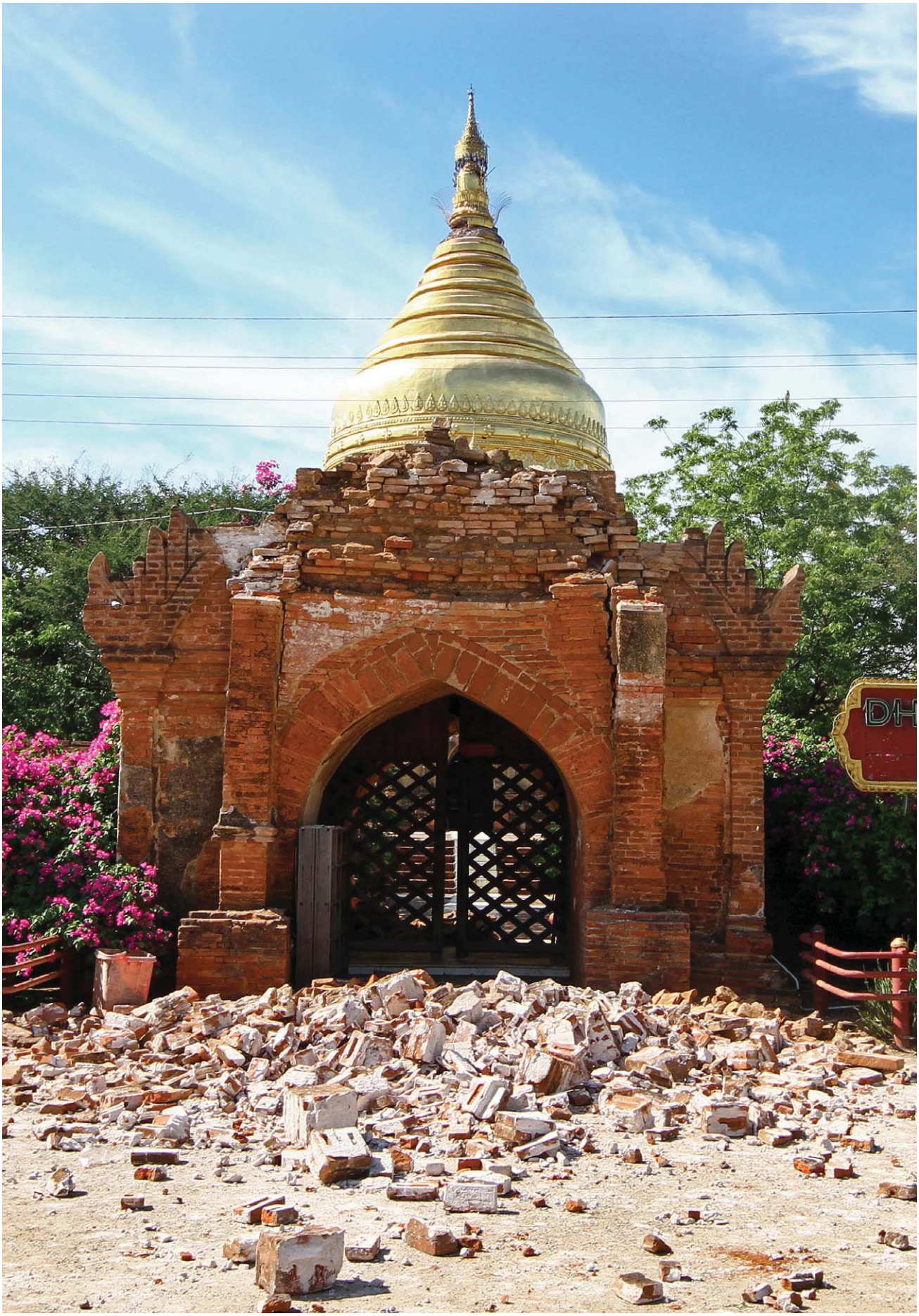
DRM Cycle Phase	Measure	Detail	Status	Stakeholder Agencies	Lead	Expected Result	Expected Timeline
Risk Identification	Develop and enhance site inventory	DANM has conducted detailed inventory of the cultural objects and monuments.	Complete	DANM	DANM	Site inventory has already contributed to hazard mapping and will be critical for further DRM efforts.	Complete
Risk Identification	Develop Bagan exposure assessment	DHUD conducted an assessment of people and buildings in Bagan.	Complete	DMH, MEC, DANM, MOC, RRD, MES, CDC	DHUD	This analysis will be part of overall site risk assessment, including potential economic losses.	Complete
Risk Identification	Develop Bagan flood risk map	DMH is capturing pluvial and fluvial flood information.	Ongoing	DMH, MEC, DANM, MOC, RRD, MES, CDC	DMH	Improved risk awareness, ability to address risk.	1–2 years
Risk Identification	Improve earthquake monitoring	MEC is conducting a seismic assessment project and dataset for probabilistic earthquake hazard maps.	Ongoing	DMH, MES, MEC, MOTC	MEC	This measure will improve accuracy of planning and management of seismic risk.	2–3 years
Risk Reduction	Develop building/ retrofit guidance and methodology	DANM issued guidelines for conserving and retrofitting cultural monuments.[a]	Complete	DMH, MES, MEC, MOTC, DANM, DHUD	DANM	Detailed building bylaws / conservation guidelines issued (including restricting concrete usage) to reduce future vulnerability.	Implementation ongoing; 1–2 years to be fully implemented
Risk Reduction	Develop zoning and urban expansion plan	DHUD prepared a detailed plan addressing the zones of urban expansion, including a buffer for heritage zone.	Complete	DMH, MES, MEC, MOTC, DANM, DHUD	DHUD	Urban expansion encourages development away from cultural heritage buffer and hazard-prone areas.	Implementation ongoing
Risk Reduction	Create Bagan Heritage Authority BaganCOM	Supported a multi-stakeholder mandate to identify and implement measures for management improvement.	Complete	DMH (MOTC), MEC, DANM, MOC, RRD, MES, CDC	DANM	Better coordination toward GOM and DANM's vision for the site.	Implementation ongoing
Risk Reduction	Increase site monitoring and compliance[b]	Securing funding and human resources to meet the needs of the site.	Ongoing	DANM, GAD, site managers	DANM	Monuments and visitors will be better managed and protected.	1–2 years

DRM Cycle Phase	Measure	Detail	Status	Stakeholder Agencies	Lead	Expected Result	Expected Timeline
Preparedness and Response	Signage	DANM is improving signage (e.g., information about monuments, risks for the area, etc.).	Ongoing	DANM, MOTC, RRD, GAD	DANM	Visitors to have information about the hazards faced and relevant guidance on how to respond	1–2 years
Preparedness and Response	Emergency training	Fire Department organizing drills / trainings; hotel operators conducting drills privately.	Ongoing	DANM, MOTC, RRD, FIRE DEPT	FIRE DEPT	Communities will know how to respond to various hazards.	Ongoing
Recovery and Rehabilitation	Physical vulnerability assessment of monuments	MES and DANM conducting a physical vulnerability assessment, with international experts, to capture monument status.	Ongoing	DMH (MOTC), MEC, DANM, MOC, RRD, MES, CDC	MES	Stakeholder to have risk information for decision making. Further benefit from (i) integration with 3D models and (ii) extension to the whole site.	3–4 years, pending expansion of efforts
Recovery and Rehabilitation	Recovery funds	Individual private donors in Myanmar have provided substantial funds. The government has disbursed nearly 30% of funds toward rehabilitation of 224 monuments.	Ongoing	GAD, DANM	GAD	Funds provide needed support to complete improvements to the site and rehabilitate monuments to guideline standards.	Ongoing

Note: CDC = City Development Committee; DANM = Department of Archaeology and National Museum; DHUD = Department of Housing and Urban Development; DMH = Department of Meteorology and Hydrology; GAD = General Administration Department; MEC = Myanmar Earthquake Committee; MES = Myanmar Engineering Society; MOC = Ministry of Construction; MOTC = Ministry of Transport and Communications; and RRD = Department of Relief and Resettlement.

a. The set of legal provisions for the Bagan Cultural Heritage Site consisting of the Conservation Guidelines (for monuments and other important attributes), the Building Bylaws (for new construction), the Development Guidelines (for public and semi-public spaces within towns, villages, and landscape), and the Rectification Guidelines (for previous inappropriate developments) specify if and how new constructions will be allowed.

b. Currently there is a team of 59 members, of which 28 are guards, 3 are DANM staff members seconded to other departments for security, and a further 10 are private security guards in charge of the protection of the site. This number will be increased and a visitors' management plan that would protect both visitors and the cultural assets will be elaborated and implemented. See DANM "Risk Preparedness Strategy" (Risk Assessment and Mitigation) Bagan Ancient Cities World Heritage (section 3.1.6 Security: Theft, looting and vandalism).



SECTION V
ACTION PLAN FOR NEW AND ENHANCED MEASURES TO MANAGE RISK IN BAGAN

GOM has identified measures to strengthen disaster risk management (DRM) in Bagan.

Each measure in Table 5 is described in terms of **DRM Cycle Phase, Measure, Detail, Priority, Stakeholder Agencies, Lead, Expected Result,** and **Expected Timeline.**

DRM Cycle Phase: This denotes the key function of this measure toward different phases of DRM.

i. *Risk Identification.* Measures to increase understanding and communication of risk.
ii. Risk Reduction. Measures aimed at mitigating and reducing risk and creation of risk in the area.
iii. Preparedness and Response. Measures to increase the ability of site managers, government, residents, industries, and communities to prepare for the risks they face and respond to actual hazard events.
iv. Recovery and Rehabilitation. Measures to target a faster and more effective recovery, both of tangible and intangible heritage.

Measure and **Detail** describe the overall measure to be pursued by GOM to enhance DRM and provide additional detail and context.

Priority describes GOM's prioritization of each measure.

Stakeholder Agencies and **Lead** denote key implementers of the measures. As noted in Section III, managing risk in Bagan relies on partnership and communication between stakeholders. DANM's role in managing and overseeing cultural heritage attributes in Myanmar is fundamental and must engage additional technical and line ministries to complete key tasks for DRM, such as detailed risk assessment (see Annex 3 for a sample risk assessment form) or preparedness and evacuation planning. Therefore, a list of key stakeholder agencies is provided for each task, as well as main lead agencies for the task and its implementation for the Bagan Cultural Heritage Site.

Expected Result provides a description of key outputs and outcomes to be achieved upon implementation of the measure.

Expected Timeline provides an indicative target for completion.

Table 5. Action Plan

DRM Cycle Phase	Measure	Detail	Priority	Stakeholder Agencies	Leads	Expected Result	Expected Timeline
Risk Identification	Design and develop a targeted risk assessment process for Bagan's needs	There are multiple needs and efforts to improve risk information in Bagan. GOM will design and implement a process to complete and share assessments. Needs include: heritage vulnerability, social vulnerability, seismic/ hydromet, exposure, tourism impact, etc.	1. Immediate	GAD, DMH & DWIR (MOTC), MEC, DANM, MOC, RRD, MES, CDC,MOHT, MOALI, MRCS, MOHA, Police, MOI	DMH and DANM	Stakeholders have understanding and access to timely and practical risk information for decision-making and investment.	1–2 years
Risk Identification	Develop and activate risk information sharing platform and protocols	Low-cost open platforms (e.g., GeoNode, InaSAFE, etc.) allow rapid sharing and use of risk information. GOM will plan and implement (i) relevant platform(s) and (ii) information sharing protocols (e.g., monument inventory, etc.).	1. Immediate	DMH (MOTC), GAD, MEC, DANM, MOC, RRD, MES, CDC, MOI, MOTC	RRD and DANM		1–2 years
Risk Identification	Develop a targeted training for risk identification	Agencies request increased DRM capacity training to enhance understanding and competencies. Topics: exposure (e.g., GIS), hazard (e.g., hydromet, seismic), vulnerability (e.g., structural, CH-specific, social)	2. Medium	DMH (MOTC), MEC, DANM, MOC, RRD, MES, CDC	DANM, RRD, MES, among others	Relevant agencies will have the capacity needed for risk identification.	2–3 years
Risk Identification	Implement a disaster and cultural heritage risk awareness raising campaign	GOM will work to enhance the general awareness and understanding of communities, industries, and site managers to the risks to cultural heritage assets from disasters and other hazards through campaigns, workshops, social media, etc.	3. Longer-Term	DMH (MOTC), MEC, DANM, MOC, RRD, MES, CDC	RRD and DANM	Increased public awareness of risks to cultural heritage attributes from disasters and other hazards.	1–2 years
Risk Identification and Reduction	Develop the Bagan Heritage Safeguarding and Retrofitting Applied Research Program	GOM to develop a targeted research /analysis program to guide appropriate safeguarding and retrofitting measures (e.g., testing and application lab/site, local, and sustainable building materials, etc.).	2. Medium	DANM, MEC, MOC, MES, CDC	DANM	Produce relevant outputs to guide appropriate safeguarding and retrofitting measures for heritage structures.	3–5 years

DRM Cycle Phase	Measure	Detail	Priority	Stakeholder Agencies	Leads	Expected Result	Expected Timeline
Risk Reduction	Improve and implement the rehabilitation/retrofit guidance and methodology	Building on research measures and international best practices (e.g., ICCROM), GOM will enhance personnel and resource allocation to improve guideline implementation.	1. Immediate	DANM, MOC, GAD, site managers	DANM	Improve the strength of sites and reduce the risk of some conservation efforts increasing site vulnerabilities.	2 years
Risk Reduction	Enhance maintenance practices of site management	GOM to increase focus on maintenance of overall sites (e.g., view-shed, waste management, cleaning, etc.).	1. Immediate	DANM, MOC, GAD, site managers	DANM	Reduce vulnerability of sites to fire, pollution, and other hazards and increase attractiveness and integrity of site.	1–2 years
Risk Reduction	Ensure integration of heritage impact assessment in development planning	Ensure spatial planning between local and union level integrates (i) safeguarding of heritage and vulnerable sites; (ii) identification / promotion of low-risk areas for new urban settlements and development.	2. Medium	DANM, MOC, GAD, DHUD	DHUD and DANM	Urban planning will guide development away from vulnerable cultural heritage attributes.	1–3 years
Risk Reduction	Enhance capacity and authority of Bagan Heritage Management Committee (BaganCOM)	GOM to enhance the ability of BaganCOM or new committee / authority to take action on DRM and overall integrity and management of Bagan.	2. Medium	DANM, MOC, GAD	To be determined	Enhanced BaganCOM is able to mobilize financial / human resources for management, and risk reduction.	1–2 years
Risk Reduction	Review Bagan's drainage and river system and identify possible improvements	GOM will review Bagan's drainage system and interaction with river system for possible improvements to manage and reduce risk to cultural heritage, communities, and DRM preparedness.	3. Longer-Term	MOTC, CDC, GAD, DANM, MES	MOTC, CDC, GAD, with DANM	Increased capacity of GOM to manage flood and drainage risks in Bagan.	3 years

DRM Cycle Phase	Measure	Detail	Priority	Stakeholder Agencies	Leads	Expected Result	Expected Timeline
Preparedness and Response	Preparedness and evacuation planning	Develop and implement heritage site-level preparedness plans and drills.	1. Immediate	RRD, GAD, MPF, DFS, MEC, MOSWRR, MOAI, MOI, MOHT, MOTC	DANM and RRD	Individual sites will develop and drill site preparedness and evacuation plans for visitors & heritage assets.	1 year
		Identify and prepare evacuation sites for identified needs and away from risk-prone areas	2. Medium		RRD, DHUD, GAD	Effective evacuation sites will be identified and ready in case of emergency.	1–2 years
		Identify and prepare roads and other infrastructure for evacuation and other preparedness measures	3. Longer-Term		RRD, MOTC, GAD	Roads and other infrastructure will be marked and ready in case of emergency.	2–3 years
Preparedness and Response	Improve site signage to indicate locations and hazards to visitors	GOM to continue campaign of integrated signage across Bagan, providing information on location, overall site, management and maintenance rules, hazards. Signage to be updated regularly and include evacuation information, as relevant.	2. Medium	GAD, MPF, DFS, MEC, MOSWRR, MOAI, MOI, media, IFRC,	DANM, RRD, GAD	Visitors will be aware of risks and guidelines for visiting monuments and have basic information to respond to emergencies.	1–2 years
Preparedness and Response	Enhance collaboration between Bagan Cultural Heritage Site and emergency response agencies	Enhance current collaboration of DANM and emergency response agencies through (i) joint training / simulation drills of CH managers and emergency responders, including at Emergency Operations Center (EOC), (ii) enhanced early warning system (EWS) and real-time information dissemination for residents and visitors (e.g., text message, Viber/WhatsApp groups).	3. Longer-Term	DANM, RRD, GAD, MPF, DFS, MEC, MOSWRR, MOAI, MOI, media, IFRC, Pagoda Trust	DANM, RRD, Mandalay Regional Gov, GAD	Joint training and projects will enhance coordination, ensure definition of responsibility in case of hazard event, and sensitize site managers to risks and responders to special nature of cultural heritage protection.	2–3 years

DRM Cycle Phase	Measure	Detail	Priority	Stakeholder Agencies	Leads	Expected Result	Expected Timeline
Recovery and Rehabilitation	Develop and implement targeted damage assessment training program for DANM and related staff	GOM will develop and implement this training program to enhance accuracy and consistency in the collection of damage information, building on research and other measures.	1. Immediate	DANM, MOC, MES, MEC	DANM, MES, DHUD	DANM and related staff will be able to capture and maintain information on site integrity and heritage attributes.	1–2 years
Recovery and Rehabilitation	Develop and implement targeted resilient conservation training program	DANM and MES to develop and implement training program for artisans, masons, workers, and others on the use of local materials for conservation and on the best practices for the consolidation of monuments and the construction of resilient buildings.	1. Immediate	DANM, MGS, MES, RRD, GAD	DANM	Rehabilitation efforts will enhance resilience.	1–2 years
Recovery and Rehabilitation	Review Bagan Heritage Recovery Fund for options to speed disbursement and increase impact	Determine possible improvements for existing Heritage Recovery Fund and other revenue lines (e.g., zone fees) to reduce barriers to disbursement and increase impact for safeguarding Bagan's heritage attributes.	1. Immediate	DANM, GAD, RRD, MPF	GAD, DANM	Funding available for post-disaster needs will be less fragmented, faster-disbursing, and more targeted for increasing disaster resilience and preserving/ enhancing heritage attributes.	1–2 years
Recovery and Rehabilitation	Conduct disaster risk financing assessment for recovery and rehabilitation at Bagan	Conduct disaster risk financing assessment to understand current flow of funds for recovery and implement reforms / new mechanisms (e.g., emergency standby fund, specific ministry needs, etc.) with a focus on ensuring prioritization of safeguarding and rehabilitating Bagan's heritage attributes.	2. Medium	DANM, GAD, RRD, MPF	MPF, DANM		1–2 years
Recovery and Rehabilitation	Develop practices for engaging local communities in recovery planning	Local communities will be trained in how to engage in future recovery efforts (e.g., community-based techniques, rehabilitation and building techniques, preparedness, and economic activities).	3. Longer-Term	RRD, GAD, DANM	RRD, DANM	Communities will be engaged in heritage recovery processes.	1–2 years

DRM Cycle Phase	Measure	Detail	Priority	Stakeholder Agencies	Leads	Expected Result	Expected Timeline
Recovery and Rehabilitation	Consider financial protection options for Bagan's residents, industries, and heritage site managers	Consider options to develop financial protection mechanisms for Bagan's residents, industries (e.g., hotels, etc.), and site managers from direct losses or disruptions to tourism-related economic activity.	3. Longer-Term	MPF, RRD	MPF, RRD, DANM	Communities and related industries will be better protected from shocks to their loverhoods and better able to recover.	3–5 years

Note: CDC = City Development Committee; CH = cultural heritage; DANM = Department of Archaeology and National Museum; DFS = Department of Fire Services; DHUD = Department of Housing and Urban Development; DMH = Department of Meteorology and Hydrology; DWIR = Department of Inland Water Resources; GAD = General Administration Department; IFRC = International Federation of Red Cross; MEC = Myanmar Earthquake Committee; MES = Myanmar Engineering Society; MGS = Myanmar Geologist Society; MOAI = Ministry of Agriculture and Irrigation; MOALI = Ministry of Agriculture, Livestock and Irrigation; MOC = Ministry of Construction; MOHA = Ministry of Home Affairs; MOHT = Ministry of Hotels and Tourism; MOI = Ministry of Information; MOSWRR = Ministry of Social Welfare, Relief and Resettlement; MOTC = Ministry of Transport and Communications; MPF = Myanmar Police Force; MRCS = Myanmar Red Cross Society; RRD = Department of Relief and Resettlement.

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SECTION VII
ANNEXES

Annex 1 – Measurement of Exposure for Bagan Ancient Monuments

Annex 2 – Analysis of Outstanding Universal Value (OUV) Assets and Vulnerability to World Heritage Center Criteria

Annex 3 – Sample Risk Assessment Field Investigation Form

Annex 4 – Participants at Bagan DRMP Workshops (December 7 and 29, 2017)

Annex 1 – Measurement of Exposure for Bagan Ancient Monuments

No.	Attribute	Earthquake	Erosion	Flood	Rain	Fire	Vegetation	Animal	Visitor	Urban &Rural Development	Theft Looting and Vandalism	Vibration	Agriculture Practice	Air Pollution
		1	2	3	4	5	6	7	8	9	10	11	12	13
1	Archaeological deposits													
	Archaeological elements	•	•	•	•	•	•	•	•		•			
	Kiln sites	•	•	•	•	•	•	•	•				•	
	Unexcavated mounds	•	•	•	•		•			•			•	
2	Architectural Objects at Museum	•				•					•			
3	Inscription													
	Ink inscription	•				•			•		•			•
	Stone inscription	•		•	•	•	•	•	•		•			•
4	Landscape of Monuments	•	•	•	•	•	•			•			•	
5	Monuments													
	Image house	•	•	•	•	•	•					•		•
	Inscription shed	•		•	•	•								•
	Library	•		•	•	•								•
	Monastery	•		•	•	•						•		•
	Ordination hall	•		•	•	•							•	
	Rectangular structure	•	•	•	•	•	•	•	•				•	
	Stupa	•	•	•	•	•	•	•	•			•	•	•
	Temple	•	•	•	•	•	•	•	•			•	•	•
	Underground structure	•		•	•					•			•	
6	Painting													
	Cloth painting	•				•			•		•			•
	Mural painting	•				•			•		•			•
7	Objects at Museum	•				•					•			
8	Overall setting of Bagan	•	•	•		•								
9	Palace	•	•	•	•	•	•	•						
10	Religious practice													
	Festival													
	Monastery	•	•	•		•	•					•		
	Sima with boundary stone inscription	•		•		•							•	
11	Sculpture	•				•	•							•
12	Wall (Old Bagan)													
	City gate and wall	•	•	•	•	•	•	•				•	•	
13	Water management features													
	Channel	•		•			•			•			•	
	Drainage	•		•			•			•			•	
	Lake	•		•									•	
	Moat	•		•									•	
	Reservoir	•		•										
	Ritual Tank	•		•										
	Tank	•		•										
	Well	•		•			•			•			•	

Annex 2 – Analysis of Outstanding Universal Value (OUV) Assets and Vulnerability to World Heritage Center Criteria

Analysis of Attributes with OUV and Criteria					
No.	Attribute	Outstanding Universal Value (OUV)			
		Criterion (iii)		Criterion (iv)	Criterion (vi)
		Cultural tradition in merit-making	Civilization	Buddhist architectural ensemble	Cultural tradition and belief
1.	Archaeological deposit				
	Archaeological elements		•		
	Kiln site		•		
	Unexcavated mounds		•		
2.	Architectural objects at museum			•	
3.	Inscription				
	Ink inscription	•	•	•	•
	Stone inscription	•	•	•	•
4.	Landscape of monuments	•	•	•	•
5.	Monument				
	Image house	•	•	•	•
	Inscription shed	•	•	•	•
	Library	•	•	•	•
	Monastery	•	•	•	•
	Ordination hall	•	•	•	•
	Rectangular Structure	•	•	•	•
	Stupa	•	•	•	•
	Temple	•	•	•	•
	Underground structure	•	•	•	•
6.	Painting				
	Cloth painting	•	•	•	•
	Mural painting	•	•	•	•
7.	Objects at museum		•		
8.	Over all setting of Bagan		•		
9.	Palace		•		
10.	Religious practice				
	Festival	•	•		•
	Monastery	•	•		•
	Sima with boundary stone and inscription	•	•		•
11.	Sculpture	•	•	•	•
12.	Wall (Old Bagan)				
	City gate and wall	•	•	•	•
13.	Water management features				
	Channel		•		
	Drainage		•		
	Kiln		•		
	Moat		•		
	Reservoir		•		
	Ritual tank		•		
	Tank		•		
	Well		•		

Annex 3 – Sample Risk Assessment Field Investigation Form

1. Description and Location	
Site Reference Number:	
Name of the Site/Object:	
Investigator(s) names and institutions:	**Investigation Date:**
Typology of the Attribute:(to be developed)	
Location (e.g. directions to Site or notes on accuracy of Site boundary):	
GPS Coordinates: GPS X:	GPS Y:
Administrative Jurisdiction (Region, District, Township, Village)	**Office Responsible for Protection and Management of Site:**
Ownership (may include multiple) ☐ **DANM** ☐ **Acquisition in Progress** ☐ **Government (other)** ☐ **Private** ☐ **Unknown**	

2. Significance and Values
Describe Significance of the Site
Describe the Value of the Site *(such as scientific, historical, aesthetic, social, spiritual value):*

3. Previous Interventions		
What was done? *Conservation (Structural) / Conservation (Material)/ Re-plastered (whitewashed) / Restoration / Reconstruction / Excavation*	**When?** *(In chronological order)*	**By Whom?**

4. Rapid Condition Assessment (at present)			
Type of Condition	**Description/ Location**	**Picture reference**	**Underlying Causes** *(agricultural practice, inadequate management, poor drainage, previous intervention, location etc.)*
☐ **Disintegration**			
☐ **Layering**			
☐ **Loss of Cohesion**			
☐ **Loss of Adhesion**			

☐ **Cracking**			
☐ **Deformation**			
☐ **Mechanical Damages**			
☐ **Biological Growth**			
☐ **Structural Damage**			
☐ **Discoloration**			
☐ **Deposition**			
☐ **Transformation**			
Overall Condition Rating (Choose one) ☐ Good ☐ Fair ☐ Poor ☐ Very Bad ☐ Destroyed			

5. Risk Assessment

The assessment forms the basis for writing the Risk Statement for each threat/hazard identified below, which should be prepared as the next step

#	**Potential Threats/ Hazards**	**Exposure**	**Related Vulnerability factors**	**Risk/Potential Impact**	**Probability (likelihood)**	**Severity of Impact**	**Risk Level**
	Such as: • *Earthquake (Dam break; Land Settlement; Fire);* • *Flood (Rainfall; Dam Break; Vibration);* • *Fire (Wild Fire; Farming Practice; Arson; Electricity Short Circuit; Gas Pipeline Explosion);* • *Vegetation (specify);* • *Theft and looting;* • *Vandalism;* • *Unreported Accidental finds;* • *Agricultural Practice;* • *Excavation Practices;* • *Animal Impact;* • *Pollution (Ground Water; Soil; Air);* • *Tourism;* • *Urban Development (including new constructions, infrastructure like roads etc.);* • *Possible violations of Antiquities Law;* *<u>Hazards connected with objects:</u> Disintegration; Light (artificial); Light (natural); Incorrect Temperature; Incorrect Humidity; People; Pollutants; Dust; Pests; Vibration* • *Etc.* *Some of these threats may not be seen today but risks have to be assessed for future possibilities of these threats*	*Describe aspect/ part of the site/object is exposed*	*Such as:* • *Inherent material characteristics;* • *inherent structural characteristics;* • *past interventions;* • *location;* • *surroundings;* • *lack of management* • *etc.* *Describe, in detail, either or more of the above.*	*Describe the kind of impact that may occur on the site/ object due to hazards and vulnerability factors*	*(High / Medium / Low)* *Based on:* • *Frequency of incidents* • *Rate of change in deterioration process after the event* • *Rate of change in the cumulative deterioration process* • *Existence or prevalence of extremities in severity of the hazard*	*(High / Medium / Low)* *Based on:* • *Extent of damage to part or the whole of the site/ object due to hazards and vulnerability factors* • *Level of impact on the specific values of the site/object*	*(Very High/ High / Medium / Low / Very Low)* *Probability x Severity of Impact = Risk Level* *VH=Very High* *H=High* *M=Medium* *L=Low* *VL=Very Low* *H x H = VH* *H x M = H* *M x H = H* *M x M = M* *L x M = L* *M x L = L* *L x L = VL*

1					☐ High ☐ Medium ☐ Low	☐ High ☐ Medium ☐ Low	☐ Very High ☐ High ☐ Medium ☐ Low ☐ Very Low
2					☐ High ☐ Medium ☐ Low	☐ High ☐ Medium ☐ Low	☐ Very High ☐ High ☐ Medium ☐ Low ☐ Very Low
3					☐ High ☐ Medium ☐ Low	☐ High ☐ Medium ☐ Low	☐ Very High ☐ High ☐ Medium ☐ Low ☐ Very Low
4					☐ High ☐ Medium ☐ Low	☐ High ☐ Medium ☐ Low	☐ Very High ☐ High ☐ Medium ☐ Low ☐ Very Low
5					☐ High ☐ Medium ☐ Low	☐ High ☐ Medium ☐ Low	☐ Very High ☐ High ☐ Medium ☐ Low ☐ Very Low

Annex 4 – Participants at Bagan DRMP Workshops (December 7 and 29, 2017)

Participants at the Consultation Workshop on December 7, 2017 (Thande Hotel, Bagan)

Sr. No	Name	Title/Position	Department
1	Zaw Min Aung	Staff officer	Department of Archaeology and National Museum
2	U Kyaw Khaing	Principal	Department of Archaeology and National Museum
3	U Naing Win	Assistant Director	Department of Archaeology and National Museum
4	U Lin Tun Kyi	Staff Officer	Department of Archaeology and National Museum
5	U Than Zaw Oo	Director	Department of Archaeology and National Museum
6	U Win Kyaing	Principal	Department of Archaeology and National Museum
7	U Saw Naing Oo	Staff Officer	Department of Archaeology and National Museum
8	U Arkar Aye	Deputy Administrator	Department of Archaeology and National Museum
9	U Ko Ko	Assistant Director	Department of Agriculture, Land Management
10	U Soe Soe Lin	Deputy Director	Department of Archaeology and National Museum
11	Daw May Phyu Soe	Assistant Director	Relief and Resettlement Department
12	U Aung Aung Kyaw	Director	Department of Archaeology and National Museum
13	Maung Maung Than	GIS Specialist	Consultant
14	U Thein Lwin	Deputy Director General	Department of Archaeology and National Museum
15	Daw Min Min Thwin	Staff Officer	Department of Archaeology and National Museum
16	Daw Khin Phyu Mar	Staff Officer	Department of Archaeology and National Museum
17	U Phyo Pyae Ko Ko	Staff Officer	Department of Archaeology and National Museum
18	U Htun Htun Aye	Assistant Director	Department of Archaeology and National Museum
19	U Zaw Wai	Chairman	Hotel Association
20	Dr. Myint Thein	Director of District General Hospital	Nyaung Oo District General Hospital
21	U Ko Ko Gyi	Chairman	Bagan Development Organization
22	U Zaw Zaw Aye	Deputy Director	Ministry of Construction
23	Daw Sandar Win	Assistant Director	Ministry of Construction
24	Daw Than Than Oo	Staff Officer	Ministry of Construction
25	Kyaw Min Oo	Assistant Director	Department of Highways
26	U Kyaw Toe	MP	House of Representative
27	U Htin Kyaw	Deputy Director	Planning Department
28	Daw Thin Thin Khaing	Deputy Director	Relief and Resettlement Department
29	U Zin Oo	Assistant Director	Department of Archaeology and National Museum
30	U Thet Zaw	Assistant Director	Department of Archaeology and National Museum
31	U Soe Win Htay	Deputy Director	Department of Archaeology and National Museum
32	U Saw Htwe Zaw	Vice Chairman	Myanmar Engineering Society
33	Dr. Yin Myo Min Htwe	Assistant Director	Department of Meteorology and Hydrology
34	Dr. Myo Thant	Vice President	Myanmar Earthquake Committee
35	U Myo Nyunt	Director (retired)	Department of Archaeology and National Museum
36	Nay Lin	Deputy Commander	Nyaung Oo District Police Force
37	Zaw Win Cho	Member	Bagan Heritage Trust
38	U That Khine	Director	Department of Fire Service
39	U Maung Maung	President	Myanmar Lacquer Association

Sr. No	Name	Title/Position	Department
40	U Soe Thint	Head of the District Administration Department	District Administration Department
41	U Min Swe	Staff Officer	Department of Archaeology and National Museum
42	Daw Tharaphi Aung	Staff Officer	Department of Archaeology and National Museum
43	Daw Aye Aye Khine	Assistant Director	Department of Archaeology and National Museum
44	U Maung Lin	Member	Myanmar Lacquer Association
45	Sharhank Miswia	DRR Program Manager	UN Habitat
46	U Hla Moe Zaw	Assistant Director	Ministry of Construction
47	U Zaw Win Myint	Assistant Director	District Immigration Department
48	Aung Shein	Assistant Director	Department of Rural Development
49	U Aung Kyaing	Deputy Director General (retired)	Department of Archaeology
50	Daw Latt Latt Aung	Director	Department of Water Resources and Improvement of River
51	Daw Myint Myint Oo	Staff Officer	Ministry of Hotels and Tourism
52	U Yan Naung Kyaw	President	Magathiri Trust
53	U Myint Than	Deputy Director	Department of Archaeology and National Museum
54	Daw Win Pa Pa	Staff Officer	Department of Archaeology and National Museum
55	Daw Aye Aye Khine	Audit	Department of Archaeology and National Museum
56	Daw Seint Seint Chaw	Staff Officer	Department of Archaeology and National Museum
57	Daw Kay Thi Mon	Officer	Department of Archaeology and National Museum
58	U Thi Ha Maung Maung	Officer	Department of Archaeology and National Museum
59	U Ko Ko Aung	Assistant Director	Department of Archaeology and National Museum
60	U Myint Khine	Chairman	Myanmar Hotel Association

Participants at the Consultation Workshop on December 29, 2017 (Bagan River View Hotel)

Sr. No	Name	Title/Position	Department
1	Kyaw Swe	Chairman	Tour guide Association
2	Naing Tun	Vice Chairman	Tour guide Association
3	Kyaw Kazar	Assistant Director	Department of Fire Service
4	U Myo Aung	Staff Officer	Department of Archaeology
5	U Maung Maung	President	Myanmar Lacquer Association
6	U Maung Lin	Vice President	Myanmar Lacquer Association
7	U Ko Ko Naing	Staff Officer	Department of Agriculture, Land Management
8	U San Win Aung	Deputy Director	Ministry of Hotel and Tourism
9	U Min Swe	Deputy Director	Department of Archaeology
10	U Than Swe	Chairman	Pagoda Trust (Sulamuni)
11	U Myo Thin	Assistant Director	General Administration Department
12	U Soe Thint	Director	District General Administration Department
13	Maung Maung Than	GIS Specialist	Consultant
14	Zaw Min Aung	Staff officer	Department of Archaeology and National Museum
15	U Kyaw Khaing	Principal	Department of Archaeology and National Museum
16	U Naing Win	Assistant Director	Department of Archaeology and National Museum
17	U Lin Tun Kyi	Staff Officer	Department of Archaeology and National Museum
18	U Than Zaw Oo	Director	Department of Archaeology and National Museum
19	U Win Kyaing	Principal	Department of Archaeology and National Museum
20	U Saw Naing Oo	Staff Officer	Department of Archaeology and National Museum
21	U Arkar Aye	Deputy Administrator	Department of Archaeology and National Museum
22	U Soe Soe Lin	Deputy Director	Department of Archaeology and National Museum
23	U Aung Aung Kyaw	Director	Department of Archaeology and National Museum
24	U Thein Lwin	Deputy Director General	Department of Archaeology and National Museum
25	Daw Min Min Thwin	Staff Officer	Department of Archaeology and National Museum
26	Daw Khin Phyu Mar	Staff Officer	Department of Archaeology and National Museum
27	U Phyo Pyae Ko Ko	Staff Officer	Department of Archaeology and National Museum
28	U Htun Htun Aye	Assistant Director	Department of Archaeology and National Museum
29	U Aung Nay Phyoe	Assistant Director	Department of Urban and Housing
30	U Nyi Nyi Saw Hla	Staff Officer	Department of Urban and Housing
31	U Kyaw Swar Oo	Police Captain	District Police Force
32	U Sawili	Director	Relief and Resettlement Department
33	U Saw	MP	House of Representative
29	U Zin Oo	Assistant Director	Department of Archaeology and National Museum
30	U Thet Zaw	Assistant Director	Department of Archaeology and National Museum
31	U Soe Win Htay	Deputy Director	Department of Archaeology and National Museum
32	Dr. Yin Myo Min Htwe	Assistant Director	Department of Meteorology and Hydrology
33	U Myo Nyunt	Director (retired)	Bagan Heritage Trust
34	Daw Aye Aye Khine	Assistant Director	Department of Archaeology and National Museum
35	U Aung Kyaing	Deputy Director General (retired)	Department of Archaeology and National Museum

Sr. No	Name	Title/Position	Department
36	Daw Latt Latt Aung	Director	Department of Water Resources and Improvement of River
37	Daw Aye Aye Khine	Audit	Department of Archaeology and National Museum
38	Daw Seint Seint Chaw	Staff Officer	Department of Archaeology and National Museum
39	Daw Su New Aung	Officer	Department of Archaeology and National Museum
40	Daw San San Hla	Officer	Department of Archaeology and National Museum
41	U Phyo Wanna Kyaw	Officer	Department of Archaeology and National Museum
42	U Myint Khine	Chairman	Bagan Development Association