

Appendix 8: RHIO Management Measures relevant to EPA* objectives and strategies to minimise impacts to values of Fortescue Marsh Management Area (FMMA) (*Environmental and Water assessments relating to mining and mining related activities in the Fortescue Marsh, 2013)

Relevant Environmental Value	FMMA Zones With Potential Impacts from the Revised Proposal	FMMA Objectives	EPA Strategies	RHIO Management Measures
Pools and Springs	<ul style="list-style-type: none"> • 1b Marsh 	<ul style="list-style-type: none"> • Protect natural pools and springs. 	<ul style="list-style-type: none"> • Apply an independent peer review of hydrological models to support water and environmental assessments. The review should be consistent with the National Water Commission’s Australian Groundwater Modelling Guidelines (2012). • Prevent discharge of excess water directly to the wetland or indirectly via industry-induced surface expression of saline or fresh water. If discharge is proposed it should be in accordance with an approved management and monitoring plan and ideally be of an episodic nature (campaign discharge) to coincide with natural flooding/inundation events. 	<ul style="list-style-type: none"> • No direct impacts will occur to the 1b Marsh FMMA zone • Surface water structures have been reviewed by GHD (2018a) to ensure that surface water flows entering the Marsh will not be reduced by the Revised Proposal. • Roy Hill Surface Water Management Procedure (OP-PRO-00034) • RHIO Hydrogeological modelling has been undertaken by a GHD (2018), a third party consultant • Roy Hill Mine Groundwater Operating Strategy Report (OP-REP-00512) • Consultation is undertaken between RHIO and FMG in regard to groundwater management, water supply issues and cumulative impacts on the Marsh via the Chichester Joint Water Management Group Terms of Reference • RHIO will develop and implement a Water Management Plan • RHIO undertake, and will continue, monitoring of groundwater and surface water within the Revised Development Envelope • Monitor groundwater levels against trigger criteria and implement management actions should the trigger levels be reached/exceeded • RHIO will conduct a peer review of hydrological models associated with Life of Mine (LOM) Water Management Strategy (WMS) prior to implementation
Wetland	<ul style="list-style-type: none"> • 1b Marsh 	<ul style="list-style-type: none"> • Minimise disruption to aquifers supporting the Marsh. • Maintain the natural flow regime at the Marsh boundary. • Minimise disturbance to native vegetation. 	<ul style="list-style-type: none"> • Prevent discharge of excess water directly to the wetland or indirectly via industry-induced surface expression of saline or fresh water. If discharge is proposed it should be in accordance with an approved management and monitoring plan and ideally be of an episodic nature (campaign discharge) to coincide with natural flooding/inundation events. 	<ul style="list-style-type: none"> • No water is discharged directly to the wetlands • No clearing of vegetation to be undertaken in 1b Marsh FMMA • Surface water structures have been reviewed by GHD (2018a) to ensure that surface water flows entering the Marsh will not be reduced by the Revised Proposal. • Roy Hill Surface Water Management Procedure (OP-PRO-00034) • Roy Hill Mine Groundwater Operating Strategy Report (OP-REP-00512) • RHIO Hydrogeological modelling is undertaken by a GHD (2018), a third party consultant. Preliminary modelling indicates drawdown and mounding do not affect 1b Marsh

Relevant Environmental Value	FMMA Zones With Potential Impacts from the Revised Proposal	FMMA Objectives	EPA Strategies	RHIO Management Measures
			<ul style="list-style-type: none"> • Installation of bores that penetrate multiple aquifers will require a minimum standard of an ADIA Class 2 driller or have equivalent Water Drilling certification approved by the Department of Water. • Apply an independent peer review of hydrological models to support water and environmental assessments. The review should be consistent with the National Water Commission's Australian Groundwater Modelling Guidelines (2012). • Avoid (where possible) and minimise clearing of samphire vegetation or halophytic vegetation. • Minimise disturbance activities with a preference to use previously disturbed areas for new disturbance footprints, e.g. existing dilapidated fence lines and corridors for vehicle movements. • Any ground disturbing activity within the proposed 2015 conservation estate should be undertaken in a manner consistent with DEC conservation estate management guidelines (where available). Prior to the availability of these guidelines, consultation with the DEC is considered essential. • Implement best practice impact mitigation and management techniques. • Undertake research and monitoring to determine the extent of cumulative hydrological impacts on the Marsh. 	<ul style="list-style-type: none"> • Roy Hill Ground Disturbance Permit Procedure (OP-PRO-00193) • Consultation is undertaken between RHIO and FMG in regard to groundwater management, water supply issues and cumulative impacts on the Marsh via the Chichester Joint Water Management Group Terms of Reference • RHIO undertake, and will continue, monitoring of groundwater and surface water within the Revised Development Envelope • Monitor groundwater levels against trigger criteria and implement management actions should the trigger levels be reached/exceeded • RHIO will conduct a peer review of hydrological models associated with Life of Mine (LOM) Water Management Strategy (WMS) prior to implementation • RHIO will develop and implement a Water Management Plan

Relevant Environmental Value	FMMA Zones With Potential Impacts from the Revised Proposal	FMMA Objectives	EPA Strategies	RHIO Management Measures
Water quality gradient.	<ul style="list-style-type: none"> • 1b Marsh 	<ul style="list-style-type: none"> • Maintain water quality in the Marsh. • Minimise disruption to aquifers supporting the Marsh. • Maintain the natural surface water flow regime of the Marsh. 	<ul style="list-style-type: none"> • Prevent discharge of excess water directly to the wetland or indirectly via industry-induced surface expression of saline or fresh water. If discharge is proposed it should be in accordance with an approved management and monitoring plan and ideally be of an episodic nature (campaign discharge) to coincide with natural flooding/inundation events. • Installation of bores that penetrate multiple aquifers will require a minimum standard of an ADIA Class 2 driller or have equivalent Water Drilling certification approved by the Department of Water. • Apply an independent peer review of hydrological models to support water and environmental assessments. The review should be consistent with the National Water Commission's Australian Groundwater Modelling Guidelines (2012). 	<ul style="list-style-type: none"> • No water is discharged directly to the wetlands • Excess water will be managed under the LOM WMS which includes MAR and evaporation ponds for disposal of excess water • Roy Hill Surface Water Management Procedure (OP-PRO-00034) • Roy Hill Mine Groundwater Operating Strategy Report (OP-REP-00512) • RHIO Hydrogeological modelling is undertaken by a GHD (2018), a third party consultant • RHIO will develop and implement a Water Management Plan • RHIO will conduct a peer review of hydrological models associated with Life of Mine (LOM) Water Management Strategy (WMS) prior to implementation • Surface water structures have been reviewed by GHD (2018a) to ensure that surface water flows entering the Marsh will not be reduced by the Revised Proposal
Species of conservation significance	<ul style="list-style-type: none"> • 1b Marsh • 2a Calcrete Flats • 3a Kulbee Alluvial Flank • 3b Marilana Plain 	<ul style="list-style-type: none"> • Protect species of conservation significance and their habitat. 	<ul style="list-style-type: none"> • Avoid (where possible) and minimise clearing of samphire and halophytic vegetation. • Minimise disruption to groundwater levels or water quality gradients in aquifers that support important habitats. • Minimise disruption to natural surface flow regimes. • Excess water should be re-injected in accordance with the Department of Water's Pilbara Water in Mining Guideline (2009). 	<ul style="list-style-type: none"> • Species of conservation significance have been identified during flora and fauna surveys and are avoided where possible • The clearing disturbance footprint will be minimised during the mine planning and design phase, sufficient to enable safe construction and operation of the mining operation • No clearing that has not already been approved under previous EPBC Act assessments will be conducted in the Low Rocky Hills habitat • Clearing of the critical habitat of the Northern Quoll, Ghost Bat, Greater Bilby and Pilbara Olive Python within the Revised Development Envelope will be avoided where possible

Relevant Environmental Value	FMMA Zones With Potential Impacts from the Revised Proposal	FMMA Objectives	EPA Strategies	RHIO Management Measures
			<ul style="list-style-type: none"> • Manage surface discharge of excess water and restrict to episodic (campaign) discharges. • Apply an independent peer review of hydrological models to support water and environmental assessments. The review should be consistent with National Water Commission's Australian Groundwater Modelling Guidelines (2012). • Undertake surveys to identify and map distributions of conservation significant species. 	<ul style="list-style-type: none"> • All disturbance will be managed using the RHIO Ground Disturbance Permit system to avoid the unauthorised clearing of vegetation • Roy Hill Ground Disturbance Permit Procedure (OP-PRO-00193) • Roy Hill Surface Water Management Procedure (OP-PRO-00034) • RHIO Hydrogeological modelling is undertaken by a GHD (2018), a third party consultant • RHIO will conduct a peer review of hydrological models associated with LOM WMS prior to implementation • LOM WMS has been developed in accordance with Department of Water's Pilbara Water in Mining Guideline (2009) • Vertebrate fauna assessment was undertaken by Biologic in 2018 • Significant habitat such as Ghost Bat caves and semi-permanent pools will not be disturbed by the Revised Proposal • Additional targeted fauna and flora surveys will be conducted in areas subject to the Revised Proposal which have not already been surveyed • Infrastructure and transport routes will be located to preferentially avoid areas of importance to significant species • Linear infrastructure will incorporate fauna crossing areas to ensure fauna habitat is not segregated • Feral animal control activities will be implemented across the Revised Development Envelope • Appropriate speed limits for vehicles will be maintained by ensuring all roads are signposted and vehicle speeds are monitored and enforced
Samphire vegetation community.	<ul style="list-style-type: none"> • 1b Marsh 	<ul style="list-style-type: none"> • Protect samphire and halophytic vegetation. • Enhance understanding of <i>Tecticornia</i> species. 	<ul style="list-style-type: none"> • Minimise disruption to groundwater levels or water quality gradients in aquifers that support samphire vegetation communities. • Minimise disruption to natural surface flow regimes. 	<ul style="list-style-type: none"> • RHIO Hydrogeological modelling is undertaken by a GHD (2018), a third party consultant • RHIO will conduct a peer review of hydrological models associated with LOM WMS prior to implementation • Roy Hill Mine Groundwater Operating Strategy Report (OP-REP-00512) • Roy Hill Ground Disturbance Permit Procedure (OP-PRO-00193)

Relevant Environmental Value	FMMA Zones With Potential Impacts from the Revised Proposal	FMMA Objectives	EPA Strategies	RHIO Management Measures
			<ul style="list-style-type: none"> Excess water should be re-injected in accordance with the Department of Water's Pilbara Water in Mining Guideline (2009). Manage surface discharge of excess water and restrict to episodic (campaign) discharges. Undertake surveys to delimit and define samphire vegetation communities. 	<ul style="list-style-type: none"> Roy Hill Surface Water Management Procedure (OP-PRO-00034) Roy Hill Groundwater and Storage Facility Management Procedure (OP-PRO-00002). Surface water structures have been reviewed by GHD (2018a) to ensure that surface water flows are returned to natural courses Flora surveys have been undertaken within the mine area. Targeted flora and fauna surveys will be undertaken prior to clearing in the borefield and associated pipeline route to avoid conservation significant species where possible
Aquatic Invertebrates	<ul style="list-style-type: none"> 1b Marsh 2a Calcrete Flats 3b Marillana Plains 	<ul style="list-style-type: none"> Enhance knowledge of local invertebrates. 	<ul style="list-style-type: none"> Minimise disruption to groundwater levels or water quality gradients in aquifers that support significant aquatic invertebrate populations. Minimise disruption to natural surface flow regimes. Excess water should be re-injected in accordance with the Department of Water's Pilbara Water in Mining Guideline (2009). Manage surface discharge of excess water and restrict to episodic (campaign) discharges. 	<ul style="list-style-type: none"> RHIO Hydrogeological modelling is undertaken by a GHD (2018), a third party consultant LOM WMS has been developed in accordance with Department of Water's Pilbara Water in Mining Guideline (2009). Roy Hill Mine Groundwater Operating Strategy Report (OP-REP-00512) Roy Hill Ground Disturbance Permit Procedure (OP-PRO-00193) Surface water structures have been reviewed by GHD (2018a) to ensure that surface water flows are returned to natural courses. Roy Hill Surface Water Management Procedure (OP-PRO-00034) Roy Hill Surface Water Management Procedure (OP-PRO-00034). RHIO will develop and implement a Water Management Plan
Waterbirds	<ul style="list-style-type: none"> 1b Marsh 	<ul style="list-style-type: none"> Protect waterbird habitat and foraging habitat. Maintain water quality and natural flow regimes in the Marsh 	<ul style="list-style-type: none"> Minimise disruption to groundwater levels or water quality gradients in aquifers that support waterbird habitat. Maintain the natural surface water flow regime. Excess water should be re-injected in accordance with the Department of Water's Pilbara Water in Mining Guideline (2009). Manage surface discharge of excess water and restrict to episodic (campaign) discharges. 	<ul style="list-style-type: none"> RHIO Hydrogeological modelling is undertaken by a GHD (2018), a third party consultant LOM WMS has been developed in accordance with Department of Water's Pilbara Water in Mining Guideline (2009) Roy Hill Mine Groundwater Operating Strategy Report (OP-REP-00512) Surface water structures have been reviewed by GHD (2018a) to ensure that surface water flows are returned to natural courses Roy Hill Surface Water Management Procedure (OP-PRO-00034) RHIO will develop and implement a Water Management Plan Feral animal control activities will be implemented across the Development Envelope

Relevant Environmental Value	FMMA Zones With Potential Impacts from the Revised Proposal	FMMA Objectives	EPA Strategies	RHIO Management Measures
			<ul style="list-style-type: none"> • Undertake unmanaged livestock and feral predator control measures. 	
Natural water regimes	<ul style="list-style-type: none"> • 2a Calcrete Flats • 2c Fortescue River Coolibah • 3a Kulbee Alluvial Flank • 3b Marillana Plains 	<ul style="list-style-type: none"> • Maintain the natural flow regimes, especially at the Marsh boundary • Maintain natural cycles of wetting for clay pan habitats. • Minimise disruption to aquifers from activities in neighbouring zones. 	<ul style="list-style-type: none"> • Prevent discharge of excess surface water where possible. • Limit disturbance to claypan habitats where possible. • Excess water should be managed in accordance with the Department of Water's Pilbara Water in Mining Guideline (2009). • Apply an independent peer review of hydrological models to support water and environmental assessments. The review should be consistent with National Water Commission's Australian Groundwater Modelling Guidelines (2012). • Undertake research and monitoring to determine the extent of cumulative hydrological impacts on the Marsh. 	<ul style="list-style-type: none"> • EPA Report 1342 assessed the project as not having a significant impact to the Fortescue Marsh from the Mine and Stage 2 Borefield activities • Claypan habitat will be avoided where possible • Mapped drainage foci locations will be avoided • Roy Hill Ground Disturbance Permit Procedure (OP-PRO-00193) • Roy Hill Mine Groundwater Operating Strategy Report (OP-REP-00512) • Part V EP Act approval received for disposal of excess water from dewatering over a two year period • RHIO Hydrogeological modelling is undertaken by a GHD, a third party consultant • RHIO will develop and implement a Water Management Plan • Roy Hill Surface Water Management Procedure (OP-PRO-00034) • Roy Hill Environmental Basis of Design (OP-SPC-00506) • Vegetation health monitoring has been undertaken regularly since 2010 • Surface water structures have been reviewed by GHD to ensure that surface water flows are returned to natural courses • Consultation is undertaken between RHIO and FMG in regard to groundwater management, water supply issues and cumulative impacts on the Marsh via the Chichester Joint Water Management Group Terms of Reference • Monitor groundwater levels against trigger criteria and implement management actions should the trigger levels be reached/exceeded
Subterranean fauna	<ul style="list-style-type: none"> • 2a Calcrete Flats • 2c Fortescue River Coolibah 	<ul style="list-style-type: none"> • Enhance understanding of local subterranean fauna. 	<ul style="list-style-type: none"> • Undertake targeted surveys to confirm presence and species richness/endemism of subterranean fauna. • Develop a Fortescue Marsh Management Area subterranean fauna theme within NatureMap. 	<ul style="list-style-type: none"> • Subterranean fauna surveys were undertaken by SMEC in 2009 and by Bennelongia in 2009 and 2018 • Water quality reinjected into each borefield will be consistent with the background water quality of the area • Water quality monitoring will occur to ensure that water reinjected within each area remains within the quality range of background water quality

Relevant Environmental Value	FMMA Zones With Potential Impacts from the Revised Proposal	FMMA Objectives	EPA Strategies	RHIO Management Measures
	<ul style="list-style-type: none"> • 3a Kulbee Alluvial Flank • 3b Marillana Plains 			<ul style="list-style-type: none"> • Consultation is undertaken between RHIO and FMG in regard to groundwater management, water supply issues and cumulative impacts on the Marsh via the Chichester Joint Water Management Group Terms of Reference • Roy Hill Mine Groundwater Operating Strategy Report (OP-REP-00512) • Monitor groundwater levels against trigger criteria and implement management actions should the trigger levels be reached/exceeded • Troglifauna sampling will be undertaken in the SWIB
Vegetation communities	<ul style="list-style-type: none"> • 2a Calcrete Flats 	<ul style="list-style-type: none"> • Minimise impact to native vegetation communities. • Rehabilitate native vegetation where possible. 	<ul style="list-style-type: none"> • Minimise clearing of native vegetation. • Limit the surface discharge of excess water, especially in vicinity of claypan habitats. 	<ul style="list-style-type: none"> • Roy Hill Ground Disturbance Permit Procedure (OP-PRO-00193) • Roy Hill Surface Water Management Procedure (OP-PRO-00034) • All disturbance will be managed using the RHIO Ground Disturbance Permit system to avoid the unauthorised clearing of vegetation • The clearing disturbance footprint will be minimised during the borefield planning and design phase, sufficient to enable safe construction and operation of the borefield • Minimal clearing will occur in this FMMA zone and clearing will be limited to that required for borefields • Areas of existing disturbance will be utilised before clearing of new ground where possible • Rehabilitation will occur upon completion of operation of infrastructure in accordance with the RHIO Mine Closure Plan approved by DMIRS
Bilby	<ul style="list-style-type: none"> • 2c Fortescue River Coolibah 	<ul style="list-style-type: none"> • Protect the Bilby and its habitat. 	<ul style="list-style-type: none"> • Minimise disturbance to Bilby habitats. • Avoid (where possible) disturbance to extant Bilby burrows and minimise clearing of native vegetation where critical habitat has been identified. • Undertake targeted surveys to determine persistence, extent and preferred habitat of Bilbies. • Undertake feral predator control measures. 	<ul style="list-style-type: none"> • Vertebrate fauna assessment was undertaken by Biologic in 2018 • Clearing of the critical habitat of the Greater Bilby within the Revised Development Envelope will be avoided where possible • All disturbance will be managed using the RHIO Ground Disturbance Permit Procedure (OP-PRO-00193) to avoid the unauthorised clearing of vegetation • Areas of existing disturbance will be utilised before clearing of new ground where possible • Additional targeted fauna surveys will be conducted in areas subject to the Revised Proposal which have not already been surveyed

Relevant Environmental Value	FMMA Zones With Potential Impacts from the Revised Proposal	FMMA Objectives	EPA Strategies	RHIO Management Measures
				<ul style="list-style-type: none"> • Infrastructure and transport routes will be located to preferentially avoid areas of importance to significant species • Linear infrastructure will incorporate fauna crossing areas to ensure fauna habitat is not segregated • Feral animal control activities will be implemented within the Revised Development Envelope • Appropriate speed limits for vehicles will be maintained by ensuring all roads are signposted and vehicle speeds are monitored and enforced
Mulga woodlands	<ul style="list-style-type: none"> • 3a Kulbee Alluvial Flank • 3b Marillana Plain 	<ul style="list-style-type: none"> • Manage impacts to mulga vegetation. • Manage overland surface water flows. 	<ul style="list-style-type: none"> • Avoid (where possible) and minimise clearing of mulga vegetation. • Minimise disruption to surface flows through the appropriate design and placement of infrastructure. 	<ul style="list-style-type: none"> • EPA Report 1342 assessed the project as not having a significant impact to Mulga trees from the Mine and Stage 2 Borefield activities • Roy Hill Ground Disturbance Permit Procedure (OP-PRO-00193) • Roy Hill Clearing and Soil Management Procedure (OP-PRO-00187) • Roy Hill Surface Water Management Procedure (OP-PRO-00034) • Surface water structures have been reviewed by GHD (2018a) to ensure that surface water flows are returned to natural courses • Roy Hill Mine Groundwater Operating Strategy Report (OP-REP-00512) • All disturbance will be managed using the RHIO Ground Disturbance Permit system to avoid the unauthorised clearing of vegetation • The clearing disturbance footprint will be minimised during the mine planning and design phase, sufficient to enable safe construction and operation of the mining operation • Areas of existing disturbance will be utilised before clearing of new ground where possible • Roy Hill Environmental Basis of Design (OP-SPC-00506) • Astron (2019) conducted a risk assessment on impacts to vegetation resulting from LOM WMS • 500m buffer zone is implemented inside the western boundary of tenement M46/518 to minimise shadow effects to Mulga vegetation beyond the boundary of the project area

Relevant Environmental Value	FMMA Zones With Potential Impacts from the Revised Proposal	FMMA Objectives	EPA Strategies	RHIO Management Measures
Riparian vegetation	<ul style="list-style-type: none"> • 2c Fortescue River Coolibah 	<ul style="list-style-type: none"> • Minimise impacts to riparian native vegetation. • Maintain the natural surface water flows and flooding regime of the alluvial and gilgai plains. • Minimise disruption to aquifers supporting groundwater dependent ecosystems and riparian vegetation. 	<ul style="list-style-type: none"> • Infrastructure (roads, rail, levees) should be designed and constructed to maintain the natural flooding regime. • Map the condition of riparian vegetation and undertake revegetation activities where appropriate. 	<ul style="list-style-type: none"> • Roy Hill Environmental Basis of Design (OP-SPC-00506) • All disturbance will be managed using the RHIO Ground Disturbance Permit Procedure (OP-PRO-00193) to avoid the unauthorised clearing of vegetation • Areas of existing disturbance will be utilised before clearing of new ground where possible • Locate, design and construct infrastructure, where possible outside of creek lines and to maintain the natural flooding regime • Condition of riparian vegetation in the Remote MAR Borefield has been mapped
Land Systems	<ul style="list-style-type: none"> • 3b Marillana Plan 	<ul style="list-style-type: none"> • Manage impacts to the land system. 	<ul style="list-style-type: none"> • Minimise the clearing of native vegetation. • Minimise disruption to natural surface flow regimes through the appropriate design and placement of infrastructure. 	<ul style="list-style-type: none"> • All disturbance will be managed using the RHIO Ground Disturbance Permit Procedure (OP-PRO-00193) to avoid the unauthorised clearing of vegetation • Areas of existing disturbance will be utilised before clearing of new ground where possible • Locate, design and construct infrastructure, where possible outside of creek lines and to maintain the natural flooding regime