

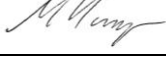
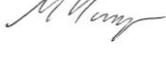



ADAPTIVE MANAGEMENT STRATEGY
RAW WATER SUPPLY OEMP – ATTACHMENT I

JUNE 2018



Revision History

Version	Revision Date	Details	Authorised	
			Name/Position	Signature
1.0	29/02/16	Draft for review	M Haege/Geolyse	
2.0	08/04/16	Draft for review	M Haege/Geolyse	
3.0	09/05/16	Issue for implementation	M Haege/Geolyse	
4.0	04/07/16	Edits in response to comments from DP&E received 28/06/16	M Haege/Geolyse	
5.0	15/06/18	Updated to address actions identified in the Internal Compliance Audit	M Haege/Geolyse	

ABBREVIATIONS

AEMP	Aquatic Environmental Monitoring Program
AHD	Australian height datum
AMS	Adaptive management strategy
ANZECC	Australian and New Zealand Environment and Conservation Council
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
BSCSHS	Blackmans Swamp Creek stormwater harvesting scheme
CCS	Community communication strategy
CTF	Cease to flow
CoA	Condition of approval
DP&E	Department of Planning and Environment
Dol	Department of Industry
DPI	Department of Primary Industries
DPI Water	Department of Primary Industries Water
DST	Decision Support Tool
EA	Environmental Assessment
EP&A Act	NSW Environmental Planning and Assessment Act 1979
GL	Gigalitre (1,000 megalitres)
GMP	Groundwater monitoring program
ha	Hectares
HMP	Hydrology monitoring program
IMP	Inspection and maintenance plan
kL	Kilolitre (1,000 litres)
km	Kilometre (1,000 metres)
kWhr	Kilowatt hour
L	Litre (1,000 millilitres)
LGA	Local Government Area
L/s	Litres per second
m ³	Cubic metre (1,000 litres)
m ³ /hr	Cubic metres per hour
m ³ /s	Cubic metres per second
mg/L	Milligrams per litre
mL	Millilitre
ML	Megalitre (1 million litres or 1,000 kilolitres)
ML/day	Megalitres per day
m	Metre
mm	Millimetre
MOP	Macquarie River to Orange pipeline

OCC	Orange City Council
OEMP	Operation Environmental Management Plan
PA	Project approval
PCSHS	Ploughmans Creek stormwater harvesting scheme
ScWMP	Scour water management plan
SEP	Stakeholder engagement plan
STP	Sewage treatment plant
µg/L	Micrograms per litre
µS/cm	Micro Siemens per centimetre
WAL	Water access licence
WFP	Water filtration plant
WSP	Water sharing plan

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Background

1.1 INTRODUCTION

This Adaptive Management Strategy (AMS) forms part of the *Orange Raw Water Supply System Operation Environmental Management Plan (OEMP)*.

It has been developed to set out the procedures to manage the operation of the Orange City Council (OCC) raw water supply system in response to monitoring undertaken for the Aquatic Environment Monitoring Program (AEMP – Attachment D), the Hydrology Monitoring Program (HMP – Attachment E) and the operating rules defined by the Decision Support Tool (DST – Attachment C).

1.2 ADAPTIVE MANAGEMENT STRATEGY

Specific approval requirements for the AMS are provided below.


Project Approval for the Macquarie River to Orange pipeline

Condition D3 of the Project Approval outlines the requirement for the AMS as follows:

D3. *The **Adaptive Management Strategy** referred to in condition D2 [the requirement to prepare and implement an OEMP] is to set out the procedures to manage the operation of the project in response to monitoring results obtained in condition B1 [AEMP] and the operating rules defined in condition B4 [DST]. The AMS is to:*

- (a) Incorporate a decision making framework that sets out specific actions that may be required to be implemented in order to reduce impacts identified as a result of the monitoring required in condition B1;*
- (b) Identify matters to be addressed in annual reports required under condition C5 in relation to the outcomes of monitoring, the application of the decision making framework, the mitigation measures identified, progress with the implementation of such measures, and their success.*
- (c) Review mechanisms to assess the effectiveness of the Adaptive Management Strategy and propose changes to manage impacts of the environment.*

The report referred to under condition C5 [Annual Review] shall be submitted to the DPI, OEH and the Department identified in condition B1. The Director General may, at the request of the Proponent vary the reporting requirement or period by notice in writing to the Proponent. The Proponent may request the Director General to consider a variation to the reporting requirements at any time.

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The Proponent is required to implement reasonable and feasible mitigation measures as identified under D3(a) where the need for further action is identified through the respective Monitoring Program, or as otherwise agreed with the Director General.

1.3 WHAT IS ADAPTIVE MANAGEMENT?

1.3.1 AMS PROCESS

Adaptive management is a systematic approach for improving management by predicting the outcomes of management activities and then strategically monitoring the actual outcomes to gather information to improve future management. Adaptive management promotes flexible decision-making that can be adjusted as outcomes from management actions and other events become better understood.

In terms of process, adaptive management requires stated management objectives to guide decisions about what actions to take, assumptions about expected outcomes to compare against actual outcomes, monitoring to provide feedback about the system and actions, learning from the system as actions are taken to manage it, and incorporating what is learned into future actions. This process is reflected in **Figure 1**.

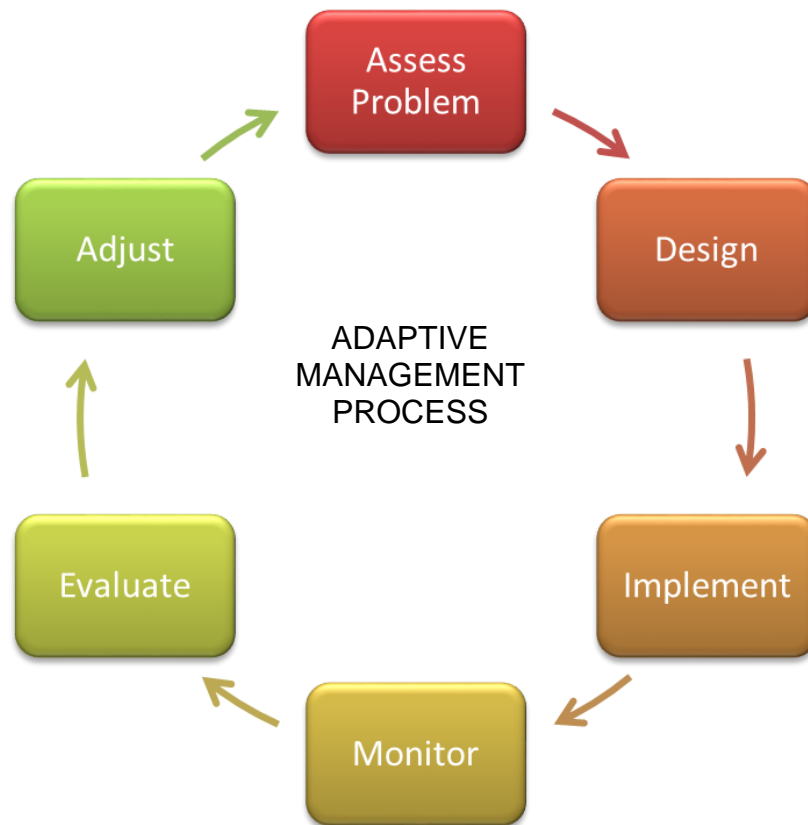



Figure 1: Adaptive management process

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In summary an adaptive management approach:

- allows managers to maintain flexibility in their decisions, knowing that uncertainties exist;
- provides managers the latitude to change direction;
- improves understanding of ecological systems to achieve management objectives; and
- ensures actions are taken to improve progress towards desired outcomes.

1.3.2 ADAPTIVE MANAGEMENT FRAMEWORK

The framework of the AMS for the Orange raw water supply OEMP is shown in **Figure 2**. This is based around a practical application of the adaptive management process. This AMS is presented in accordance with this framework as follows:

- Setting the scope of the AMS;
- Understanding risk and setting performance objectives;
- Management planning and implementing actions;
- Monitoring and data collection;
- Reporting, evaluation and review;
- Actions for amending management plans; and
- Reviewing the AMS.

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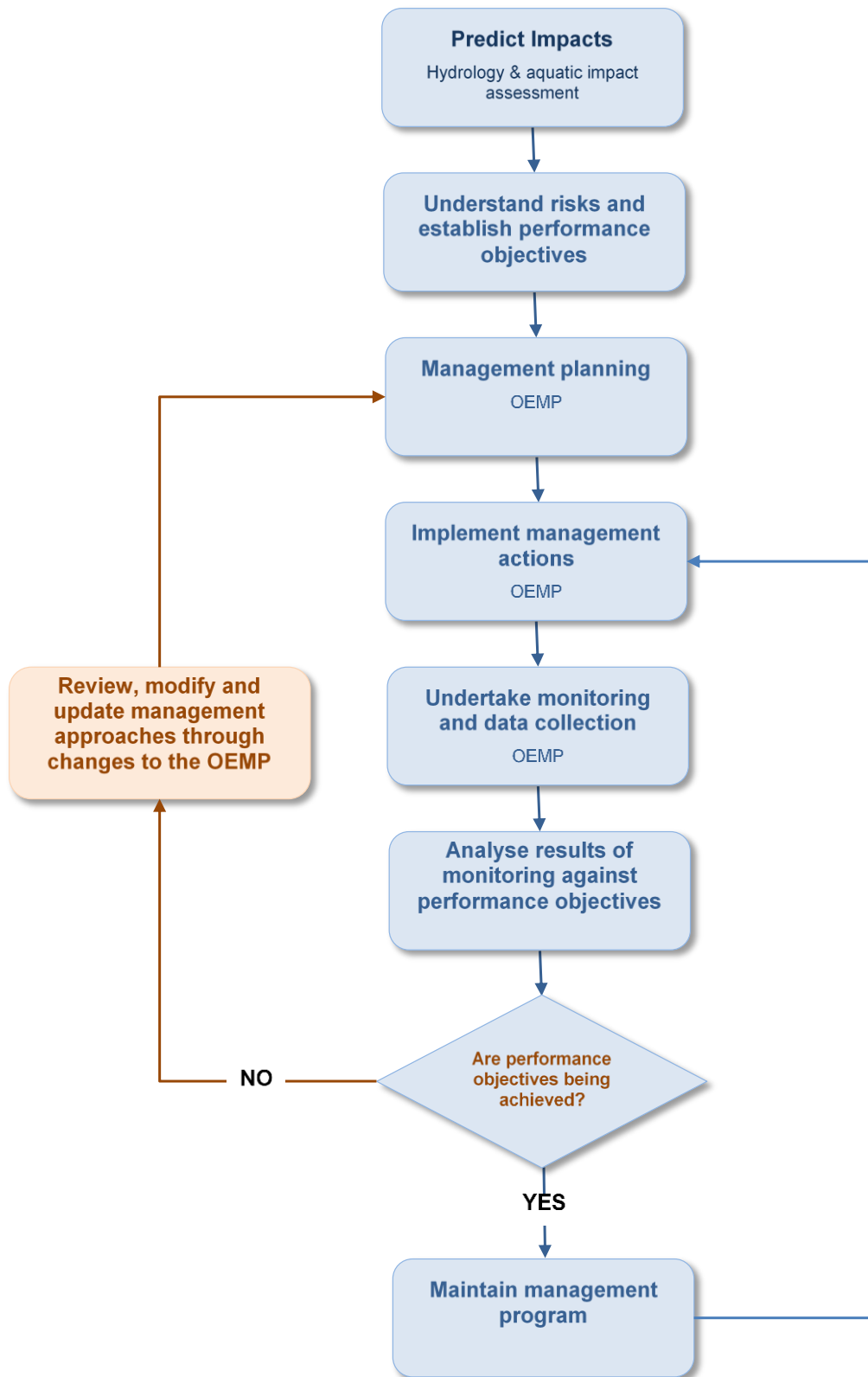


Figure 2: AMS Framework

Adaptive Management Strategy

2.1 SCOPE

In accordance with CoA D3, the AMS applies to:

- The Aquatic Environment Monitoring Program (CoA B1);
- The Decision Support Tool (CoA B3);
- The operating rules defined in CoA B4; and
- Annual Review (CoA C5).

2.2 PERFORMANCE OBJECTIVES

2.2.1 AEMP


The specific objectives of the AEMP are:

1. To identify any changes in hydrology and aquatic ecology (including fish and aquatic and riparian vegetation) in the Macquarie River as a result of the operation of the Macquarie River to Orange pipeline project.
2. To determine the efficiency of the Macquarie River to Orange pipeline offtake design and screens to limit impingement, entrainment and minimise impacts to eggs, larvae or changes to recruitment of threatened aquatic species.
3. To identify any changes in hydrology and aquatic ecology (including fish and aquatic and riparian vegetation) in Summer Hill Creek as a result of increased flow volumes and spills from Suma Park Dam.
4. To determine if the environmental flow releases maintain or enhance the key values of water quality, aquatic biodiversity, river health and general ecological condition of Summer Hill Creek.
5. To identify if environmental flow Rule 2 maintains 4% riffle habitat at four (4) riffles on Summer Hill Creek between the confluence of Emu Swamp Creek and the confluence of Blackmans Swamp Creek.

2.2.2 DST

The overall objective of the DST is to manage and optimise the use of the various raw water supplies in the system based on the “**Five C’s**”:

- **Critical level** – operating the system to ensure that:
 - the combined storage is at or above a defined critical level at the end of each water year; and/or

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- restriction regimes are consistent with the frequency and duration of restriction components of the 5/10/10 secure yield rule.
- **Climate** – adopting operating rules based on expected climatic conditions.
- **Controlling spill** – minimising spill from Suma Park Dam by operating the system cognisant of forecast climatic conditions and likely catchment inflow.
- **Conditions** – ensuring all raw water supplies are operated in accordance with approval conditions.
- **Cost** – minimising the cost of the raw water supply by adopting operating rules that use the lowest cost water first.

2.2.3 PROJECT APPROVAL CONDITION B4

Project Approval CoA B4 and associated CoA B6 require:

B4 The Project is to be operated consistent with:

(a) The Orange Water Supply Decision Support Tool in condition B3;


(b) The operating rules where:

- i. Pumping is only to occur when the instantaneous river flow immediately downstream of the pumps will exceed the 80th percentile flow (the note below specifies how the 80th percentile flow rate is determined); and*
- ii. No more than 12 ML is to be extracted from the Macquarie river at Cobbs Hut Hole over any 24 hour period; and*
- iii. The instantaneous rate of extraction is not to exceed 15.2 ML/day; and*
- iv. The water level in Suma Park Dam is less than 90 percent full; and*
- v. A cease to pump trigger applies, corresponding to a flow in the Macquarie river at Gauging Station 421192 (upstream of the pumps) of 15.2 ML/day above the 80th percentile flow (e.g. 92 +15.2 = ~108 ML/day); and*

(c) The river flow margin of error for Gauging Station 421192 determined in accordance with condition B6.

B6 River flow gaugings shall be completed for Gauging Station 421192 in order to improve and verify the streamflow rating for the Macquarie River at Gauging Station 421192, in consultation with DPI (NOW).

The operating rules shall adopt a flow trigger that includes a margin of error of the flow rating determined in consultation with DPI (NOW) until such time as DPI (NOW) is satisfied that the flow rating correlates with flows in the Macquarie River at Gauging Station 421192.

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2.3 PLANNING AND IMPLEMENTATION

The Orange raw water supply OEMP has been prepared cognisant of the performance objectives outlined in **Section 2.2**.

Impact assessment undertaken during the project investigation and approval stage for the Macquarie River to Orange pipeline, Suma Park Dam upgrade and stormwater harvesting schemes concluded that when these schemes are operated in accordance with approved conditions, there would be no significant detrimental environmental impact.

The OEMP defines actions to ensure the schemes are operated in accordance with approvals and licenses. Relevant Council staff responsible for the actions are identified.

Specific sub-plans of the OEMP that outline management actions and monitoring for the AMS are the:

- Aquatic Environment Monitoring Program (Attachment D);
- Decision Support Tool (Attachment C); and
- Hydrology Monitoring Program (Attachment E).

These sub-plans may be modified through the implementation of this AMS.

2.4 MONITORING AND DATA COLLECTION

Monitoring and data collection to be undertaken to inform the AMS are outlined in the:


- Aquatic Environment Monitoring Program (Attachment D);
- Decision Support Tool (Attachment C); and
- Hydrology Monitoring Program (Attachment E).

Monitoring programs may be modified through the implementation of this AMS.

2.5 REPORTING, EVALUATION AND REVIEW

The final steps in the adaptive management process are to evaluate and review management practices in light of the knowledge gained through monitoring. The updating and review process may simply increase the confidence in the suitability of existing management plans. However, this process may also uncover new insights about how management actions are affecting the achievement of management objectives.

Annual reporting will be completed in accordance with each sub-plan. Evaluation of the monitoring results will be undertaken against the objectives outlined in **Section 2.2** for each sub-plan. A consolidated Annual Review will be completed in accordance with **Section 4.4 – OEMP Reporting**. Results of the Annual Review and any audit reports that may have been completed in the operating year will inform the adaptive management process.

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Each sub-plan annual report will include a summary of all monitoring results and, importantly for the AMS, will:

- Identify any non-compliance over the last year, and describe what actions were (or are being) taken to ensure compliance;
- Identify any trends in the monitoring data over the life of the development;
- Identify any discrepancies between the predicted and actual impacts of the development, and analyse the potential cause of any significant discrepancies; and
- Identify measures that could be implemented to improve the environmental performance of the development and justification for any decision to not implement those measures.

These will be summarised in the Annual Review.

The Annual Review will form the basis for seeking approval for any changes to management plans.


2.6 AMENDING MANAGEMENT PLANS

A process for amending management plans in the event of identified negative changes will be applied. This will be based on a graded hierarchy of responses to ensure the causes of any problems are understood and changes to management plans are applied to reverse the situation.

The amendment process will include:

- internal review by relevant OCC staff to analyse the issue;
- increased monitoring and/or technical analysis to help determine the cause of the problem;
- engaging additional expert analysis if required;
- identification and evaluation of possible solutions;
- recommending changes to management plans and seeking approval for these changes;
- implementation of revised management actions following approval;
- further monitoring, evaluation and review to determine if the problem has been addressed; and
- incorporation of the outcomes of the process in the next Annual Review (**Section 4.4 – OEMP Reporting**).

The **Water and Sewerage Strategic Manager** shall be responsible for ensuring that any corrective actions are implemented and updates to the OEMP made as required.

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AMS Actions

3.1 OPERATING YEAR

The operating year is defined as 1 July to 30 June.

This is to be consistent with the water year as used by the NSW Department of Industry – Water (Dol Water) for reporting under the *Water Management Act 2000*.

3.2 AMS IMPLEMENTATION

When: Continual implementation and/or triggered in response to:


- The Annual Review (**Section 4.4 – OEMP Reporting**); or
- An incident report (**Section 3.2.18 – Environmental Incident Management**); or
- An audit (**Section 4.3 – Environmental Auditing and Compliance**).

Actions: **1** The **Water and Sewerage Strategic Manager** shall ensure all routine monitoring and data collection is undertaken in accordance with the OEMP. A calendar is provided in **Attachment B** of the OEMP which lists all routine actions.

2 The **Water and Sewerage Strategic Manager** shall ensure all annual reports for sub-plans are completed in time to allow the Annual Review to be submitted by 1 September each year. Refer to **Section 4.4 – OEMP Reporting** and relevant sub-plans (AEMP, DST and HMP).

3 The **Water and Sewerage Strategic Manager** shall ensure each sub-plan annual report identifies:

- any non-compliance over the last year, and describe what actions were (or are being) taken to ensure compliance;
- any trends in the monitoring data over the life of the development;
- any discrepancies between the predicted and actual impacts of the development, and presents analysis of the potential cause of any significant discrepancies; and
- measures that could be implemented to improve the environmental performance of the development and justification for any decision to not implement those measures.

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- 4** If a sub-plan annual report recommends a change to one of the management plans, the **Water and Sewerage Strategic Manager** shall consider the information presented and either:
1. approve the proposed changes and seek approval from the Department of Planning and Environment for changes to the OEMP (go to Action 6); or
 2. initiate further investigations (go to Action 5).
- 5** If further investigations are initiated at Action 4, the **Water and Sewerage Strategic Manager** shall implement:
- an internal review by relevant OCC staff to analyse the issue; or
 - increased monitoring to help determine the cause of the problem, if deemed appropriate; or
 - further technical analysis of the data supported by additional expert analysis if required.

The outcome from these further investigations will be confirmation (or otherwise) of the issue and identification and evaluation of possible solutions and/or corrective actions if required.

- 6** The **Water and Sewerage Strategic Manager** shall ensure that any corrective actions identified from Action 5 are implemented and updates to the OEMP made as required.

Any changes to management plans in the OEMP will be subject to approval from the Department of Planning and Environment (Action 7).


- 7** Changes to management plans in the OEMP will be endorsed through consultation with the relevant Government Agency as follows:
- AEMP – Department of Industry – Water (DoI Water) and DPI Fisheries
 - DST – DoI Water

The endorsed changes will be submitted to the Department of Planning and Environment for approval.

- 8** The **Water and Sewerage Strategic Manager** shall disseminate and implement approved OEMP management plans.

Who: The **Water and Sewerage Strategic Manager** shall be responsible for undertaking Actions 1 to 8.

Records: A record of the implementation of the AMS will be provided in the next scheduled Annual Review.

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3.3 AMS REVIEW

3.3.1 REVISION TO STRATEGIES, PLANS AND PROGRAMS

CoA C6 requires that OCC shall review, and if necessary revise, strategies, plans and programs included in the OEMP to the satisfaction of the Director-General within 3 months of:

- a) the Annual Review (**Section 4.4 – OEMP Reporting**);
- b) any Incident Report (**Section 3.2.18 – Environmental Incident Management**);
- c) an Audit Report (**Section 4.3 – Environmental Auditing and Compliance**); or
- d) any modification to the conditions of the Project Approval,

This is to ensure that plans and programs are updated on a regular basis, and incorporate any recommended measures to improve environmental performance.

3.3.2 DOCUMENT CONTROL

The following will be classed as ‘major’ revisions:

- Changes to processes;
- Changes to monitoring programs, either timing or parameters monitored;
- Changes made in response to an incident; and/or
- Changes requested by a relevant Government agency.


Major revisions will be identified by the whole number in the version number (i.e. 1.0, 2.0, 3.0....) and will be reviewed, approved and re-circulated as necessary.

The following will be classed as ‘minor’ revisions:

- Minor typing and grammar corrections;
- Changes to position titles; and
- Updates to recording forms to suit changes in operations.

Minor revisions will be identified by the decimal point in the version number (i.e. 1.1, 2.2, 3.3....) and will not require review and approval prior to re-circulation.

Major and minor revisions will be listed in the Revision History at the front of this document.

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