

NOTE:

The review and subsequent recommendation for the update of AS 3778.4.7 was done in three stages.

The first review compared the current AS 3778.4.7 with ISO 3459:2013

The second review compared ISO 3459:2013 and DIS ISO 3459:2021 (the draft being prepared by ISO at that stage)

The final review compares the DIS ISO 3459:2021 with the FDIS ISO 3459:2021 (the final draft for approval and publication)

All three reviews are included in this pdf below, with the final recommendation first followed by the earlier reviews.

Note that the "minor highlighted changes" referred to in the final recommendation are corrections which were referred to ISO to be addressed.

Comparison of DIS ISO standard 4359-2021 with revised FDIS ISO standard ISO 4359-2021

Updated ISO Standard	ISO 4359-2021	Flow measurement structures — Rectangular, trapezoidal and U-shaped flumes
Updated ISO Standard	ISO 4359-2021	Flow measurement structures — Rectangular, trapezoidal and U-shaped flumes

High-level comment on differences

The updated FDIS ISO Standard is nearly identical to the DIS ISO edition. There were formatting and numbering changes, word smithing and some addition and deletion of descriptive sentences. Need to determine if use of comma for decimals ok for Australian use.

Reviewer recommendation

I recommend that the technical committee

- accept the updated FDIS ISO 4359-2021 in full to replace current AS with minor highlighted changes addressed.

<i>options</i>
<ul style="list-style-type: none">• <i>accept the updated ISO in full to replace current AS (simplest option!)</i>
<ul style="list-style-type: none">• <i>reject the updated ISO and withdraw the current AS (in cases where the update is not appropriate for Australian practice)</i>
<ul style="list-style-type: none">• <i>reject the updated ISO and re-confirm the current AS without change (an alternative option in cases where the update is not appropriate for Australian practice)</i>
<ul style="list-style-type: none">• <i>further work required to adapt the ISO for an updated AS (non-preferred option, exceptional cases only)</i>

Detailed summary of differences

The table below outlines in more detail a summary of the differences between the current Australian Standard under review and the relevant updated ISO standard and includes reviewer comment where relevant.

Column 1: Identifies the number and name of the section in the current Australian Standard

Column 2: Classification of the change for that section. Classified as either:

- **No change (green shading)** – The updated ISO is the same as the current Australian Standard.
- **Minor change (blue shading)** – Changes that have minimal impact on the outcome, including
 - minor format, style or heading changes
 - minor additions, removals or changes to a few words or clauses
 - addition or exclusion of more detailed explanation
 - very minor changes to steps or processes.
- **Significant change (orange shading)** – Changes that have a moderate to major impact on the outcome, such as
 - Changes to requirements
 - Significant changes to calculations, steps or processes.

Column 3: More detail to describe the change, and comment from the reviewer (enough detail for the consideration of AHA and WaMSTeC members in their review).

Text colour is used in this column as follows:

- *Black text* – More detailed explanation of the changes and reviewer comment. **Specific reviewer comment on the changes highlighted in yellow.**
- *Blue text* – reference to information included in the updated ISO that is not in the current Australian Standard
- *Red text* – reference to information included in the current Australian Standard that is not in the updated ISO.

Section (ISO section number)	Classification of change AS to ISO	More detail and comment on changes in the updated ISO
Table of Contents	Minor change	<p>Some changes to the table of contents, including formatting and Foreword is now listed in the table of contents</p> <p>Page numbering has changed – Scope now starting on page 1 vs page 5</p> <p>Heading 9 changed to General formulae (previously equations) for discharge</p> <p>Breakdown of Annex B not listed,</p> <p>Annex D title change</p> <p>Incorporation of Amendment ISO 4359:2013/Amd.1:2017 listed</p>
Foreword	Minor Change	<p>Reordering and rewording of the main changes from DIS and inclusion of : “An acknowledgement has been added that some of the specified tolerances can be difficult to achieve in some installations.</p> <p>The first edition of this document (ISO 4359:1983) had an additional limitation requiring that the gauged head, h, be not more than 2 m. However, there is no technical justification for this restriction, so it does not appear in the second and third editions of this document.</p> <p>In 11.4.7 and 12.4.7, although the relationship of Cs with mHe/be varies very slightly with flume geometry and the value of the boundary layer displacement thickness, this variation was disregarded when applying the coefficient method in the first edition of this document, as a single graphical relationship was provided for trapezoidal flumes. This approximation has been remedied in the second and third editions of this document”</p>
1.0	Minor change	Some word-smithing and Paragraph on field installations removed (moved to section 5.1)
2.0	Minor change	Word-smithing
4.0	Minor change	Symbols tabulated

Section (ISO section number)	Classification of change AS to ISO	More detail and comment on changes in the updated ISO
5.1	Minor change	Typical field installations and additional figures (Figure 2 from section 5.3 and Fig 3 from 6.2.1) inserted to this section
5.3	Significant change	Subheading 5.3 deleted, so the rest of the numbering needs to be fixed (currently jumps from 5.2 to 5.4) There is also minor additional description to DIS version to help understand flumes (vs Weirs)
5.7	Minor change	wordsmithing
5.8 & 5.9	Significant change	Formula 4 states H and Formula 5 states h to the power of 1,5 –consider substituting with 3/2 instead of 1.5/1,5
6.1.2	Minor change	b) changed from the existing velocity distribution to : The acceptable degree of uniformity of the existin gvelocity distributions (see Fig 3)
6.1.7	Significant change	Subheading 6.1.7 deleted – but subsequent numbering does not reflect the deletion
6.1.8	Minor change	Content broken up to highlight compliance requirements as a separate NOTE
6.1.9	Minor change	Stronger language by deletion of ‘reference to’
6.2.2	Minor change	0,5Hmax = 0.5Hmax or 1/2Hmax?
6.2.2.3	Minor change	Addition of - providing that no tolerance with respect to alignment or dimension is required to be less than 0,001m. Which decimal system for the std?, or .lots of , in this section

Section (ISO section number)	Classification of change AS to ISO	More detail and comment on changes in the updated ISO
8.1.1	Minor change	Cameras and radars added to the list
9.2.7	Minor change	Figure 9 moved here from 9.2.9
9.2.11	Minor change	Figure 11 moved here from 9.2.12
9.4.4	Minor change	Table 2 moved here from 9.5
10.2	Minor change	10.2.1 changed to just 10.2
10.6.4	Minor change	Additional sentence at end of paragraph “ During the preparation of this edition, evidence has been presented which indicates that this additional uncertainty does not always apply and that h_{max}/L may be allowed to rise to 1.0”
10.6.5	Minor change	The 10.6.5 from the DIS version has been deleted (The first edition of this International Standard (ISO 4359:1983) required that the gauged head, h , be not more than 2m. However there is no technical justification for this restriction, so it does not apply from the second edition)
11.4.7	Minor change	Deleted “Although this relationship varies very slightly with flume geometry and the value of the boundary layer displacement thickness, this variation was disregarded when applying the coefficient method in the first edition of this international Standard, as a single graphical relationship was provided for trapezoidal flumes.
11.6.3	Minor change	Addition of “An exception may be made for very small flumes” to point a)

Section (ISO section number)	Classification of change AS to ISO	More detail and comment on changes in the updated ISO
11.6.5	Minor change	Deleted DIS 11.6.5 “The first edition of this International Standard (ISO 4359:1983) required that the gauged head, h, be not more than 2m. However, there is no technical justification for this restriction, so it does not apply in the present edition.
12.4.7	Minor change	Deleted DIS sentences: “ Although this relationship varies slightly with flume geometry and the value of boundary layer displacement thickness, this variation was disregarded when applying the coefficient method given in the first edition of this International Standard, as a single graphical relationships was provided to U-throated flumes”
12.4.13	Minor change	Figure 12 included
12.6.6	Minor change	Deleted 12.6.6 (from DIS) “The overall uncertainty of measurement, due to experimentally determined coefficients, the tolerances in the construction of the flume referred to in 6.2.2 and the difficulties in making accurate upstream head measurements, is described in detail in Clauses 13 and 14.”
13.2.7	Minor change	Addition of figure 13 (moved from 13.2.8)
13.3	Minor change	Note changed to : This document expresses the uncertainty of discharge coefficient $u^*(C)$ at around the 68 % level of confidence. This is in accordance with ISO/IEC Guide 98-3. See Annex B for the definitions
14.7.5	Minor change	DIS table 5 = FDIS table 10
Bibliography	Minor change	Deleted ISO 4373 and ISO 25377

Comparison of ISO standard 4359-2013 with revised ISO standard ISO 4359-2021

Updated ISO Standard	ISO 4359-2021	Flow measurement structures — Rectangular, trapezoidal and U-shaped flumes
Updated ISO Standard	ISO 4359-2013	Flow measurement structures — Rectangular, trapezoidal and U-shaped flumes

High-level comment on differences

The updated ISO Standard is near identical to the 2013 ISO edition. The only notable change is the updated equation when calculating percentage uncertainty in the combined coefficient value for rectangular flumes. This resulted in a minor reduction in discharge uncertainty from 3.3% to 2.29%. Details on the formular change can be found in section 14.4 and 14.7. The only other changes we minor formatting, one symbol added, updated in text references to other standards and several lines of text in one paragraph.

Reviewer recommendation

I recommend that the technical committee

- accept the updated ISO 4359-2021 in full to replace current AS.

<i>options</i>
<ul style="list-style-type: none">• <i>accept the updated ISO in full to replace current AS (simplest option!)</i>
<ul style="list-style-type: none">• <i>reject the updated ISO and withdraw the current AS (in cases where the update is not appropriate for Australian practice)</i>
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Detailed summary of differences

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Section (ISO section number)	Classification of change AS to ISO	More detail and comment on changes in the updated ISO
1.0	Minor change	Additional headings added to contents table. Content was included in the previous edition, just not in the content table.
4.0	Minor change	Additional symbol added – $u(E)$ <i>relative datum uncertainty</i>
6.16	Minor change	Additional text in NOTE included in updated revision. Figure 3 moved from 6.2.3.2 to 6.2.1.4
10.2	Minor change	Paragraph changed from 10.2 to 10.2.1 to other changes
12.2	Minor change	Additional two sentences at the end of paragraph stating that supercritical flow is more common in U-throated flumes.
14.4	Minor change	Different formular used in the calculation of percentage uncertainty in the discharge coefficient resulting in reduced uncertainty in the updated ISO
14.7	Minor change	Due to formular change in section 14.4 discharge uncertainty for rectangular flume reduced from 3.3% to 2.29%

Comparison of current Australian Standard with updated ISO standard

Current Australian Standard	AS 3778.4.7	Measurement using flow gauging structures – Rectangular, trapezoidal and U-shaped flumes
Updated ISO Standard	ISO 4359	Flow measurement structures – Rectangular, trapezoidal and U-shaped flumes

High-level comment on differences

There are number differences between the current Australian Standards and the latest ISO, especially on the “Evaluation of Discharge” and “Uncertainty” calculations for each flume type. ISO also published (ISO 4359_2013_Amd_1_2017_20201126_1211) amendment with updated equations that apply to uncertainty calculations that need to be updated in the Australian Standards.

It is difficult to determine if some of the changes were due to the Australian Standards being expanded for our application or if the changes are related to the different ISO versions. There are sections in the Australian Standards that provides more information with regard to the practical application, that I think should remain in our standards. This is in contrast with ISO which normally provide generic recommendation.

The way the Australian Standards are compiled (page layout, appendixes, etc.) also makes it difficult to perform a direct comparison. I think that the ISO should be incorporated in the Australian standards in full, with either a preface or an amendment outlining the AS changes applicable to our application.

Reviewer recommendation

I recommend that the technical committee

- accept the updated ISO in full to replace current AS (**Refer to the high-level comments**)

<i>options</i>
<ul style="list-style-type: none"> • <i>accept the updated ISO in full to replace current AS (simplest option!)</i>
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Section (AS section number)	Classification of change AS to ISO	More detail and comment on changes in the updated ISO
1. Scope and field of application	Minor change	<ul style="list-style-type: none"> • Minor format change and rearrangement of clauses. • The updated ISO provide graphical illustrations of flow conditions, typical field installations, site conditions, rectangular throated flume, trapezoidal throated flume and U-throated flume • The updated ISO clearly indicate the standard is not applicable to “Venturi” flumes.
2. References	Minor Changes	<ul style="list-style-type: none"> • The updated ISO provide statement of application of references associated with the standard. • The updated ISO removed reference to ISO 748 and ISO1438. The two references included in Australian Standards is not applicable to the standard.
3. Definitions and symbols	Significant Changes	<ul style="list-style-type: none"> • The updated ISO made a number of changes to the symbol abbreviations to align with the updated standards.
4. Unit of measurement	Minor Changes	<ul style="list-style-type: none"> • The Australian Standard includes as section on “Units of Measurement” that is not present in the ISO standard.
5. Selection of the type of flume 5.1 5.2 5.3	Minor Changes	<ul style="list-style-type: none"> • The updated ISO (5.1, 5.2 & 5.3) expanded on flume principles with detailed description in conjunction with illustrations and equations. Examples of the different flume types and performance graphs of each flume type is provided in Annexure A. Sections 5.1, 5.2 and 5.3 are allocated for describing flume principles, contrast to AS.
5.4	Minor Changes	<ul style="list-style-type: none"> • The updated ISO (5.4) allocated section 5.4 to rectangular-throated flume, contrast to AS. The description of rectangular-throated flume was further expanded.
	Minor Changes	<ul style="list-style-type: none"> • The updated ISO (5.5) created a new section for trapezoidal-throated flumes. It also provides additional information to prevent sediment accretion

Section (AS section number)	Classification of change AS to ISO	More detail and comment on changes in the updated ISO
	Minor Changes	<ul style="list-style-type: none"> The updated ISO (5.6) created a new section for U-throated flumes. No changes to the content was made
	Minor Changes	<ul style="list-style-type: none"> The updated ISO (5.7, 5.8, 5.9 & 5.10) created new sections outlining simplified form of critical depth flumes theory Provides the basic discharge equation for critical depth flume through equation 1 – 5. Equations for coefficients in equation for critical depth flume is referenced further in the standard
6. Installation 6.1 Selection of site 6.1.1	No change	
6.1.2	Minor Changes	<ul style="list-style-type: none"> The Australian Standard includes sub-sections m) and n) describing aquatic weed and sediment. The NUMBERING of subsections in AS is NOT correct
6.1.3	Minor Changes	<ul style="list-style-type: none"> The Australian Standard provides additional criteria to reject measurement site with respect to upstream velocity distribution. The placement of all formulas, tables and figures at the end of the AS is NOT efficient and makes it very hard to follow the process
	Minor Changes	<ul style="list-style-type: none"> The updated ISO (6.1.4) created a new section outlining process of measurement site selection with respect to uniform velocity distribution.
	Minor Changes	<ul style="list-style-type: none"> The updated ISO (6.1.5) created a new section outlining process of measurement site selection with respect to non-uniform velocity distribution.
	Minor Changes	<ul style="list-style-type: none"> The updated ISO (6.1.6) created a new section outlining the methods for determining the velocity distribution.
	Minor Changes	<ul style="list-style-type: none"> The updated ISO (6.1.7) created a new section providing typical examples of velocity distributions in channels.

Section (AS section number)	Classification of change AS to ISO	More detail and comment on changes in the updated ISO
	Minor Changes	<ul style="list-style-type: none"> The updated ISO (6.1.8) created a new section highlighting the impact of flumes could have fish and other aquatic species.
6.2 Installation Conditions 6.2.1 General Requirements 6.2.1.1	Minor Changes	<ul style="list-style-type: none"> The updated ISO (6.2.1.2) created a separate section for “Installation requirements”.
	Minor Changes	<ul style="list-style-type: none"> The updated ISO (6.2.2) created a new section “Flume Structure” The updated ISO (6.2.2.1, 6.2.2.2, 6.2.2.3 & 6.2.2.4) created 4 new sections outlining construction of flume structures <ul style="list-style-type: none"> 6.2.2.1 Construction 6.2.2.2 Finishing 6.2.2.3 Tolerances 6.2.2.4 Survey
6.2.2 Approach Channel 6.2.2.1	Minor Changes	<ul style="list-style-type: none"> Approach channel section and all subsequent sub sections were moved to new section in the updated ISO (6.2.3). The updated ISO (6.2.3.1) wording varies from the AS. Both standards focuses on velocity distribution, with ISO relates to channel cross section and AS relates to physical or hydraulic features impacting velocity distribution
6.2.2.2 – 6.2.2.7	Minor Changes	<ul style="list-style-type: none"> The updated ISO (6.2.3.2 a-f) describes the general requirements related to approach channel. Contrast to the specific requirements stipulated in sections 6.2.2.2 - 6.2.2.7 in AS
6.3 Flume Structure	Minor Changes	<ul style="list-style-type: none"> Flume Structure section and all subsequent sub sections were moved to new section in the updated ISO (6.2.2). The NUMBERING of subsections in AS is NOT correct

Section (AS section number)	Classification of change AS to ISO	More detail and comment on changes in the updated ISO
6.4 Downstream conditions	Minor Changes	<ul style="list-style-type: none"> Downstream conditions were moved to new section in the updated ISO (6.2.4) The updated ISO (6.2.4.1 & 6.2.4.2) created 2 sections outlining the downstream requirements The updated ISO (6.2.4) wording varies from the AS. Both standards focuses on downstream water level, with ISO relates to design of structure for modular flow conditions and AS relates to physical and hydraulic conditions that could impact the measurement.
7. Maintenance – General requirements	Minor Changes	<ul style="list-style-type: none"> The updated ISO (7.1, 7.2, 7.3 & 7.4) created 4 sections outlining the maintenance requirements. The wording between AS and ISO is similar
8. Measurement of head 8.1 General requirements 8.1.1	Minor Changes	<ul style="list-style-type: none"> The Australian Standard provides reference to the location of the head measurements.
8.1.2	No change	
	Minor Changes	<ul style="list-style-type: none"> The updated ISO (8.2.) created a new section “Location of head measurement”
	Minor Changes	<ul style="list-style-type: none"> The updated ISO (8.2.1, 8.2.2, & 8.2.3) created 3 new sections outlining the location of head measurement related to upstream and tail water level
8.2 Gauge well 8.2.1 – 8.2.7	Minor Changes	<ul style="list-style-type: none"> Gauge well section and all subsequent sub sections were moved to new section in the updated ISO (8.3). The updated ISO (8.3.1 – 8.3.6) describes the general gauge well requirements. Contrast to the specific requirements stipulated in sections 8.2.1 - 8.2.7 in AS. There are sections that are similar, but the AS provide much more detailed requirements.

Section (AS section number)	Classification of change AS to ISO	More detail and comment on changes in the updated ISO
8.3 Zero setting 8.3.1	Minor Changes	<ul style="list-style-type: none"> Zero setting section and all subsequent sub sections were moved to new section in the updated ISO (8.4). The updated ISO (8.4.1) minor word changes
8.3.2	Minor Changes	<ul style="list-style-type: none"> The updated ISO (8.4.2, 8.4.3 & 8.4.4) created three new sections expanding the process of zero checks
9. Determination of discharge 9.1 General equations for discharge 9.1.1	Minor Changes	<ul style="list-style-type: none"> The updated ISO (9.1.1) wording varies from the AS. The updated ISO provides a more in-depth explanation of the theory
9.1.2	Minor Changes	<ul style="list-style-type: none"> The updated ISO (9.1.2) created a separate section for Specific Energy
	Minor Changes	<ul style="list-style-type: none"> The updated ISO (9.1.3) created a separate section for Continuity.
	Minor Changes	<ul style="list-style-type: none"> The updated ISO (9.1.4) created a separate section for Critical Flow.
9.1.3	Minor Changes	<ul style="list-style-type: none"> Section moved to new section in the updated ISO (9.1.5). The updated ISO (9.1.5) wording varies from the AS.
9.1.4	Minor Changes	<ul style="list-style-type: none"> Section moved to new section in the updated ISO (9.1.6). No word changes
9.2 Calculation of discharge from observed head 9.2.1-9.2.4	Significant Changes	<ul style="list-style-type: none"> The Australian Standards provides summary of theoretical process to perform the calculations The updated ISO (9.2.1-9.2.12) provides in depth theory of discharge calculations with associated tables, illustrations and charts. SIGNIFICANT DIFFERENCE IN CONTENT

Section (AS section number)	Classification of change AS to ISO	More detail and comment on changes in the updated ISO
9.3 Calculation of stage-discharge relationship 9.3.1	Minor Changes	<ul style="list-style-type: none"> The updated ISO (9.3.1) minor word changes.
9.3.2	Minor Changes	<ul style="list-style-type: none"> The updated ISO (9.3.2) minor word changes.
	Minor Changes	<ul style="list-style-type: none"> The updated ISO (9.3.3) created a separate section for discussion on the conversion of effective total head to measured gauge head.
9.4 Approach velocity and coefficient of velocity 9.4.1	Minor Changes	<ul style="list-style-type: none"> The updated ISO (9.4.1) minor word changes.
	Minor Changes	<ul style="list-style-type: none"> The updated ISO (9.4.2) created a separate section for discussion on the default value of α.
9.4.2	Minor Changes	<ul style="list-style-type: none"> Section moved to new section in the updated ISO (9.4.3). No word changes
9.4.3	Minor Changes	<ul style="list-style-type: none"> Section moved to new section in the updated ISO (9.4.4). The updated ISO (9.4.4) minor word changes.
9.4.4	Minor Changes	<ul style="list-style-type: none"> Section moved to new section in the updated ISO (9.4.5). No word changes
9.4.5	Minor Changes	<ul style="list-style-type: none"> Section moved to new section in the updated ISO (9.4.6). No word changes
	Minor Changes	<ul style="list-style-type: none"> The updated ISO (9.5.) created a new section “Selection of flume size and shape”

Section (AS section number)	Classification of change AS to ISO	More detail and comment on changes in the updated ISO
10. Rectangular throated flume 10.1 Description 10.1.1	Minor Changes	<ul style="list-style-type: none"> The updated ISO (10.1.1) minor word changes.
10.1.2	No Changes	
10.1.3	No Change	
10.1.4	No Change	
10.1.5	Minor Changes	<ul style="list-style-type: none"> The Australian Standard provides note of requirements of baffle platform.
10.2 Location of head measurement section	Minor Changes	<ul style="list-style-type: none"> The updated ISO (10.2) minor word changes.
10.3 Provision for modular flow 10.3.1	No Change	
10.3.2	Minor Changes	<ul style="list-style-type: none"> The updated ISO (10.3.3) created a separate section for discussion on the installation of flume in an existing channel. No word changes
10.4 Evaluation of discharge 10.4.1 – 10.4.4	Significant Changes	<ul style="list-style-type: none"> The Australian Standards provides summary of theoretical process to evaluate the discharge The updated ISO (10.4.1 – 10.4.13) provides in depth theory of discharge calculations with associated tables, illustrations and charts. The updated ISO provides tabled layout of iterative spreadsheet calculations for determining discharge. SIGNIFICANT DIFFERENCE IN CONTENT

Section (AS section number)	Classification of change AS to ISO	More detail and comment on changes in the updated ISO
10.5 Computation of stage-discharge relationship 10.5.1	Minor Changes	<ul style="list-style-type: none"> The updated ISO (10.5.1) provides a more detailed explanation.
10.5.2	Minor Changes	<ul style="list-style-type: none"> The updated ISO (10.5.2) created a separate section for trapezoidal-throated flume stage discharge relationship.
10.6 Limits of application 10.6.1	No Changes	
10.6.2	Minor Changes	<ul style="list-style-type: none"> The updated ISO (10.6.2) provides a more detailed explanation.
10.6.3	No Changes	
10.6.4	Minor Changes	<ul style="list-style-type: none"> The updated ISO (10.6.4) minor word changes.
	Minor Changes	<ul style="list-style-type: none"> The updated ISO (10.6.5.) created a new section on the maximum head
	Minor Changes	<ul style="list-style-type: none"> The updated ISO (10.6.6.) created a new section on the overall uncertainty, referencing sections 13 and 14
	Significant Changes	<ul style="list-style-type: none"> The updated ISO (10.6.7.) provides an updated equation of the estimation of standard percentage uncertainty of the discharge coefficient $u^*(C)$ in equation 43. This equation is now REPLACED with equation in section 10.6.7 in ISO 4359:2013 / Amd.1:2017

Section (AS section number)	Classification of change AS to ISO	More detail and comment on changes in the updated ISO
10.7 Uncertainty of measurement 10.7.1	Minor Changes	<ul style="list-style-type: none"> The Australian Standard provides information on overall uncertainty of measurement dependence. The updated ISO does not have this section included The same information is provided in the updated ISO (13.1.1)
10.7.2	Significant Change	<ul style="list-style-type: none"> The updated ISO (10.6.7.) provides an updated equation of the estimation of standard percentage uncertainty of the discharge coefficient $u^*(C)$ in equation 43. This equation is now REPLACED with equation in section 10.6.7 in ISO 4359:2013 / Amd.1:2017
10.7.3	Minor Changes	<ul style="list-style-type: none"> The Australian Standard provides information on combining measurement uncertainties. The same information is provided in the updated ISO (13.2)
11 Trapezoidal throated flumes 11.1 Description 11.1.1	Minor Changes	<ul style="list-style-type: none"> The Australian Standard provides reference in standards to design methods to approximate stage-discharge relation.
11.1.2	Minor Changes	<ul style="list-style-type: none"> The updated ISO (10.6.4) minor word changes.
11.1.3 – 11.1.6	No Changes	
11.2 Location of head measurement section	Minor Changes	<ul style="list-style-type: none"> The updated ISO (10.2) minor word changes.
11.3 Provision for modular flow 11.3.1 – 11.3.4	No Changes	

Section (AS section number)	Classification of change AS to ISO	More detail and comment on changes in the updated ISO
11.4 Evaluation of discharge 11.4.1 – 11.4.7	Significant Change	<ul style="list-style-type: none"> The Australian Standards provides summary of theoretical process to evaluate the discharge The updated ISO (11.4.1 – 11.4.13) provides in depth theory of discharge calculations with associated tables, illustrations and charts. The updated ISO provides tabled layout of iterative spreadsheet calculations for determining discharge. SIGNIFICANT DIFFERENCE IN CONTENT
11.5 Computation of stage-discharge relationship	Minor Changes	<ul style="list-style-type: none"> The updated ISO (11.5.1.) created a new section providing general discussion on calculating stage-discharge relationship
	Minor Changes	<ul style="list-style-type: none"> The updated ISO (11.5.2.) created a new section providing discussion on boundary layer treatment
11.5.1	Significant Change	<ul style="list-style-type: none"> Section moved to new section in the updated ISO (11.5.3). The updated ISO (11.5.3) provide updated process, equations and variable abbreviations.
11.5.2	Significant Change	<ul style="list-style-type: none"> The updated ISO (11.5.3) provide updated process, equations and variable abbreviations.
11.5.3	Minor Changes	<ul style="list-style-type: none"> The updated ISO (11.5.4) provide a more condensed outline of the process
11.5.4	Minor Change	<ul style="list-style-type: none"> The updated ISO (11.5.5) minor word changes. The updated ISO (11.5.6) created a separate section for calculating cross sectional area of approach channel
11.5.5	Minor Change	<ul style="list-style-type: none"> The updated ISO (11.5.7) provide a more condensed outline of the process

Section (AS section number)	Classification of change AS to ISO	More detail and comment on changes in the updated ISO
11.5.6	Minor Change	<ul style="list-style-type: none"> The updated ISO (11.5.8) provide a broader discussion on the development of rating curves and the use of spreadsheet for calculations.
	Significant Change	<ul style="list-style-type: none"> The updated ISO (11.5.9) provide tabled layout of iterative spreadsheet calculations for determining discharge
11.6 Graphical approach to design	Significant Change	<ul style="list-style-type: none"> The Australian Standard provides detailed process of using graphical approach for design. The updated ISO does not have this section included SIGNIFICANT DIFFERENCE IN CONTENT
11.7 Limits of Application 11.7.1	Minor Changes	<ul style="list-style-type: none"> Section moved to new section in the updated ISO (11.6.1). No word changes
11.7.2	Minor Changes	<ul style="list-style-type: none"> Section moved to new section in the updated ISO (11.6.4). The updated ISO (11.6.4) minor word changes.
11.7.3	Minor Changes	<ul style="list-style-type: none"> Section moved to new section in the updated ISO (11.6.2). The updated ISO (11.6.2) minor word changes.
11.7.4	Minor Changes	<ul style="list-style-type: none"> The Australian Standard provides additional criteria for Froude number when coarse sediment deposited in approach channel
11.7.5	Minor Changes	<ul style="list-style-type: none"> Section moved to new section in the updated ISO (11.6.3). The updated ISO (11.6.3) minor word changes.
	Minor Changes	<ul style="list-style-type: none"> The updated ISO (11.6.5.) created a new section on the maximum head
	Minor Changes	<ul style="list-style-type: none"> The updated ISO (11.6.6.) created a new section on the overall uncertainty, referencing sections 13 and 14

Section (AS section number)	Classification of change AS to ISO	More detail and comment on changes in the updated ISO
	Significant Changes	<ul style="list-style-type: none"> The updated ISO (11.6.7.) provides an updated equation of the estimation of standard percentage uncertainty of the discharge coefficient $u^*(C)$ in equation 58. This equation is now REPLACED with equation in section 11.6.7 in ISO 4359:2013 / Amd.1:2017
11.8 Uncertainty of measurement 11.8.1	Minor Changes	<ul style="list-style-type: none"> The Australian Standard provides information on overall uncertainty of measurement dependence. The updated ISO does not have this section included The same information is provided in the updated ISO (13.1.1)
11.8.2	Significant Change	<ul style="list-style-type: none"> The updated ISO (11.6.7.) provides an updated equation of the estimation of standard percentage uncertainty of the discharge coefficient $u^*(C)$ in equation 58. This equation is now REPLACED with equation in section 11.6.7 in ISO 4359:2013 / Amd.1:2017
11.8.3	Minor Changes	<ul style="list-style-type: none"> The Australian Standard provides information on combining measurement uncertainties. The same information is provided in the updated ISO (13.2)
12. U-throated (round-bottomed) flumes 12.1 Description 12.1.1	Minor Changes	<ul style="list-style-type: none"> The updated ISO (12.1.1) minor word changes.
12.1.2 - 12.1.5	No Changes	
12.2 Location of head measurement section	No Changes	
12.3 Provision for modular flow 12.3.1 – 12.3.4	No Changes	

Section (AS section number)	Classification of change AS to ISO	More detail and comment on changes in the updated ISO
12.4 Evaluation of Discharge 12.4.1 – 12.4.9	Significant Changes	<ul style="list-style-type: none"> The Australian Standards provides summary of theoretical process to evaluate the discharge The updated ISO (12.4.1 – 11.4.13) provides in depth theory of discharge calculations with associated tables, illustrations and charts. The updated ISO provides tabled layout of iterative spreadsheet calculations for determining discharge. SIGNIFICANT DIFFERENCE IN CONTENT
12.5 Computation of stage-discharge relationship	Minor Changes	<ul style="list-style-type: none"> The updated ISO (12.5.1.) created a new section providing general discussion on calculating stage-discharge relationship
	Minor Changes	<ul style="list-style-type: none"> The updated ISO (12.5.2.) created a new section providing discussion on boundary layer treatment
12.5.1	Significant Change	<ul style="list-style-type: none"> Section moved to new section in the updated ISO (12.5.3). The updated ISO (12.5.3) provide updated process, equations and variable abbreviations.
12.5.2	Significant Change	<ul style="list-style-type: none"> Section moved to new section in the updated ISO (12.5.3). The updated ISO (12.5.3) provide updated process, equations and variable abbreviations.
12.5.3	Significant Change	<ul style="list-style-type: none"> Section moved to new section in the updated ISO (12.5.3). The updated ISO (12.5.3) provide updated process, equations and variable abbreviations.
12.5.4	Significant Change	<ul style="list-style-type: none"> Section moved to new section in the updated ISO (12.5.3). The updated ISO (12.5.3) provide updated process, equations and variable abbreviations.
12.5.5	Minor Changes	<ul style="list-style-type: none"> The updated ISO (12.5.4) provide a more condensed outline of the process

Section (AS section number)	Classification of change AS to ISO	More detail and comment on changes in the updated ISO
12.5.6	Minor Changes	<ul style="list-style-type: none"> The updated ISO (12.5.5) minor word changes. The updated ISO (12.5.6) created a separate section for calculating cross sectional area of approach channel
12.5.7	Minor Changes	<ul style="list-style-type: none"> The updated ISO (12.5.7) provide a more condensed outline of the process
12.5.8	Minor Change	<ul style="list-style-type: none"> The updated ISO (12.5.8) provide a broader discussion on the development of rating curves and the use of spreadsheet for calculations.
12.5.9	Significant Change	<ul style="list-style-type: none"> The updated ISO (12.5.9) provide tabled layout of iterative spreadsheet calculations for determining discharge
12.6 Limits of Application 12.6.1	No Change	
12.6.2	Minor Changes	<ul style="list-style-type: none"> Section moved to new section in the updated ISO (12.6.5). The updated ISO (12.6.5) minor word changes.
12.6.3	Minor Changes	<ul style="list-style-type: none"> Section moved to new section in the updated ISO (12.6.2). The updated ISO (12.6.2) minor word changes.
12.6.4	Minor Changes	<ul style="list-style-type: none"> Section moved to new section in the updated ISO (12.6.3). The updated ISO (12.6.3) minor word changes.
12.6.5	Minor Changes	<ul style="list-style-type: none"> Section moved to new section in the updated ISO (12.6.4). The updated ISO (12.6.4) minor word changes.
	Minor Changes	<ul style="list-style-type: none"> The updated ISO (12.6.6.) created a new section on the maximum head
	Minor Changes	<ul style="list-style-type: none"> The updated ISO (12.6.7.) created a new section on the overall uncertainty, referencing sections 13 and 14

Section (AS section number)	Classification of change AS to ISO	More detail and comment on changes in the updated ISO
	Significant Changes	<ul style="list-style-type: none"> The updated ISO (12.6.8.) provides an updated equation of the estimation of standard percentage uncertainty of the discharge coefficient $u^*(C)$ in equation 77. This equation is now REPLACED with equation in section 12.6.8 in ISO 4359:2013 / Amd.1:2017
12.7 Uncertainty of measurement 12.7.1	Minor Changes	<ul style="list-style-type: none"> The Australian Standard provides information on overall uncertainty of measurement dependence. The updated ISO does not have this section included The same information is provided in the updated ISO (13.1.1)
12.7.2	Significant Change	<ul style="list-style-type: none"> The updated ISO (12.6.8.) provides an updated equation of the estimation of standard percentage uncertainty of the discharge coefficient $u^*(C)$ in equation 77. This equation is now REPLACED with equation in section 12.6.8 in ISO 4359:2013 / Amd.1:2017
12.7.3	Minor Changes	<ul style="list-style-type: none"> The Australian Standard provides information on combining measurement uncertainties. The same information is provided in the updated ISO (13.2)
13 Errors in flow measurements General	Significant Change	<ul style="list-style-type: none"> The updated ISO (13) provides in depth theory on uncertainty of flow measurement SIGNIFICANT DIFFERENCE IN CONTENT
	Significant Change	<ul style="list-style-type: none"> The updated ISO (14) provides example of uncertainty calculations measurement SIGNIFICANT DIFFERENCE IN CONTENT
Annexures	Significant Change	<ul style="list-style-type: none"> The Australian Standards and updated ISO Annexures does not compare. SIGNIFICANT DIFFERENCE IN CONTENT