Toitū Te Whenua
Land Information New Zealand

Proposed Amendments to the Utility Location Standard

Increasing vertical accuracy requirements to support as-builts

Consultation Document

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Office of the Surveyor-General

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Te Kāwanatanga o Aotearoa
New Zealand Government

Reference documents

Location	Description
https://www.linz.govt.nz/sites/default/files/doc/2022 Utility Location Standard.pdf	The Utility Location Standard (ULS) – LINZ OP S 01287
https://www.linz.govt.nz/sites/default/files/2022-07/Decision Report following consultation on draft standard.pdf	Decision Report – following consultation on the draft standard (1 June 2022)

Authority and regulatory attributes

Authority	Under section 7(1)(b) of the Cadastral Survey Act 2002, the Surveyor-General has the function and duty to maintain a national survey control system. This is defined in the Act as a system used to determine the position of points, features, and boundaries in cadastral surveys, other surveys, and land information systems. The Utility Location Standard enables the location and positional accuracy of utility assets to be defined. The Surveyor-General has no power to require compliance with the Utility Location Standard.

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Foreword

The Utility Location Standard (ULS) provides a specification for recording the position of utility assets, including the accuracy requirements.

Since the Standard was published in 2022, feedback from some utility owners has indicated that enhancements are needed to enable wide adoption.

This document proposes to amend the Standard to include a higher accuracy requirement for invert levels.

I believe that there would be significant benefits to all parties from a consistent single standard that can be applied throughout the country.

Therefore it is important that the Standard meets the needs of utility owners and asset managers and can also be pragmatically applied by those using it on-site for survey following installation, maintenance and repair.

Please let me know whether you would support the adoption of the ULS if it were enhanced as proposed here. I am also interested in hearing whether councils would be prepared to refer to it as part of their as-built requirements, rather than specifying their own accuracy standards.

Thank you for taking the time to review this document.

I look forward to your feedback.

Anselm Haanen
Surveyor-General / Kairūri Matua

Consultation

The Surveyor-General is seeking feedback from councils and industry on this proposal to amend the Utility Location Standard (ULS).

We are particularly interested to hear feedback about the proposed accuracy tolerances, and whether councils would be prepared to use the amended ULS as part of a local as-built standard.

You can provide written feedback by emailing: utilitylocation@linz.govt.nz

It would be helpful if your submission:

- refers to the section number in this document where possible
- includes the reason behind your comments, possibly by citing an example.

Feedback is due by Monday 30 September 2024.

Confidentiality

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Enquiries and submissions: utilitylocation@linz.govt.nz

1 Introduction

This section provides a brief background to the development of the Utility Location Standard (ULS) and discusses the feedback that prompted us to propose amendments to the standard.

1.1 The Utility Location Standard

We developed the ULS for defining the location and positional accuracy of utility assets. It is intended to provide consistency and confidence in the positional information of assets to enable them to be located in future, and to inform planning of new infrastructure.

The standard requires positions to be defined in three dimensions, using the New Zealand Transverse Mercator 2000 (NZTM2000) projection and New Zealand Vertical Datum 2016 (NZVD2016).

It also specifies accuracy classes and includes a requirement to record the date of the survey.

The ULS is intended to be used by contractors, surveyors, engineers, and others who undertake the actual survey and measurement of the assets. A utility owner or asset manager can specify that the standard must be used when recording the location of new or maintained assets (in contracts for example).

The ULS was published in June 2022 following feedback on a draft version.

1.2 Feedback since the ULS was published

Some organisations have been reluctant to adopt the standard due to concerns that the ULS does not meet all their requirements, and some consider the standard is not needed when they already have their own as-built standards.

We have consequently talked to both asset managers who receive and manage data, and the surveyors who supply the data to the asset managers.

Common themes have emerged:

- Some territorial authorities have told us that invert levels (for drainage assets) should be highly accurate to reliably verify the assets will perform as designed – especially at shallow grades.
- Some surveyors have told us that some territorial authorities are specifying unnecessarily high accuracies for drainage assets (in their as-built standards), requiring excessive effort and expense to achieve those accuracies.

While the ULS was designed primarily for recording the positions of utility assets, we are now proposing enhancements to support as-built requirements. In this proposal, the focus is on the increased accuracy requirement for vertical levels on key assets – such as drainage pipe invert levels in urban areas.

1.3 Council as-built requirements

Council standards for as-builts are highly variable around the country.

Several councils require invert levels to be certified to ± 0.01 m. Surveyors have indicated that this is often unnecessary and can be costly to achieve.

We also see some councils and various organisations specifying invert level accuracies at ± 0.02 m, or higher.

We have not been able to find any robust assessment for determining the accuracy requirements for invert levels.

While we acknowledge that different regions may have geographical factors that influence the accuracy standards (Christchurch is relatively flat for example), we believe a single national standard should be available that accommodates these factors and supports a more consistent approach.

2 Proposal

We propose to extend the scope of the ULS to meet the more specific information requirements for as-builts.

From the limited feedback received since the ULS was published, we have concluded that the requirements in the ULS are sufficient for the horizontal positioning of assets. However, the accuracy of the invert levels associated with gravity drainage pipes/channels is a key concern for some.

Accordingly, we are proposing that the vertical accuracy requirements for these invert levels should be tighter.

2.1 Accuracy – finding the right balance

Competing concerns must be balanced when setting the accuracy level:

- If accuracy is set too high, the required survey methods to achieve the specified accuracy may incur unreasonable costs.
- If accuracy is set too low, then the data may not be fit-for-purpose, which can lead to undesirable outcomes.

Our goal is to strike the right balance so that surveyed as-built data is measured and recorded efficiently without incurring unnecessary time and cost, and the surveyed data is fit-for-purpose.

2.2 Proposed changes to the vertical accuracy requirements

This section outlines the proposal to change how the vertical accuracy is specified.

2.2.1 Vertical accuracy of invert levels relative to an origin mark

We propose that high accuracy levels be defined in terms of an origin mark. An origin mark can be thought of as the 'origin of levels' – a term that is well-known to surveyors. An 'origin of levels' usually serves as a permanent reference point and is often a single existing survey mark with a known height.

This is what we consider some councils intend when they require levels to be referenced to the 'circuit' or in terms of a 'benchmark'.

An origin mark would assist future users of the information. For example, a future surveyor may use the same 'origin of levels' to maintain the relative accuracy between surveys undertaken at different times. Using an origin mark assists with checking or audit processes and may make it easier to identify any anomalies.

The origin mark should be a nearby Vertical Control Mark (VCM). Such marks are maintained by Toitū Te Whenua Land Information New Zealand (LINZ) for longevity and help verify the connection to the vertical datum.

A VCM is a survey mark that has been assigned a height in terms of NZVD2016 with a Landonline order of 3V[1] or better. Such marks can be found on the LINZ Geodetic Database.[2] The LINZ web page titled 'Obtaining New Zealand Vertical Datum 2016 (NZVD2016) Heights' provides further information on the availability of NZVD2016 heighted marks.[3]

Where a VCM is not available near the site, the asset owner may require the establishment of a new reference mark and require it to be given a level in terms of the survey control network. This is a requirement that could be included within a local as-built standard (such as a council as-built standard). We do not propose to include this as a requirement within the ULS itself.

The current Class V1 vertical accuracy specification is set at 0.05 m relative to the 'nearby survey control network', where vertical control marks in that network are required to be NZVD2016 Order 3V or better.

The Decision Report[4] (following the consultation on the draft ULS) notes that the specifications for the third order vertical control network are set at an accuracy of about 0.04 m over the expected distances.[5] Accordingly, a determination of a level from two different 3V control marks may not be sufficiently accurate to achieve the required vertical relative accuracy between 'connected' invert levels (such as those linked by a pipe or channel).

Requiring all Class V1 levels to be in terms of a single origin mark will enable more consistent vertical accuracies to be achieved for invert levels, compared to the current requirement.

[1] Landonline orders are defined in LINZS25006: Standard for tiers, classes, and orders of LINZ data.

[2] Web page: https://www.geodesy.linz.govt.nz/gdb/. LINZ is currently working on improvements to the Geodetic Database to more easily identify marks with NZVD2016 heights.

[3] Web page: https://www.linz.govt.nz/guidance/geodetic-system/coordinate-systems-used-new-zealand/vertical-datums/new-zealand-vertical-datum-2016-nzvd2016/obtaining-new-zealand-vertical-datum-2016-nzvd2016-heights.

[4] The Decision Report is referenced on page 2 under 'Reference documents'.

[5] Decision Report section: 'Vertical Accuracy' (pages 4 & 5).

To specify the higher accuracy, **we are proposing one accuracy for the invert levels in relation to the origin mark; and another accuracy between invert levels on the same feature.**

This new specification would replace the current Class V1 vertical accuracy standard.

Vertical Class V1 currently applies to 'Assets with invert levels in urban areas'.[6] **It is proposed to change this to 'Invert levels of gravity drainage assets in urban areas'**. This means that only the invert levels for gravity drainage assets are proposed to be included in vertical class V1 (and excludes other levels such as lid levels).

No changes are proposed to vertical classes V2 and V3, or to horizontal classes H1 and H2.

The specified vertical accuracy tolerances for vertical classes V2 (0.10 m) and V3 (0.30 m) are intended to be sufficient to enable assets to be confidently located in the future. By retaining the V2 and V3 vertical accuracy tolerances, relative to the 'nearby survey control network', these levels can be determined using GNSS[7] techniques.

However, to achieve the higher vertical accuracies required for 'Invert levels of gravity drainage assets in urban areas', a single 'reference mark' must be close to the site for use as an origin mark.

2.2.2 Proposed accuracy requirements

Two vertical accuracy requirements are specified, as described in Table 1:

Table 1: ULS Class V1 vertical accuracy

Requirement	Description	Tolerance
1) **Vertical accuracy of invert levels relative to the nearby origin mark**	The accuracy standard applies between each gravity drainage invert level and the origin mark.	± 0.03 m
2) **Vertical accuracy of invert levels relative to other connected invert levels.**	Two invert levels are considered 'connected' when they are both recorded within the same survey and are located on the same gravity drainage pipe/channel.	± 0.01 m

[6] As specified in section 4.5 of the ULS.

[7] Global Navigation Satellite System, such as GPS.

Both requirements apply for the Class V1 vertical accuracy standard.

All accuracy tolerances are at the 95% confidence level.

The proposed Class V1 level of accuracy is unlikely to be consistently achieved using typical real-time GNSS techniques.

The vertical accuracy of invert levels would apply to 'features' such as stormwater or wastewater drainage pipes where inverts are surveyed. Such features could be specified in the ULS where the accuracy requirement is universal, while utility owners could specify other features they require to meet the higher Class V1 vertical accuracy requirement.

The first accuracy requirement is set at a looser tolerance than the second because it:

- is not critical to the flows in the pipe or channel
- recognises that the origin mark may be at some distance from the site and the accurate transfer of heights is therefore potentially more difficult and costly to achieve.

The second (tighter) accuracy requirement between 'connected' invert levels is intended to meet the need for added confidence in the surveyed invert levels on pipes and channels, where the gradient is critical to achieving flow volumes and velocities. The common example is the surveyed levels at the inlet invert and outlet invert on a length of pipe.

2.2.3 Why these tolerances?

Historically, it appears that some tolerances for invert levels were set at ±0.01 m simply because that was the resolution of the measurement 'to the nearest centimetre'.

Physically, 10 mm is a very small dimension, especially when associated with field construction works and physically large assets.

The primary accuracy needs and risks relate to confidence that the designed flow velocities and volumes can be achieved. These needs and risks relate expressly to a length of pipe or channel noting that there can also be significant falls (or drops) between the outlet and any inlet at a manhole.

The accuracy of invert levels in relation to other features in the asset network can be to a lower standard sufficient to support overall design and planning. For any future development, it is usually necessary to re-survey the existing infrastructure to confirm and verify the relevant levels, rather than relying on the recorded levels.

Question 1: Are the proposed tolerances fit-for-purpose?

2.2.4 Data to be recorded

For both options, the origin mark's name, its reduced level and source, and the date must be included with the as-built data.

2.3 A national standard

The ULS is intended to be a single national standard, regardless of the council, district or geographical region. It is intended to be specified or referenced to enable a consistent approach and uniform standard of accuracy when surveying and recording positional asset information.

This proposal seeks to enhance the ULS so it can be more widely adopted across the country. A consistent nationwide approach will achieve certainty and efficiencies for surveyors, other suppliers, and users of the data.

> **Question 2 – for territorial authorities: If the ULS is amended as proposed, would your council be prepared to refer to it as part of council's as-built requirements?**