NZVD2016 Transformation Methodology Report

Version 1
August 2025

ECM 9583379

Te Kaunihera-ā-Rohe o Ngāmotu
New Plymouth District Council

Contents

Executive Summary

This report is intended to explain the transformation methodology undertaken by Council in converting from Taranaki 1970 (TNK70) to New Zealand Vertical Datum 2016 (NZVD2016) which occurred on 1 August 2025. Context for drivers for the transition and considerations given is also provided.

"The New Zealand Vertical Datum 2016 (NZVD2016) was introduced to replace the various local height datums (LVD) used throughout the country. It enables the consistent collection and seamless exchange of heights across New Zealand. Older datums are still in use in some areas but their reliability is uncertain and Toitū Te Whenua strongly advises switching to NZVD2016." - Land Information New Zealand (LINZ)

Reduced level (RL) values are used to measure vertical distance between a surveyed point and a datum surface. This is commonly referred to the as elevation above mean sea level. Up until 1 August 2025, NPDC had collected and recorded RL's using the TNK70 local vertical datum (LVD). There was a desire from LINZ as well as our local surveying and development communities that NPDC should collect and record in NZVD2016.

Results

- Identification, transformation and updating of existing datasets completed resulting in 33,119 asset records converted.
- New contours were published in NZVD2016 using Digital Elevation Model (DEM) from 2021 LiDAR capture project.
- Metadata and documentation updated to reference NZVD2016 (or TNK70 where data not yet converted)
- Internal and external engagement with stakeholders completed to educate on new datum requirements. Including Development Engineers on relevant consent conditions to clarify NPDC's expectation until revision of our Planning and Infrastructure Standard can be complete.
- Notice of NPDC adopting the NZVD2016 datum publicly available on the website: Height Standard Changed to NZVD2016

Background

NZVD2016 was released by LINZ to replace Local Vertical Datums (LVD) including TNK70. There is a push from LINZ and the surveying industry to adopt NZVD2016 for accurate and consistent reporting of RL's across the country.

"Continuing to use an LVD has significant disadvantages. For instance, there are limited LVD benchmarks available, mostly situated on state highways and the centre of towns and cities. The benchmark networks established by Toitū Te Whenua have not been maintained since installation, which occurred mainly from 1960 to 1980" – LINZ

As of 1 July 2024, cadastral survey rules were amended to mandate the use of NZVD2016. Although this did not directly impact NPDC's record requirements, it reinforced that the geospatial industry has moved on from LVD.

NPDC's transition from TNK70 to NZVD2016 occurred on 1 August 2025 to ensure upcoming project summer works can be scoped according to the updated datum requirements. Engagement with relevant partners, consultants and stakeholders was identified and communicated early to reduce ambiguity. It is understood that there will be a transition period where NPDC may receive RL's in both datums and internal processes are in place to ensure ongoing reliable datum information.

For several years there has been an assumption that surveyors were capturing RLs in NZVD2016 and converting to TNK70 to meet NPDCs requirements. Moving to NZVD2016 ensures deliverables meet national standards and reduce the likelihood of unintended errors when translating to the region's datum.

Abbreviations for Taranaki 1970 datum also include TARA1970 and TARAHT1970. These have previously been used in NPDC and LINZ documentation.

Purpose

This report provides the transformation methodology undertaken by Council in converting from TNK70 to NZVD2016 and gives context for the transition, with considerations given.

Benefits

Improved data requirements:

- Moving to NZVD2016 simplifies spatial data deliverables from developers and surveyors who operate across New Zealand, standardising source data.

Consistent public data across New Zealand:

- Reliable and consistent public data across New Zealand allows for ease of comparison to levels in other circuits / regions. National datasets are easily collated for Tsunami modelling, catchment and watershed analysis for example.

Risks

The following were considered prior to updates of the historical spatial records with mitigating factors put in place to reduce their risk.

Risk	Mitigation
NPDC has recorded in TNK70 for several decades. Regular stakeholders are used to providing and receiving data in TNK70.	Communication of the project and impacts with stakeholders, consultants and surveyor communities with feedback welcomed.
Elevation values between TNK70 and NZVD2016 are similar	Communication of the project and impacts with stakeholders, consultants and surveyor communities with feedback welcomed.
Conversion to NZVD2016 has the potential to introduce errors into our RL datasets, reducing effectiveness of outputs such as stormwater modelling.	Comparison of different conversion options. Bulk update ensuring all records converted. Retaining original RLs and conversion factors on each record as a note.
RL's recorded on old drawings cannot be directly transferred to the new standardised spatial dataset.	Education and workshops held with internal data teams, providing tools and training for ad-hoc translations from TKN70 to NZVD2016 should historical information be discovered.

Scope and Limitations

- Only authoritative NPDC datasets (see appendix 2) were transformed on 1 August 2025. Information recorded in documentation, drawings or memos will not be converted as part of this exercise.
- Disposed asset records were not converted as their asset records are read-only. This includes approximately 1200 assets records abandoned in situ before 1 August 2025. These assets may still display in Councils GIS products for BeforeUDig purposes.

- NPDC survey benchmarks recorded in a User Defined Table (UDT) within Asset & Work Manager (aka RAMM) were considered out of scope. Field alias updated to TNK70 for clarity. Work is required to identify current use and future requirements.

Methodology

Contour generation

NPDC generated a new set of contours using the NZVD2016 DEM delivered as part of the 2021 LiDAR project. The existing contour datasets (captures ranging 2007-2019) were not converted and remain in TNK70 for historical reference.

Technical approach and tools used

Contours were generated using ArcGIS Pro with the following methodology.

1) Add the 1m DEM for the New Plymouth District from the 2021 LiDAR capture.
2) Create a 10km vector grid of the New Plymouth District covering the total area of the DEM.
3) Run the Split Raster Geoprocessing tool using the DEM as the input raster and the 10km vector grid to divide the raster.
4) Run the Contour Geoprocessing tool for each of the DEM rasters created in Step 3 with a contour interval of 0.5m specified in the tool.
5) For each set of contours run the Generalize Geoprocessing tool with a 0.2m tolerance to reduce the number of vertices in the contour lines.
6) Using the Append Geoprocessing tool combines all the contours into a single 0.5m contour file for the district.
7) Manually defined a set of polygons derived from the previous 0.5m contour extent from 2019 to determine areas that would be made available at 0.5m, 2m and 10m resolutions (see appendix 1).
8) Using the Split Geoprocessing tool to divide the Contour data by the polygons defined in Step 7.
9) Use Select by attribute and the contour elevations, removed unnecessary intervals for areas that don't require a high contour resolution. High density urban and peri-urban areas are kept at 0.5m contour intervals. Lower density rural areas are kept at 2m contour intervals. And very low-density rural areas are kept at 10m contour intervals.
10) Run the Dissolve Geoprocessing tool to combine all contour datasets with different contour intervals into a single dataset.
11) Run the Create Vector Tile Index tool to generate an index of the contour dataset to be used in creating a Vector Tile Layer.
12) Run the Create Vector Tile Package and published to the NPDC ArcGIS Enterprise Portals to make the contours available to NPDC staff and the Community.

Testing and validation procedures

- Compared the NZVD2016 contours generated with the process above to the 2019 0.5m contours provided by Land Pro.
- Spot check comparisons between the output contours and the original 1m DEM.

Asset Data Transformation

ArcGIS Pro was used to create the intermediate raster's and FME to read RLs from the asset data and bulk import files created for uploading.

Options Analysis

The following three methods to translate the data from TNK70 to NZVD2016 were considered:

1) Convert using LINZ vertical datum relationship grids (resampled to a 1m cell size)
2) Convert using LINZ online conversion tool
3) Convert using the conversion factor between the 1m DEM datasets TNK70 and NZVD2016

Option 3 was deemed inappropriate as a variation of up to 10mm was identified when comparing to the LINZ conversion tools. Review of the LiDAR report metadata states TNK70 DEM was converting using LINZ CONCORD tools. The reason for this variation was not available.

Option 1, converting using LINZ vertical datum relationship grids was deemed the best method as it resulted in sub-millimetre differences in returns when compared with the results from LINZ online conversion tools. This was preferred over option 2 as the conversion was built directly into the FME workbench allowing for contained analysis, reducing the likelihood for human error during the final update on 1 August. Future conversions can be done using the LINZ online conversion tool that will output near-identical values.

Comparison of sample points between point grid and LINZ tool conversion options:

Sample RL count	Average difference (mm)	Min difference (mm)	Max difference (mm)
6,748	0.03	-0.89	0.95

Technical approach and tools used

1) Download Taranaki 1970 to NZVD2016 conversion raster from LINZ data service
2) Using ArcGIS Pro
    a. Use the ArcGIS Pro Resample Geoprocessing tool to resample the LINZ conversion raster to a cell size of 1m using bilinear interpolation.
3) Identify asset attributes that hold RL values (see appendix 2)
4) Using FME
    a. Read asset data that hold RL attributes
    b. Convert each RL value (H_A) to its own XY point in NZTM with identifying attributes
        i. RL held as attribute, not Z value
        ii. Polylines (e.g. pipes) had their start and end vertex extracted and were used to assign a XY point for Upstream and Downstream RL's respectively.
    c. Intersect cell (nearest neighbour) the point and raster to extract the conversion value (o_A)
    d. Calculate NZVD2016 value using $H_{NZVD} = H_A - o_A$
    e. Recompile NZVD2016 RL point features back into asset record for bulk import into the asset system
    f. Generate a conversion note from each asset record for bulk import into asset system (see appendix 3 for details)

5) Update asset system using bulk import sheets

Testing and validation procedures

- Checks were done on each of the asset types to makes sure each attribute and notes were applied correctly.
- Sample assets were manually loaded and checked in LINZ online conversion tool and checked to be within the above tolerances.
- Bulk import logs confirmed that importing was successful.

Results

33,119 asset records were updated. 43,528 RL values updated.
Each asset record includes a note with conversion factors used. This can be used to validate the RL value converted as part of this process (see appendix 3 for example note).

References

LINZ Computation of the vertical datum relationship grids for NZVD2016
https://www.linz.govt.nz/guidance/geodetic-system/understanding-coordinate-conversions/height-datum-conversions/vertical-datum-relationship-grids/computation-vertical-datum-relationship-grids-nzvd2016

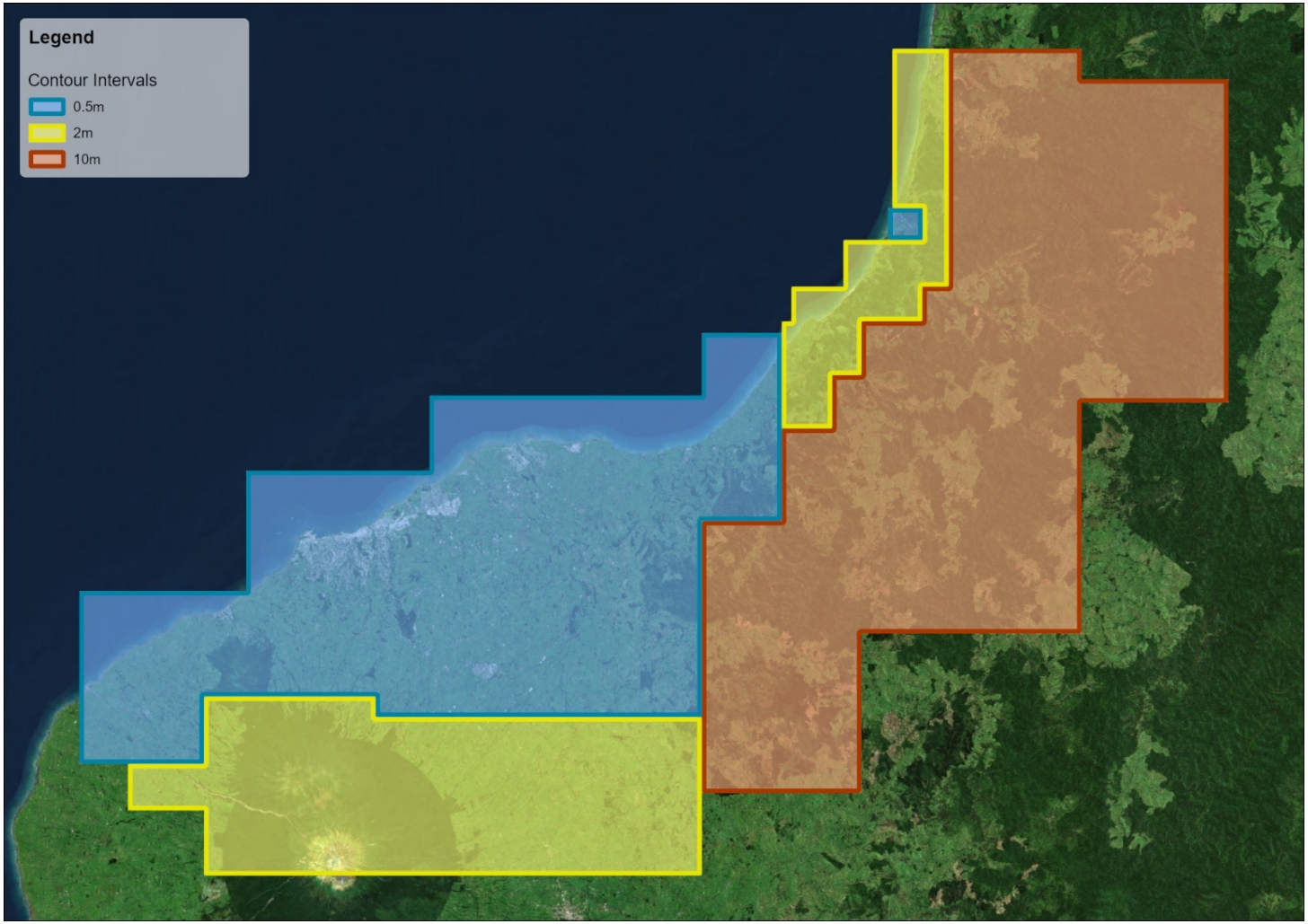
LINZ Data Service – TARA1970 to NZVD2016 conversion (raster)
https://data.linz.govt.nz/layer/103963-taranaki-1970-to-nzvd2016-conversion-raster/

Auckland Council NZVD2016 Datum Change Impact Assessment – Technical Report
Submitted by Lynker Analytics for Auckland Council, November 2022
https://at.govt.nz/media/wkpnsxvs/auckland-transport-nzvd2016-change-assessment-report-pdf.pdf

NPDC Internal Reference
ECM 9583379

Appendices

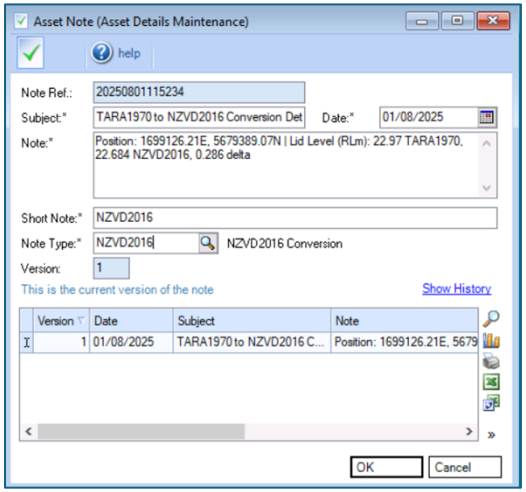
Appendix 1 – Contour Interval Areas



Appendix 2 – Asset Type attribute mapping table

	TechOne Caption								
Asset Type	**D/St Elevation (RLm)**	**Ground Level (RLm)**	**Invert Elevation**	**Lid Level**	**Lid Level (RLm)**	**Overflow Elev (RLm)**	**U/St Elevation (RLm)**	**Wet Well Elev (RLm)**	**Grand Total**
Complex Infrastructure Assets\Wastewater Complex Assets\Wastewater Pump Station						1		1	2
Infrastructure Assets\Civil\Inlet				6,707					6,707
Infrastructure Assets\Civil\Manhole					10,343				10,343
Infrastructure Assets\Civil\Open Channel (Man Made)	1						2		3
Infrastructure Assets\Civil\Pipe\Reticulation	13,905						11,967		25,872
Infrastructure Assets\Civil\Pipe\Service		533							533
Infrastructure Assets\Mechanical\Valve			56						56
Infrastructure Assets\Natural\Water Body\Stream	6						6		12
Grand Total	**13,912**	**533**	**56**	**6,707**	**10,343**	**1**	**11,975**	**1**	**43,528**

Appendix 3 - TechOne EAM NZVD2016 conversion note example



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