Modelling Group
WATER NEW ZEALAND

Modelling Symposium

30 years of water supply modelling

Presented by
Marcel Bear

WOODS
Est.1970

water
NEW ZEALAND

Hello

Interesting networks

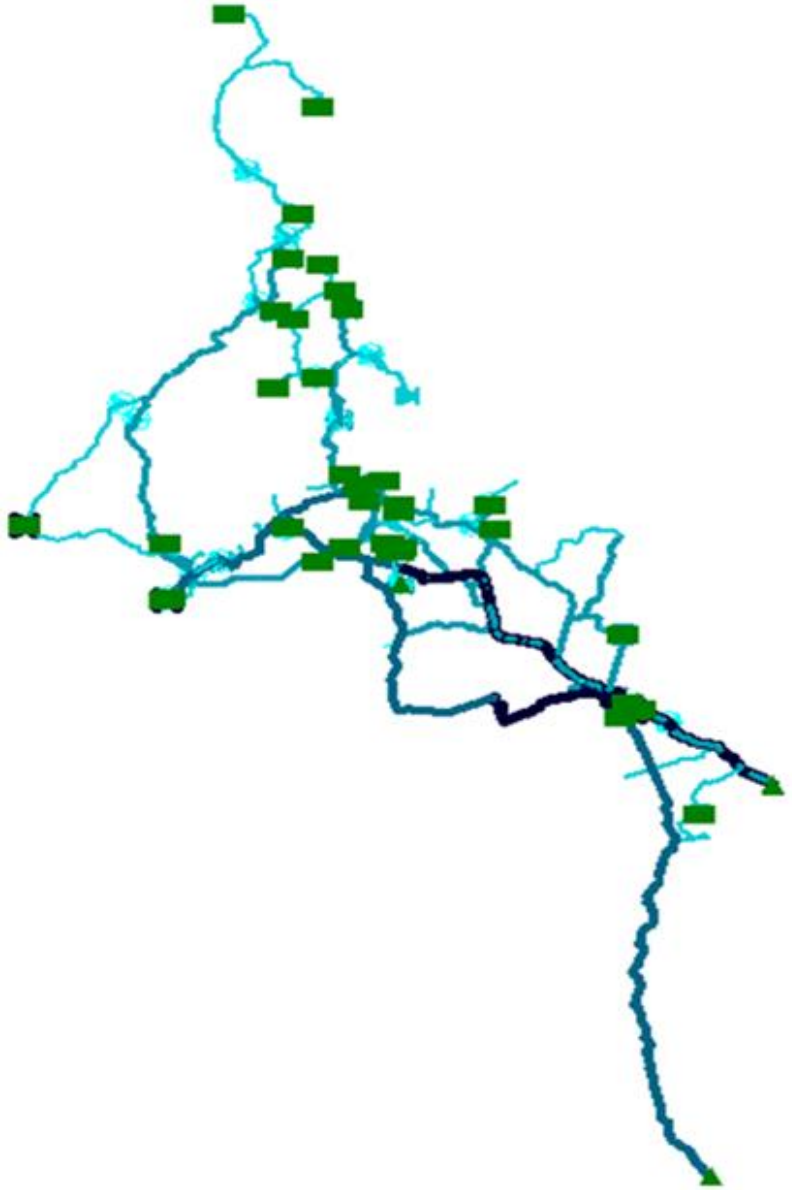
Technical topics:

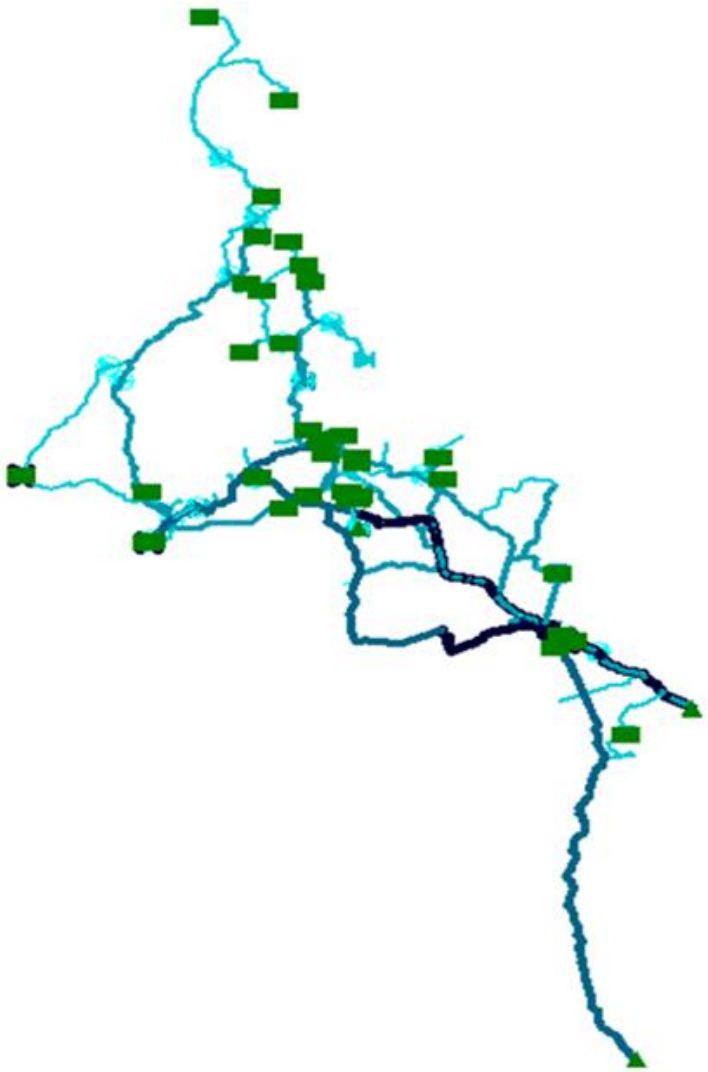
- Model Purpose
- Design
- Decimal places
- Peak factors
- Leakage

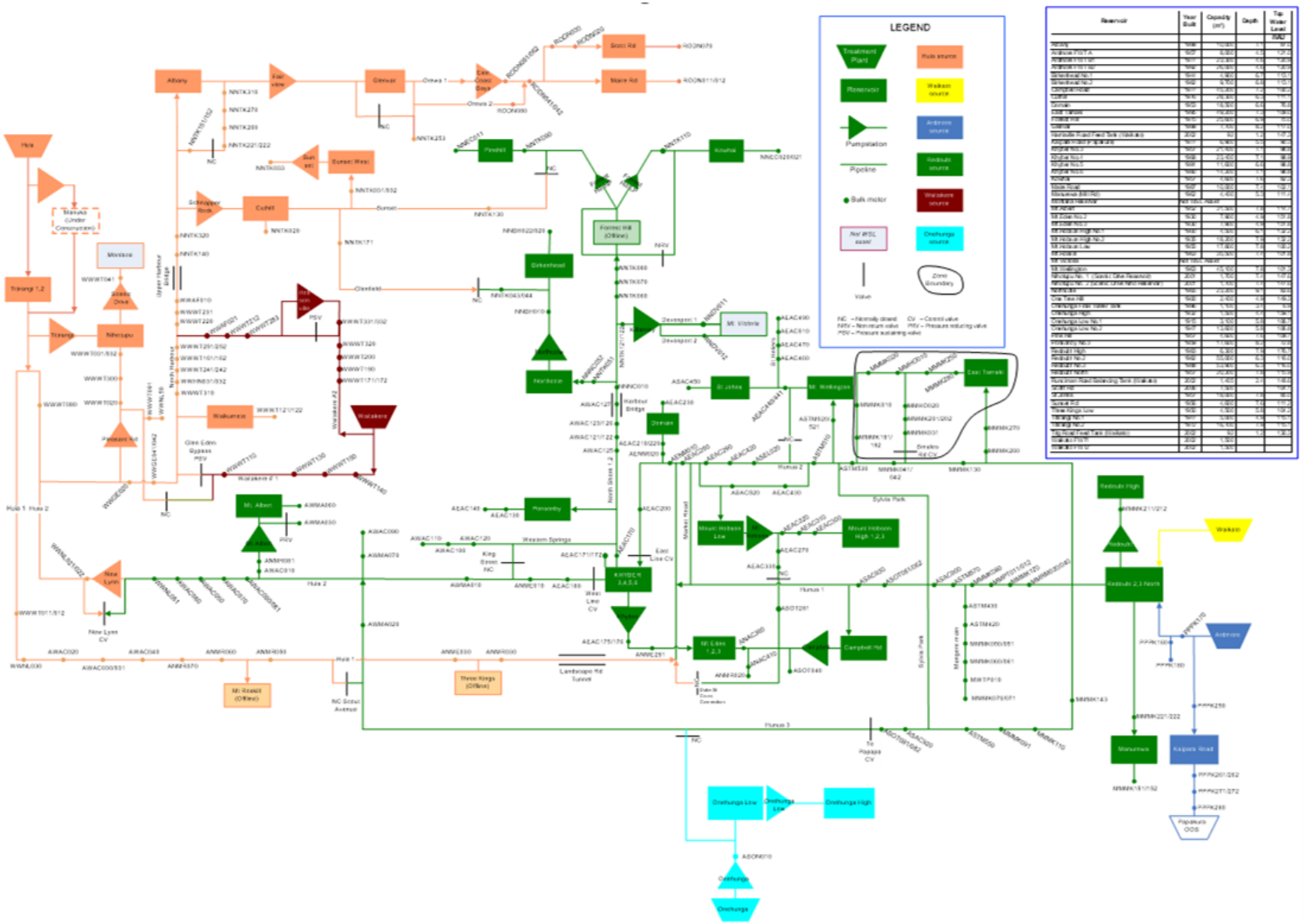
Presentation – soft skills

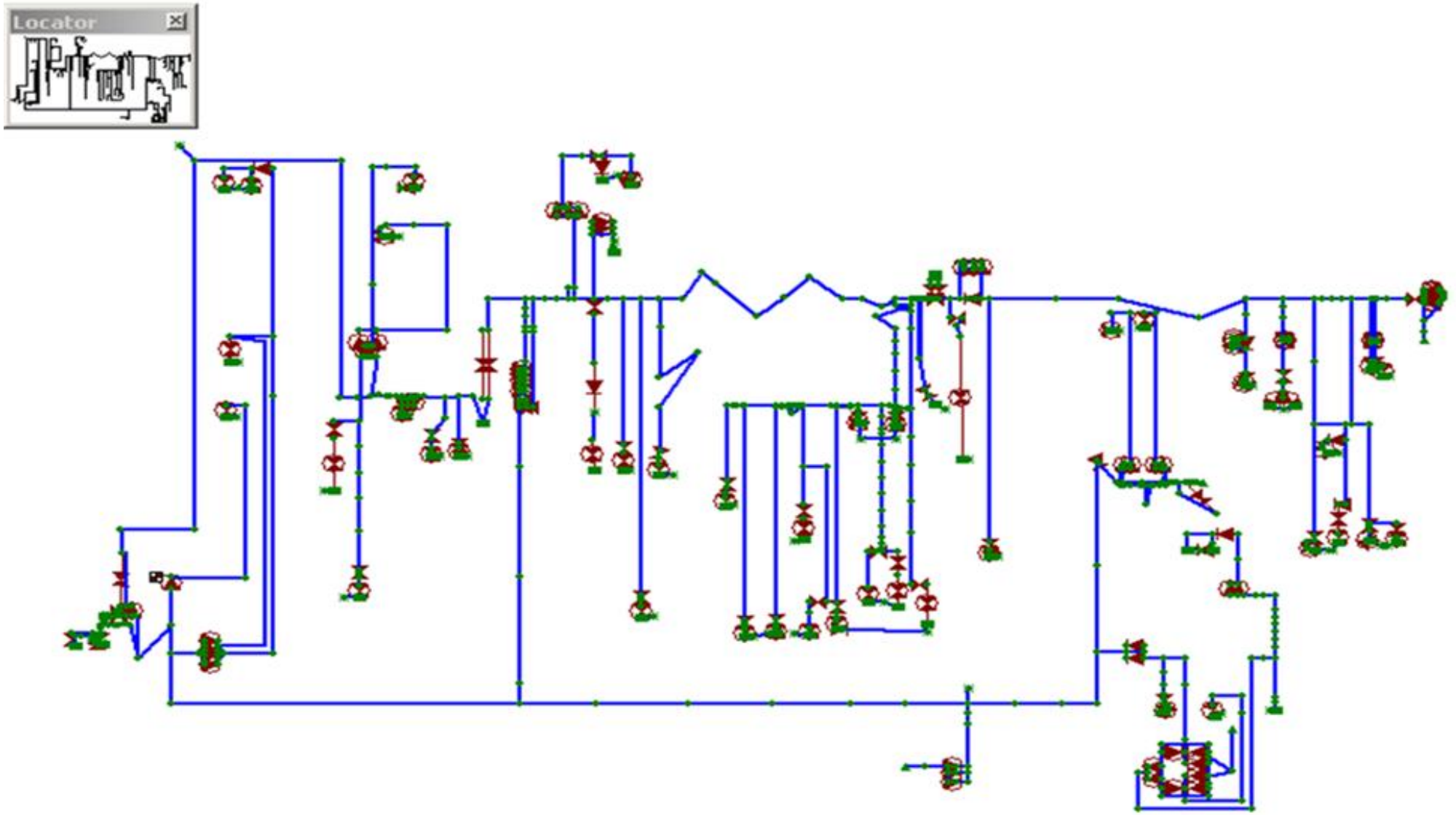
Philosophy of work (life)

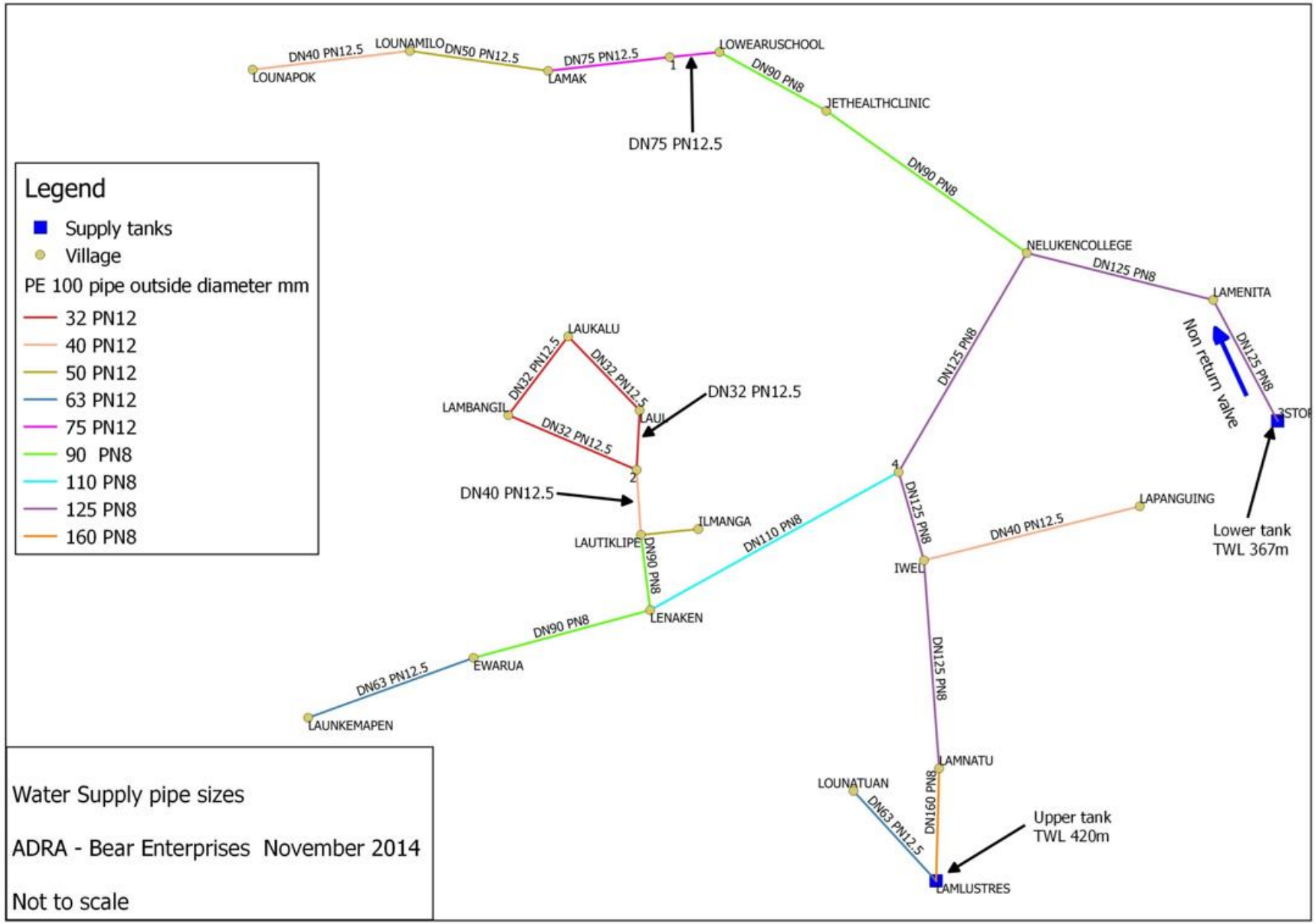
Guess the network location

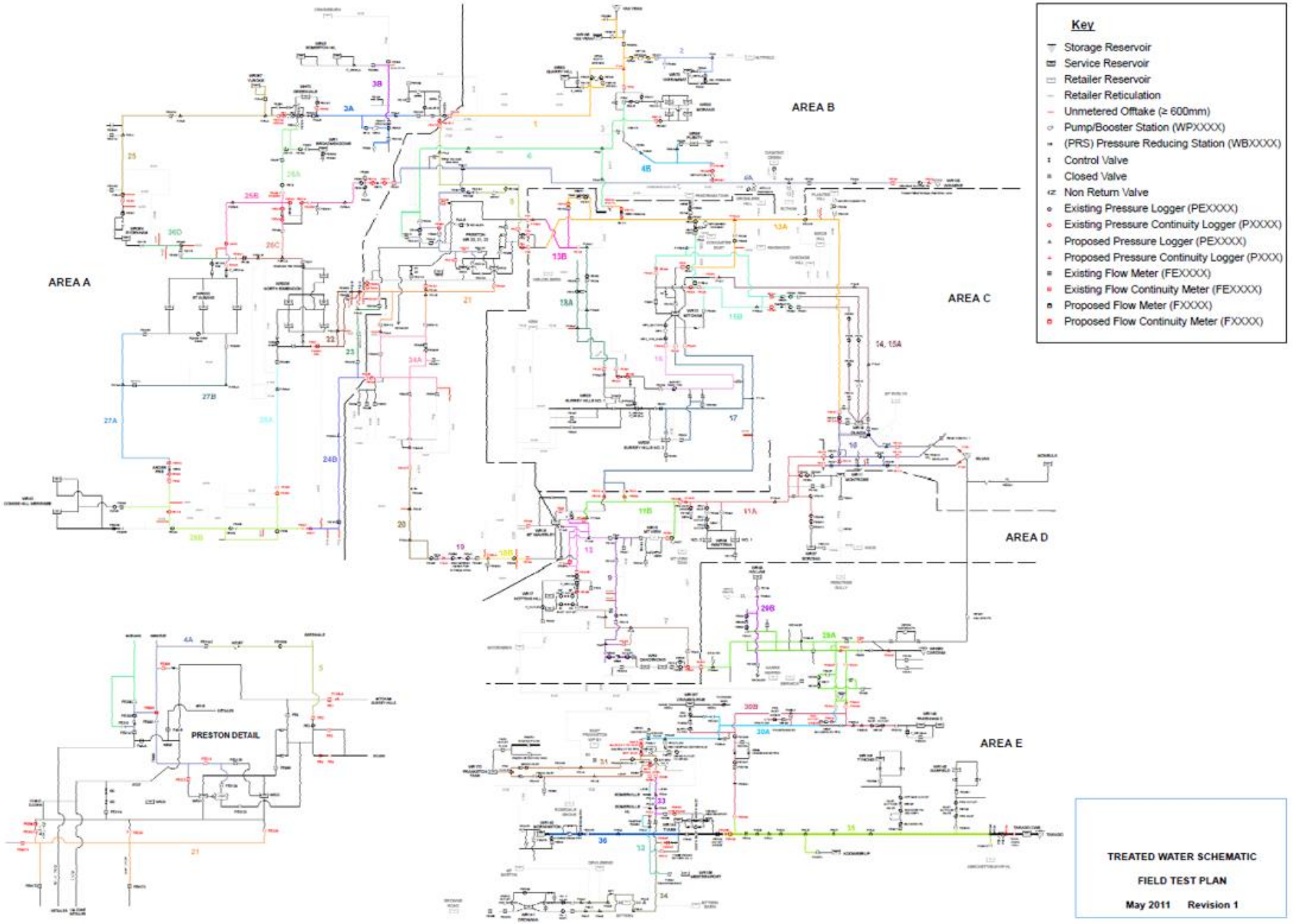


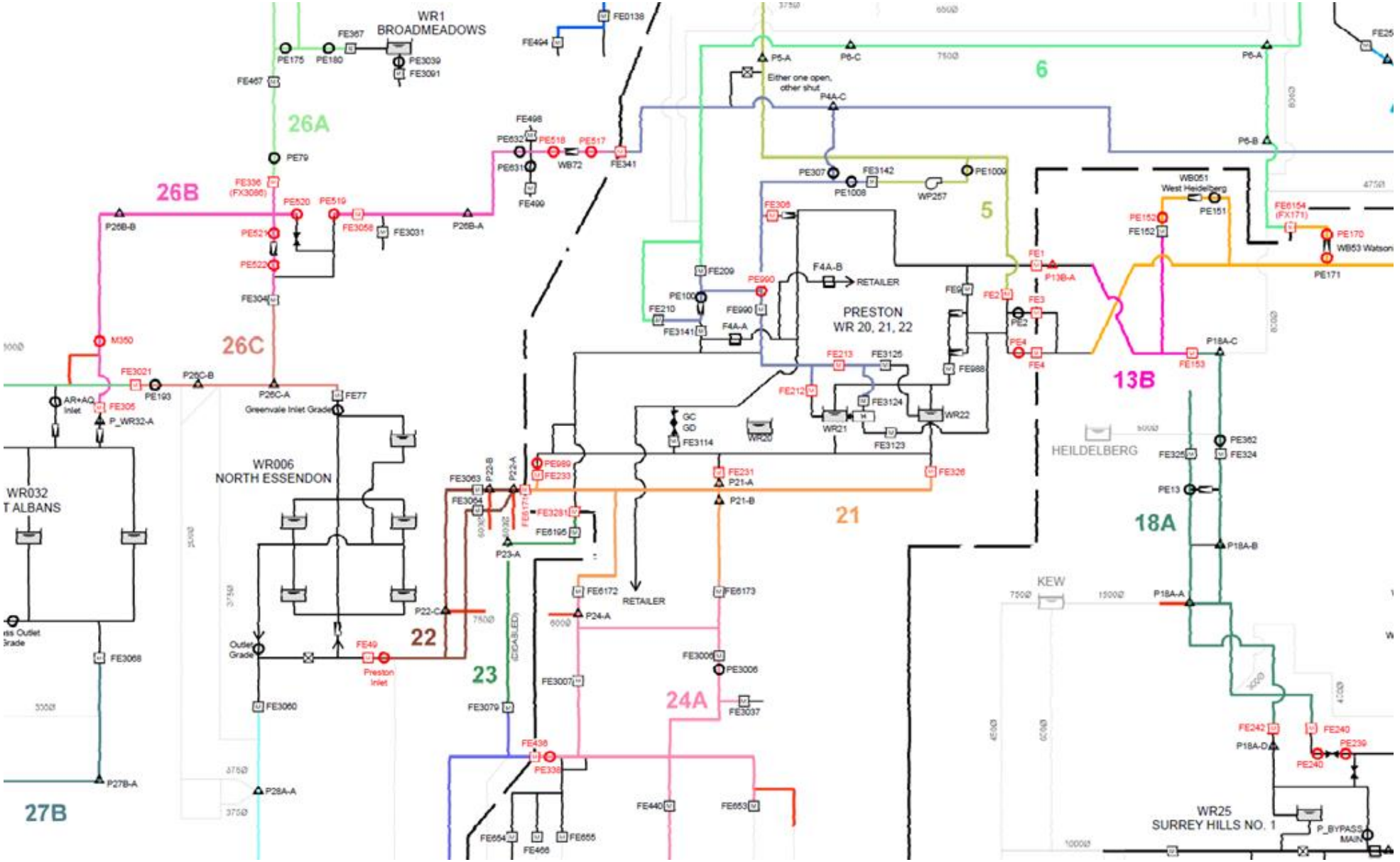


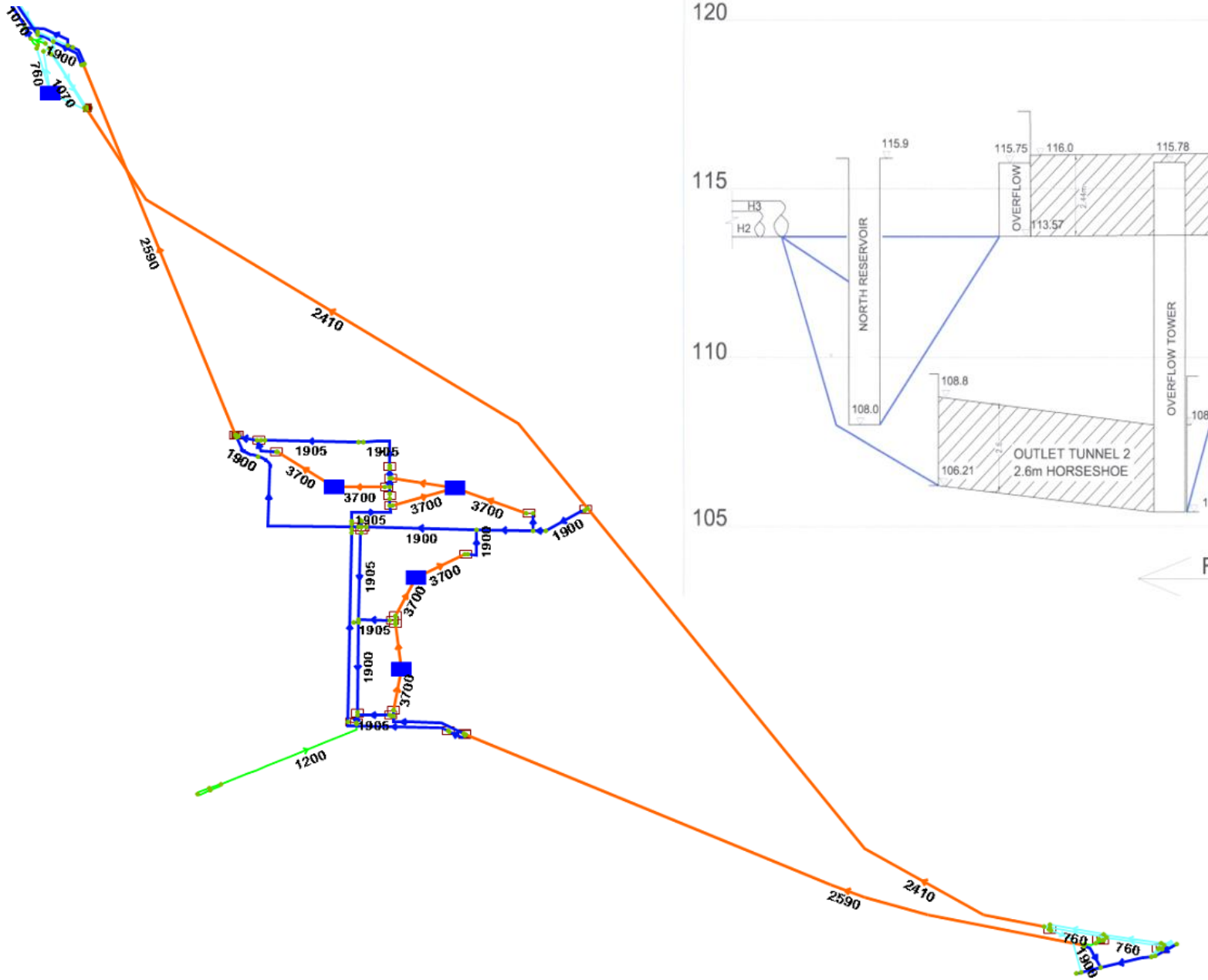

LEGEND
Treatment Plant
Reservoir
Pumpstation
Pipeline
Bulk meter
Valve
Zone Boundary
Hole source
Waikato source
Ardmore source
Kerikeri source
Whakaora source
Onehunga source
NC – Normally closed
NRV – Non-return valve
PSV – Pressure sustaining valve
CV – Control valve
PRV – Pressure reducing valve

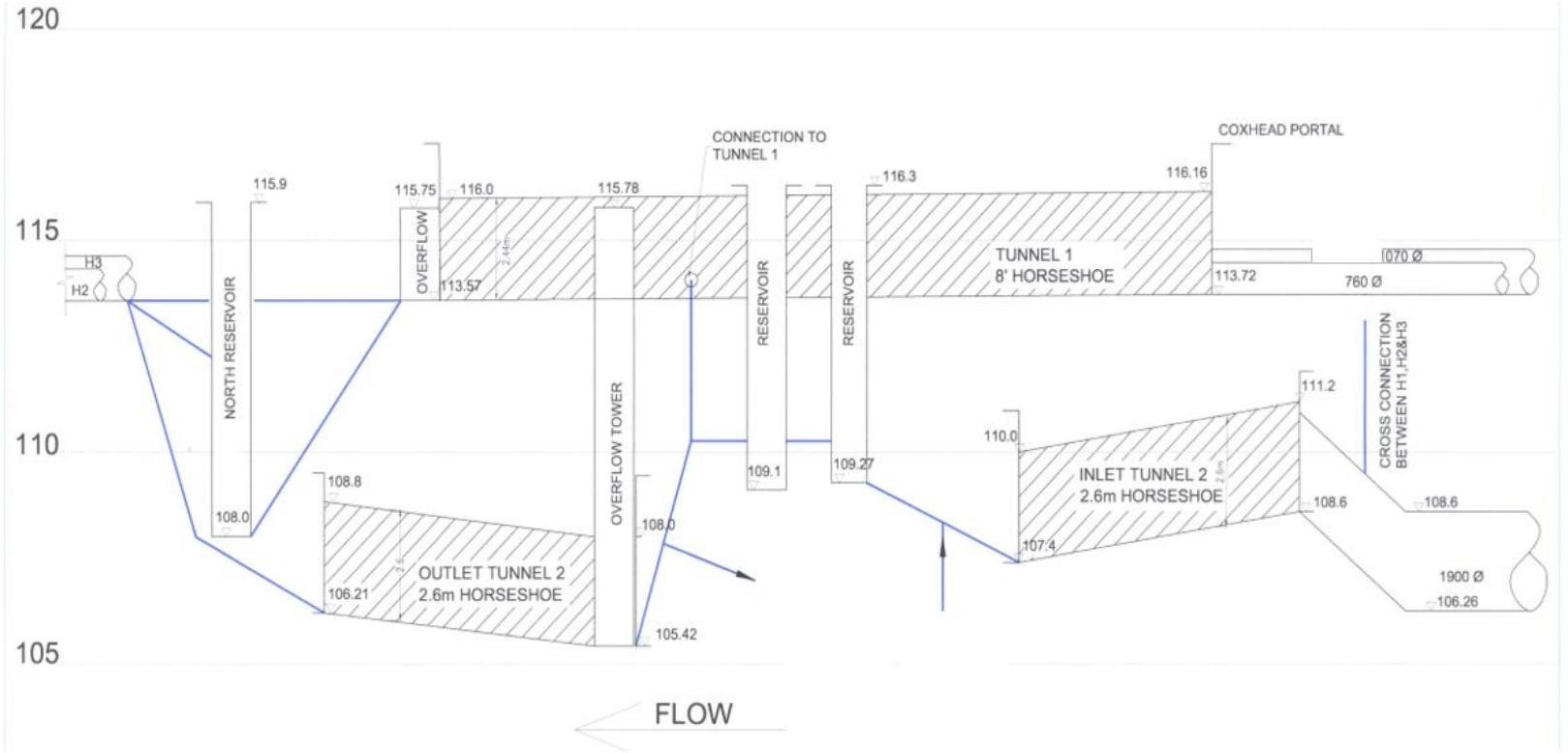

Locator


Legend
Supply tanks
Village
PE 100 pipe outside diameter mm
32 PN12
40 PN12
50 PN12
63 PN12
75 PN12
90 PN8
110 PN8
125 PN8
160 PN8
LOUNAPOK
DN40 PN12.5
LOUNAMILO
DN50 PN12.5
LAMAK
DN75 PN12.5
1
LOWEARUSCHOOL
DN75 PN12.5
DN90 PN8
JETHEALTHCLINIC
DN90 PN8
NELUKENCOLLEGE
DN125 PN8
LAMENITA
Non return valve
DN125 PN8
LAUKALU
DN32 PN12.5
DN32 PN12.5
LAMBANGIL
DN32 PN12.5
LAUI
DN32 PN12.5
2
DN40 PN12.5
ILMANGA
LAUTIKLIPE
DN90 PN8
DN110 PN8
LENAKEN
DN90 PN8
EWARUA
DN63 PN12.5
LAUNKEMAPEN
DN125 PN8
4
DN125 PN8
LAPANGUING
DN40 PN12.5
IWEL
Lower tank
TWL 367m
DN125 PN8
LAMNATU
LOUNATUAN
DN63 PN12.5
DN160 PN8
Upper tank
TWL 420m
LAMLUSTRES
Water Supply pipe sizes
ADRA - Bear Enterprises November 2014
Not to scale


Key
Storage Reservoir
Service Reservoir
Retailer Reservoir
Retailer Reticulation
Unmetered Offtake (≥ 600mm)
Pump/Booster Station (WPXXXX)
(PRS) Pressure Reducing Station (WBXXXX)
Control Valve
Closed Valve
Non Return Valve
Existing Pressure Logger (PEXXXX)
Existing Pressure Continuity Logger (PXXXX)
Proposed Pressure Logger (PEXXXX)
Proposed Pressure Continuity Logger (PXXX)
Existing Flow Meter (FEXXXX)
Existing Flow Continuity Meter (FEXXXX)
Proposed Flow Meter (FXXXX)
Proposed Flow Continuity Meter (FXXXX)
AREA A
AREA B
AREA C
AREA D
AREA E
PRESTON DETAIL
TREATED WATER SCHEMATIC
FIELD TEST PLAN
May 2011 Revision 1


WR1
BROADMEADOWS
26A
26B
26C
27B
WR006
NORTH ESSENDON
WR032
T ALBANS
PRESTON
WR 20, 21, 22
HEILDELBERG
KEW
WR25
SURREY HILLS NO. 1
West Heidelberg
RETAILER
Either one open, other shut
Greenvale Inlet Grade
Outlet Grade
Preston Inlet
6
5
21
22
23
24A
18A
13B


1070
1900
760
1070
2590
2410
1905
1900
3700
1905
1905
3700
3700
3700
1900
1900
1905
3700
3700
1905
1900
3700
1905
1200
2590
2410
760
760
1900


120
115
110
105
CONNECTION TO TUNNEL 1
COXHEAD PORTAL
115.9
115.75
116.0
115.78
116.3
116.16
H3
H2
NORTH RESERVOIR
OVERFLOW
113.57
OVERFLOW TOWER
RESERVOIR
RESERVOIR
TUNNEL 1
8' HORSESHOE
113.72
070 Ø
760 Ø
108.0
108.8
108.0
109.1
109.27
111.2
110.0
INLET TUNNEL 2
2.6m HORSESHOE
CROSS CONNECTION BETWEEN H1,H2&H3
108.6
108.6
107.4
106.21
OUTLET TUNNEL 2
2.6m HORSESHOE
105.42
1900 Ø
106.26
FLOW

Model Purpose-drives model build effort

Scale of networks

- City, suburb, lot level, town and rural

Purpose

- Planning – growth, greenfields, brownfields network design checking
- Operational – shut downs – planned or emergency

Model purpose drives level of detail and accuracy needed

Be careful when stretching model outputs beyond its original intended use

Network Design

Complete loops

- Redundancy
- Avoid dead ends

Consistent diameters

- Capacity – future you will be thankful for it

Keep it simple

Follow the code – it's there for a reason-headloss criteria especially as this give consistent capacity relative to flows

Decimal Places

The model will give you as many decimal places as you want, and then lots more

- The number of decimal places that are reported implies the accuracy of the result
- ie reporting 35.617m pressure implies we know the pressure down to the millimetre. Quoting a demand of 1.43 l/s implies we know the demand down to 10 millilitres/second (2 teaspoons/second)

Think about the other model uncertainties behind the result:

- Yield – crystal ball gazing – sure to be different in reality
- Ground level
- Pipe size (nominal or actual)
- Network operation – closed valves, unusual demands (someone fills a swimming pool)

The number of DPs reflects your confidence in the answer – allowing for ALL uncertainties

Demand peak factors

The bigger the network – the more averaging – the lower the peak factor

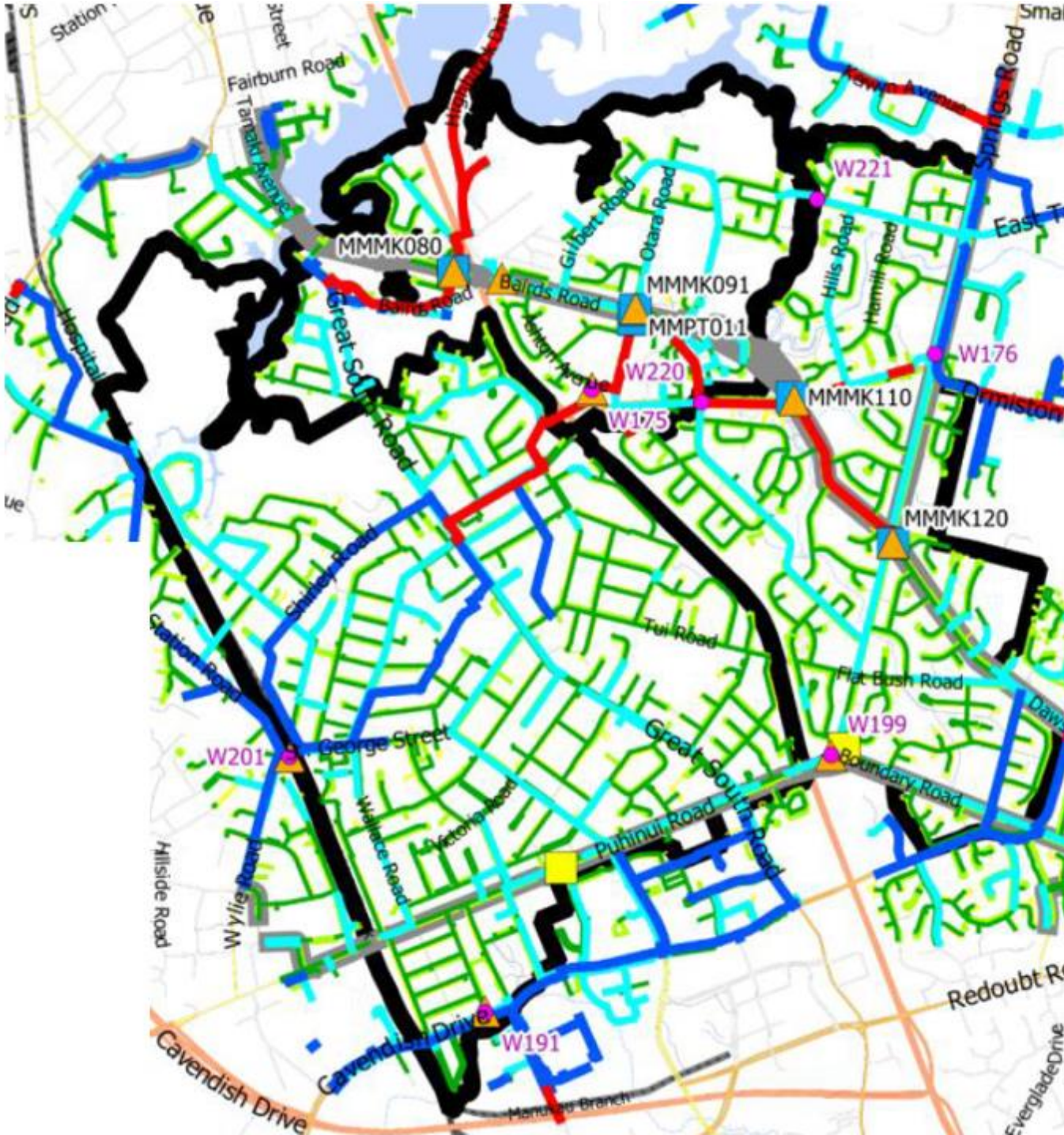
Typical code excerpt:

(a) PF = 2 for populations over 10,000;
(b) PF = 5 for populations below 2,000.
(c) Interpolated between 2 and 5 for populations between 10,000 and 2,000

The network size is based on:

- The supply zone
- Not the area being designed

Sub-areas with higher flows within a homogeneous zone are a fiction



Leakage - the silent assassin

All pressurized systems leak – from a bike tyre to water network

Often unseen – ignore at your peril

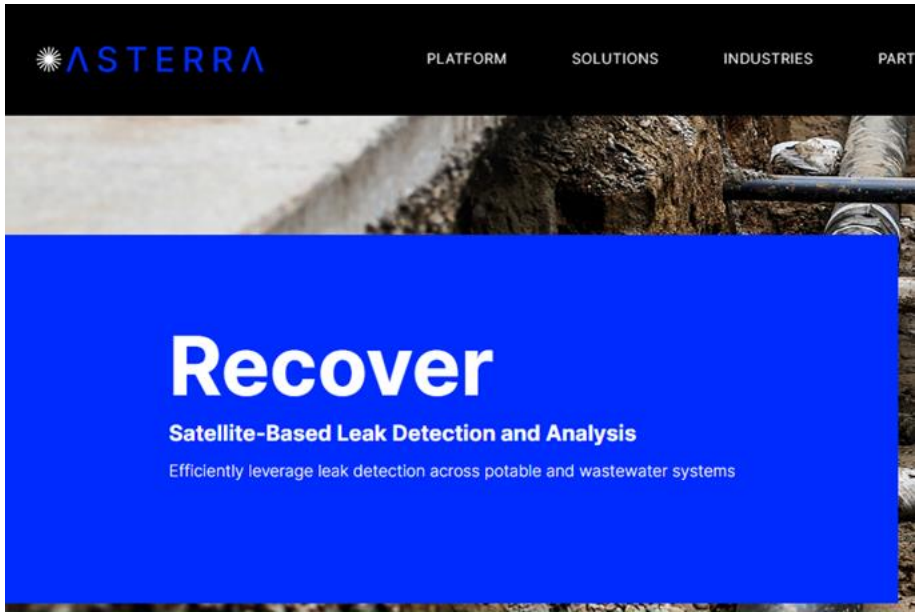
The science of leakage analysis well developed – IWA (International Water Association) extensive literature, guides and analysis software

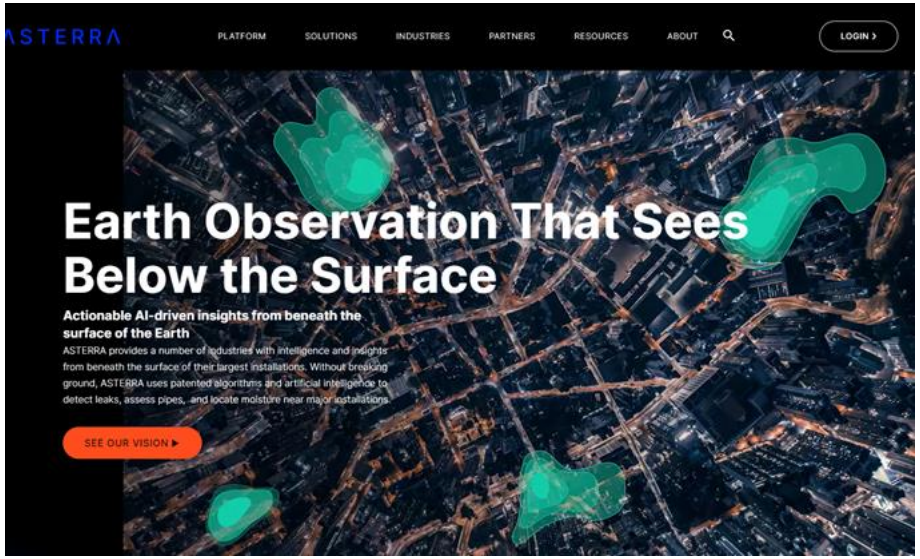
Reducing leakage requires:

- Small, well understood and controlled supply zones (DMAs PMAs)
- A team devoted to managing and maintaining the DMAs
- 'Smart' leakage detection
- Quality leak repairs

Satellite leakage detection

- Uses Synthetic Aperture Radar (SAR) from satellites - developed to find water on Mars.
- Can locate underground water. Algorithms interpret the data to separate potable leaks from groundwater/wastewater.
- Covers a wide area at once (city scale)
- Repeated passes at intervals 'train' the algorithm and track leakage change
- Can be used to direct repairs in conjunction with traditional detection (noise correlators/listening sticks)





Presentation/Reporting skills

Know your material

Don’t read the slides out - your audience can do this

Practice and refine

Capture them at the beginning and keep their interest - finish strongly

Be grateful for the time and attention the audience is giving you - interact

Reporting - put yourself in the readers shoes

There is always a bigger picture

What are they interested in knowing?

Refine, rewrite and check again

Two presentation tips I use

Tell them what you are going to tell them

Tell them

Tell them what you told them

Load

Aim

Fire

Reporting – how I go about it

Put yourself in the readers shoes

There is always a bigger picture –find out about it

What are they interested in knowing. How best to convey it?

- Be clear on the client's objective
- Summary up front: Usually the result, the cost, the timing, the implications on surrounding area
- Use pictures in preference to words

Write when you are clear on what to say – get clear –use the writing process

Get the idea down on paper/screen -flow state – then return for spelling, format etc

Write refine rewrite check write again

Approach to engineering

Two things have been invaluable to me:

Approach to engineering 1

Always assume the other guy/gal is right

If I find a 'mistake' in calculations/reporting/drawings etc, I always stop and try to see where I have gone wrong:

- In my reading of what is shown
- In my interpretation
- In my calculations

The chances are the work is correct and its my mistake.

Saves a lot of embarrassment and is good learning

If there is an error, be kind.

"Kind words and kind deeds can shift heaven" Dogen, 13th C monk

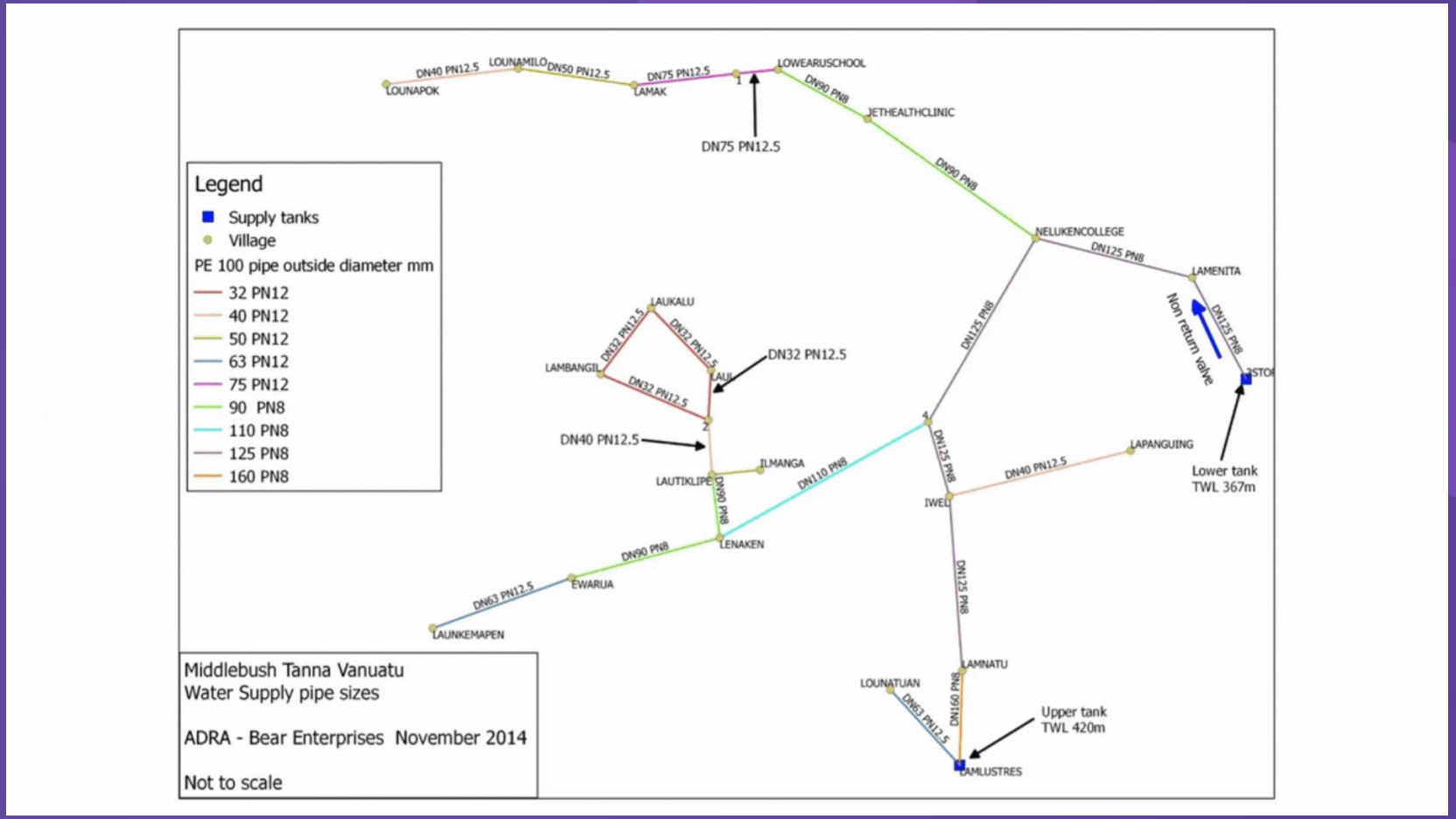
Approach to engineering 2

Modelling Group
WATER NEW ZEALAND

Modelling Symposium

Thank you

Questions
Patai



WOODS
EST.1970

water
NEW ZEALAND