

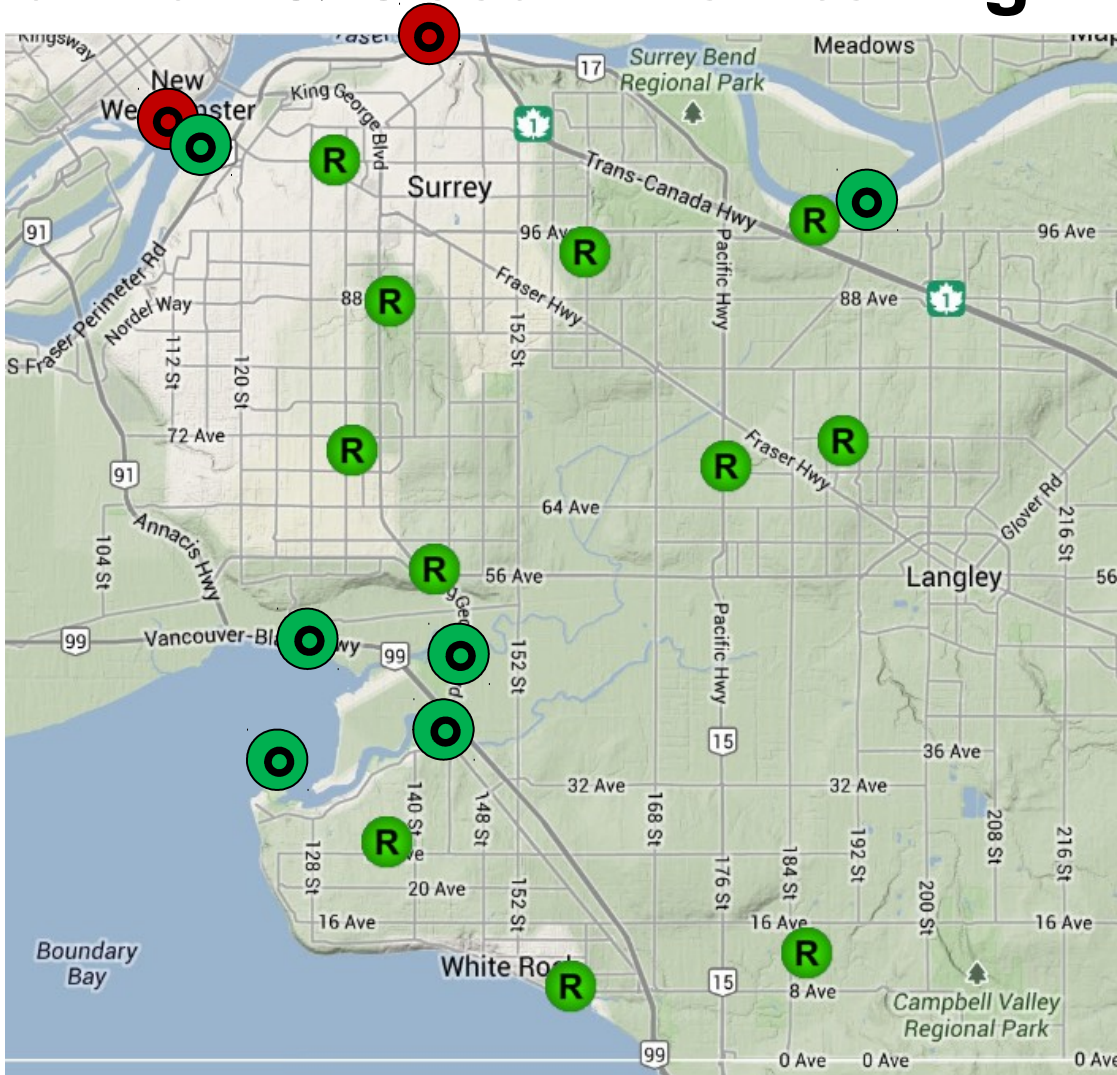
Open Data Mashups for Flood Management

February 4th, 2016 Outline:

- 1) What Data and Where?
- 2) Open Data Progression
- 3) Fraser River
- 4) Regional Online Mashup Ex.
- 5) Online Data for Flood Mgt.
- 6) Future Opportunities

Matt Osler, City of Surrey

Rainfall & Ocean Monitoring



300+ km land mass

30+ km coastline

20+ km shoreline

11 City Rain Gauges

6 City tidally influenced stations

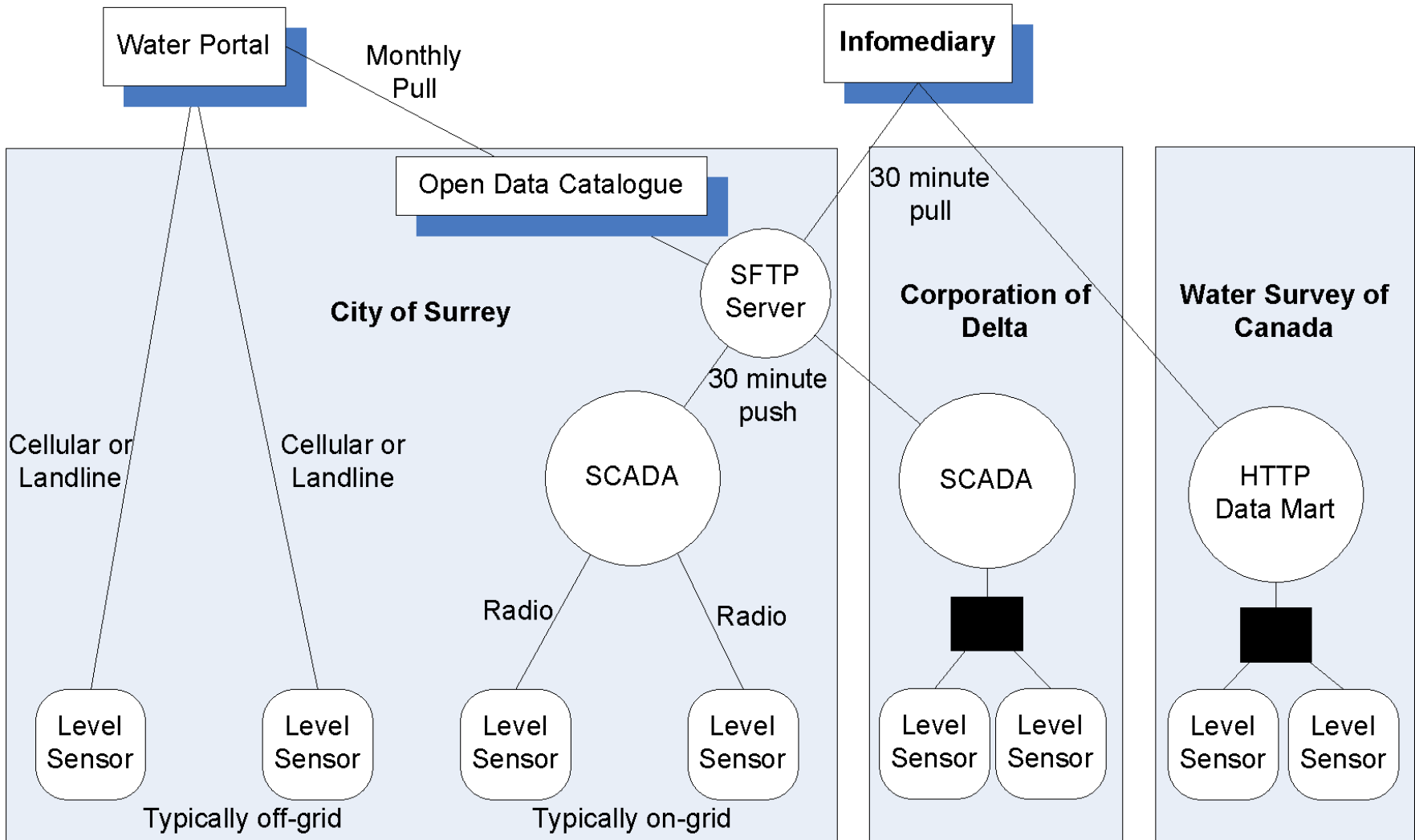
3 Neighbouring Tide Stations

- 1 neighbouring USA NOAA tide station
- 1 neighbouring Canadian DFO tide station
- 1 neighbouring WSC station tidally influenced

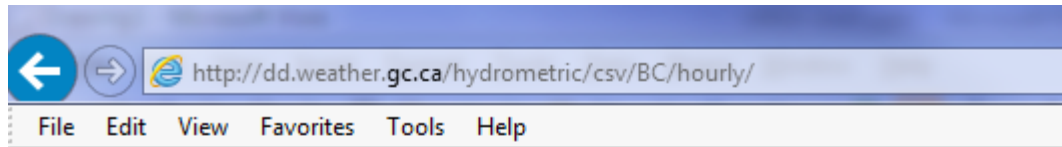
Level Sensors









Data Connections



Environment Canada Data Mart



-  [BC 08ME027 hourly hydrometric.csv](#) 28-Jan-2016 22:43 40K
-  [BC 08ME028 hourly hydrometric.csv](#) 28-Jan-2016 22:43 36K
-  [BC 08MF005 hourly hydrometric.csv](#) 28-Jan-2016 22:43 42K
-  [BC 08MF040 hourly hydrometric.csv](#) 28-Jan-2016 22:43 14K
-  [BC 08MF065 hourly hydrometric.csv](#) 28-Jan-2016 22:43 40K
-  [BC 08MF068 hourly hydrometric.csv](#) 28-Jan-2016 22:43 40K

BC_08MG005_hourly_hydrometric.csv [Read-Only]

	A	B	C	D	E	F	G	H	I	J
1	ID	Date	Water Level	Grade	Symbol	QA/QC	Discharge	Grade	Symbol / Symbole	QA/QC
2	08MG005	2016-01-20	1.367			1	25.345			1
3	08MG005	2016-01-20	1.367			1	25.345			1
4	08MG005	2016-01-20	1.365			1	25.234			1
5	08MG005	2016-01-20	1.365			1	25.234			1
6	08MG005	2016-01-20	1.365			1	25.234			1
7	08MG005	2016-01-20	1.364			1	25.178			1
8	08MG005	2016-01-20	1.368			1	25.4			1
9	08MG005	2016-01-20	1.367			1	25.345			1
10	08MG005	2016-01-20	1.364			1	25.178			1
11	08MG005	2016-01-20	1.366			1	25.289			1
12	08MG005	2016-01-20	1.367			1	25.345			1
13	08MG005	2016-01-20	1.364			1	25.178			1

Why Open Data & Flood Management?

Vision 2041



The goal of open data is to:

- empower citizens,
- help small businesses,
- create value in some other positive unforeseen way.

Open Data Catalogue

Search By Category



Business and
Economy



Community
Services



Environment



Finance



Health and Safety



Imagery



Infrastructure



Land Use and
Development



Local Government



Miscellaneous



Recreation and
Culture



Transportation

Focus on easy to use public access

- Initially piecemeal webpages with data download was well received
- Catalogue started in 2014 to provide comprehensive data portal data.surrey.ca
 - Multiple data formats offered for convenience and basic visualization

Open data?

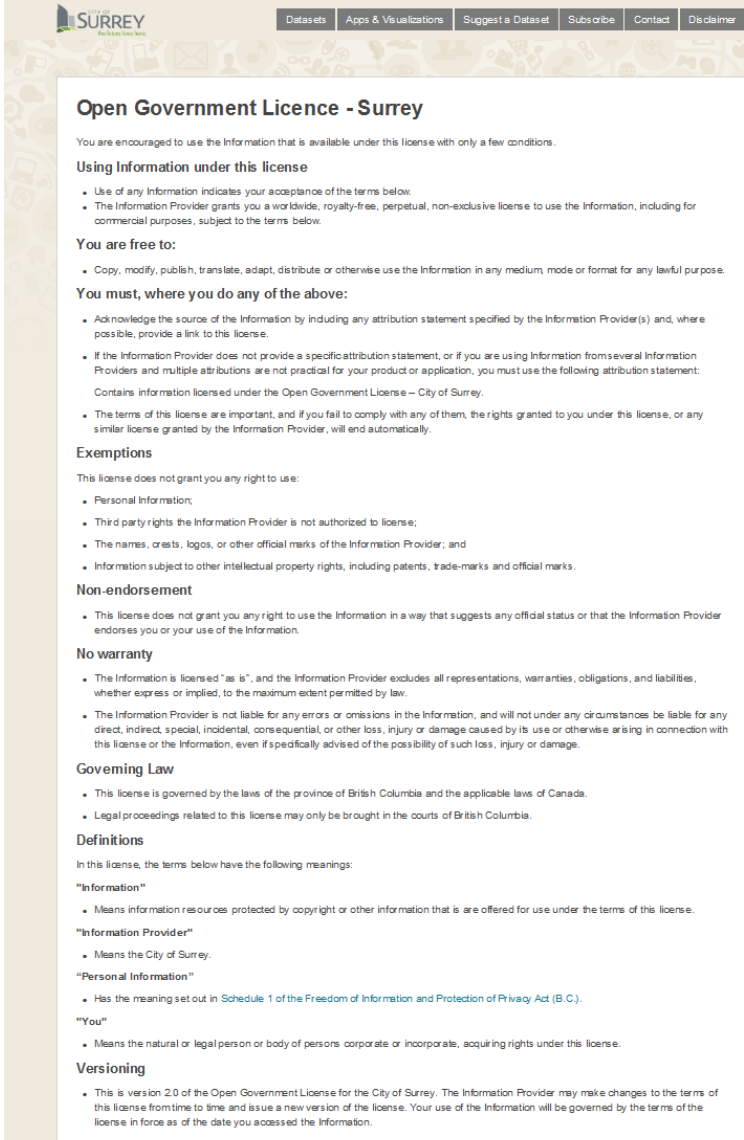
1. Publically available
 - Public domain \neq Open data
2. License allows re-use

Open data is the idea that certain data should be freely available to everyone to use and republish as they wish, without restrictions

EX:

<http://data.surrey.ca/pages/open-government-licence-surrey>

http://wateroffice.ec.gc.ca/disclaimer_info_e.html



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Versioning

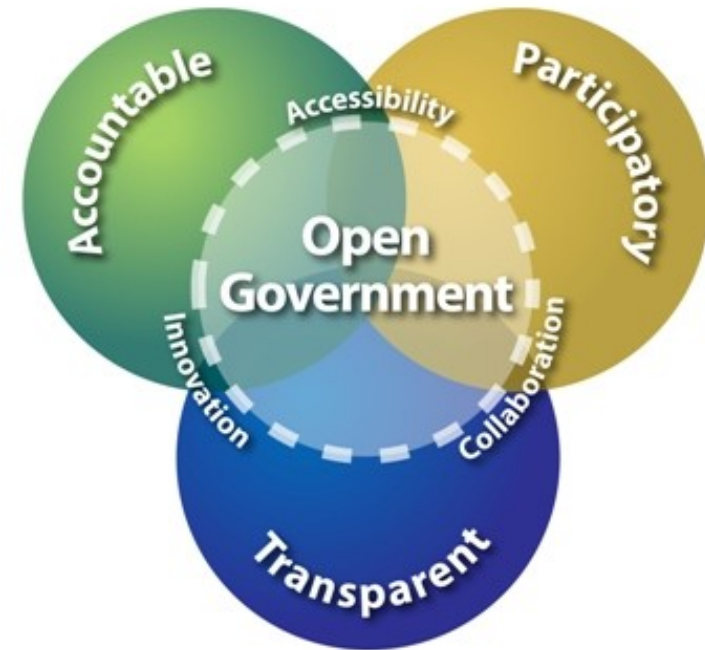
- This is version 2.0 of the Open Government License for the City of Surrey. The Information Provider may make changes to the terms of this license from time to time and issue a new version of the license. Your use of the Information will be governed by the terms of the license in force as of the date you accessed the Information.

Benefits of Open Data

- Supports **open, transparent & accessible government**
- Efficient data exchange internally & externally
- Increases Visibility
- Increased Uptake and Use of Data
 - Easier to implement Mashups



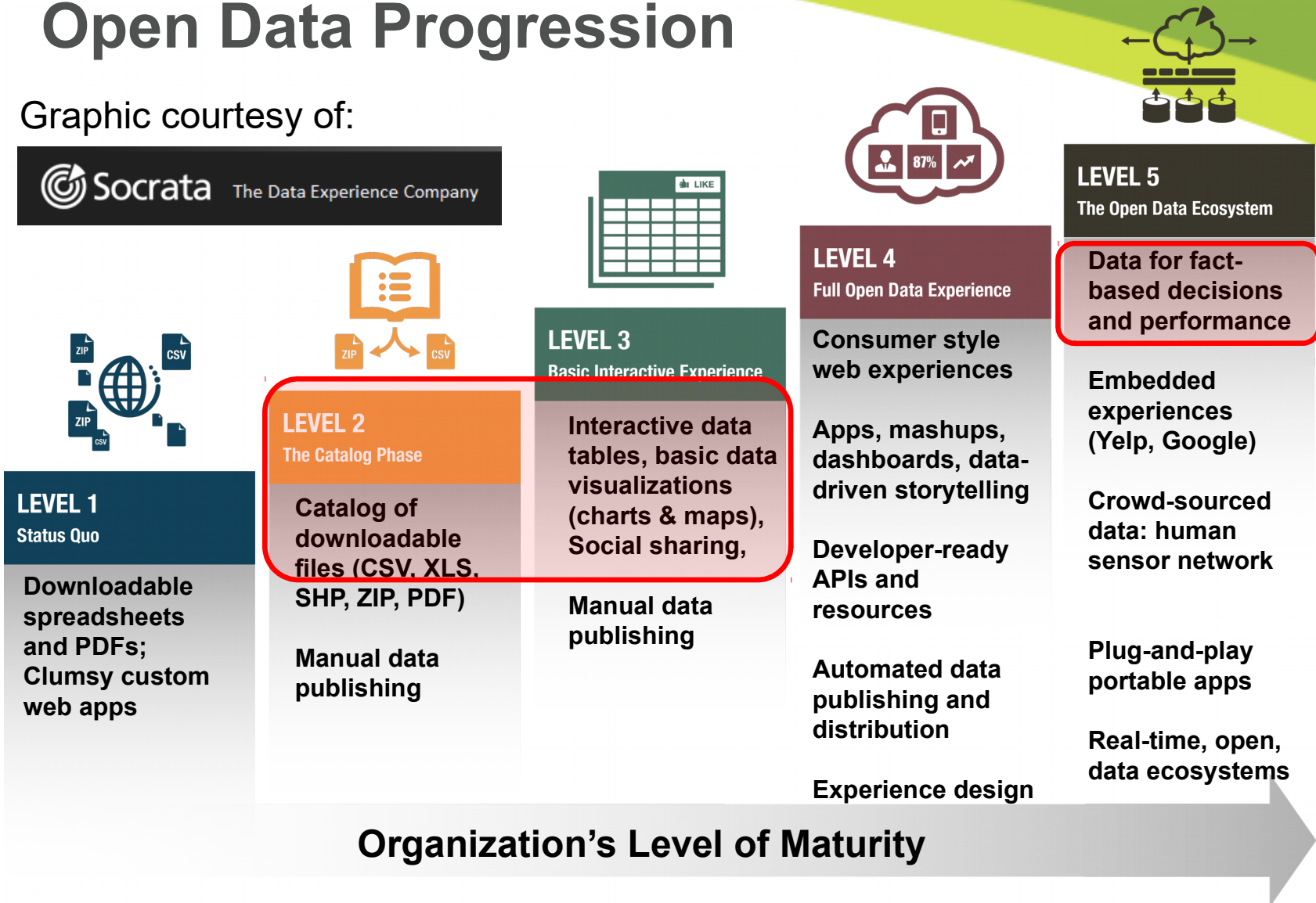
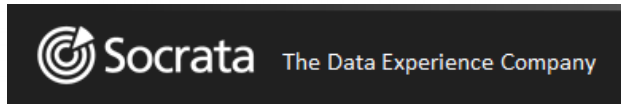
<http://map.psi.enacting.org/>



<http://www.kitchener.ca/en/insidecityhall/open-data.asp>

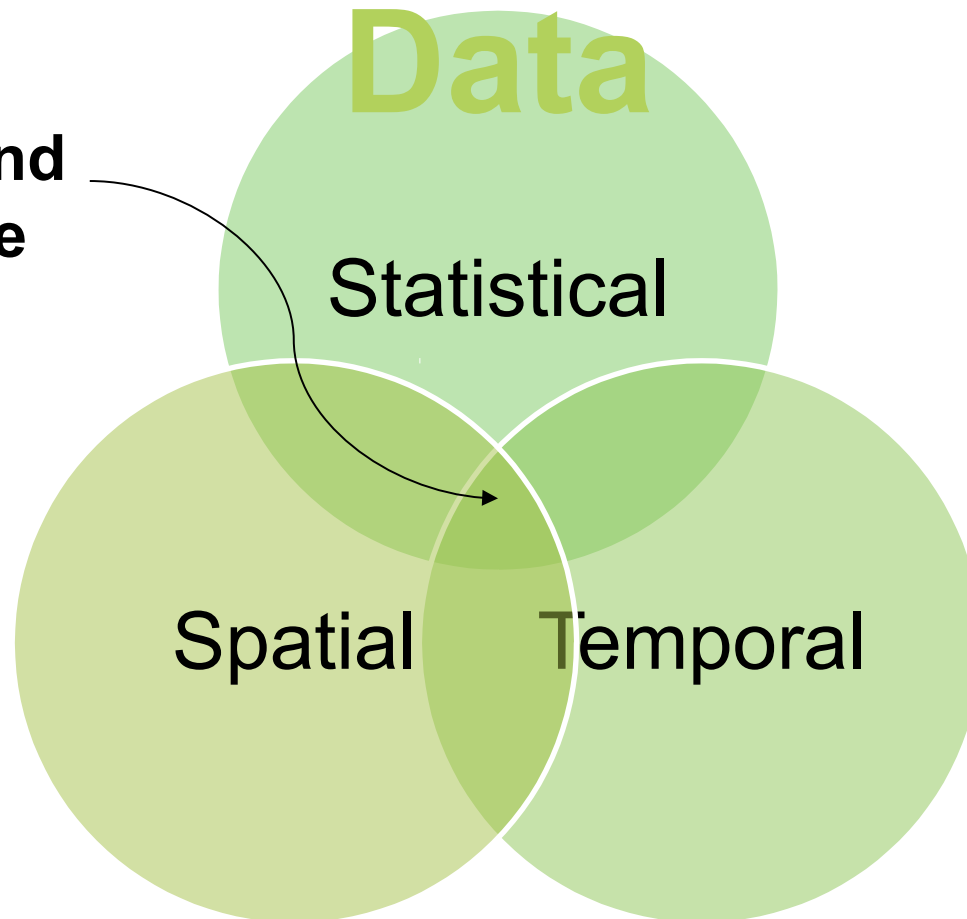
Open Data Progression

Graphic courtesy of:



Example Fraser River Level App

**Fact-based
decisions and
performance**

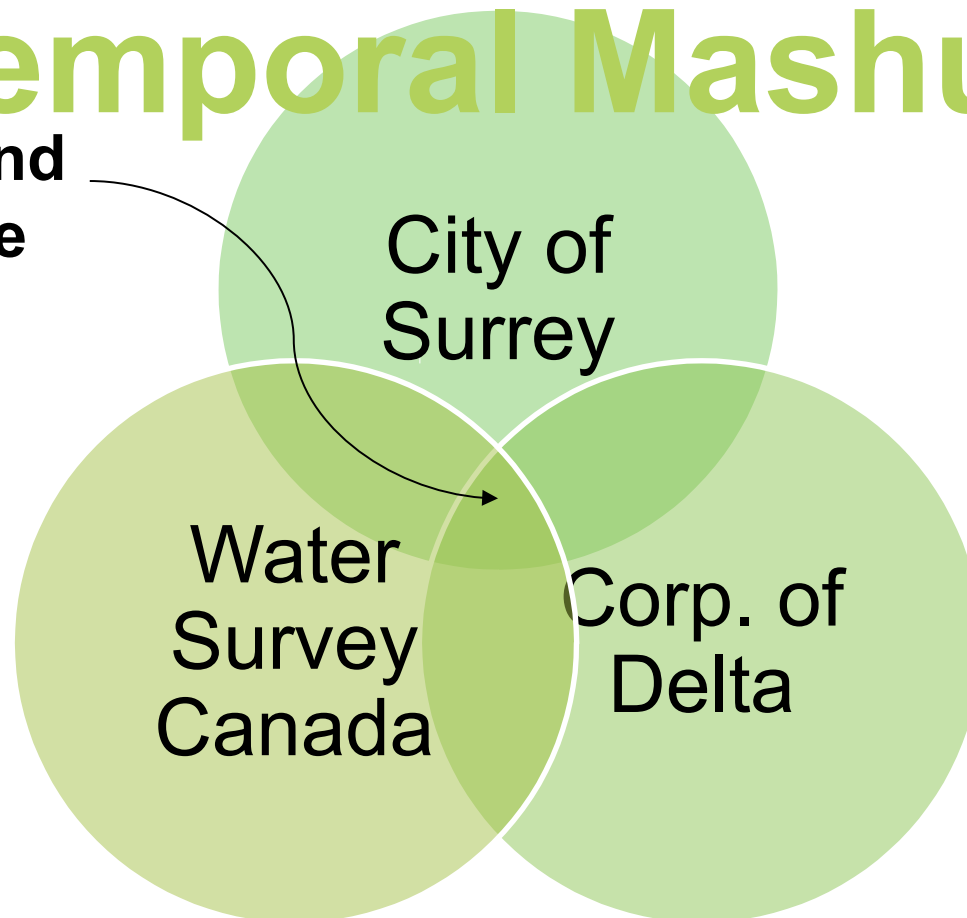


Space-Time! Geo-enabling the Internet of Things

Example Fraser River Level App

Fact-based decisions and performance

Temporal Mashup



Example Fraser River Level App

**Base map
Familiarity**

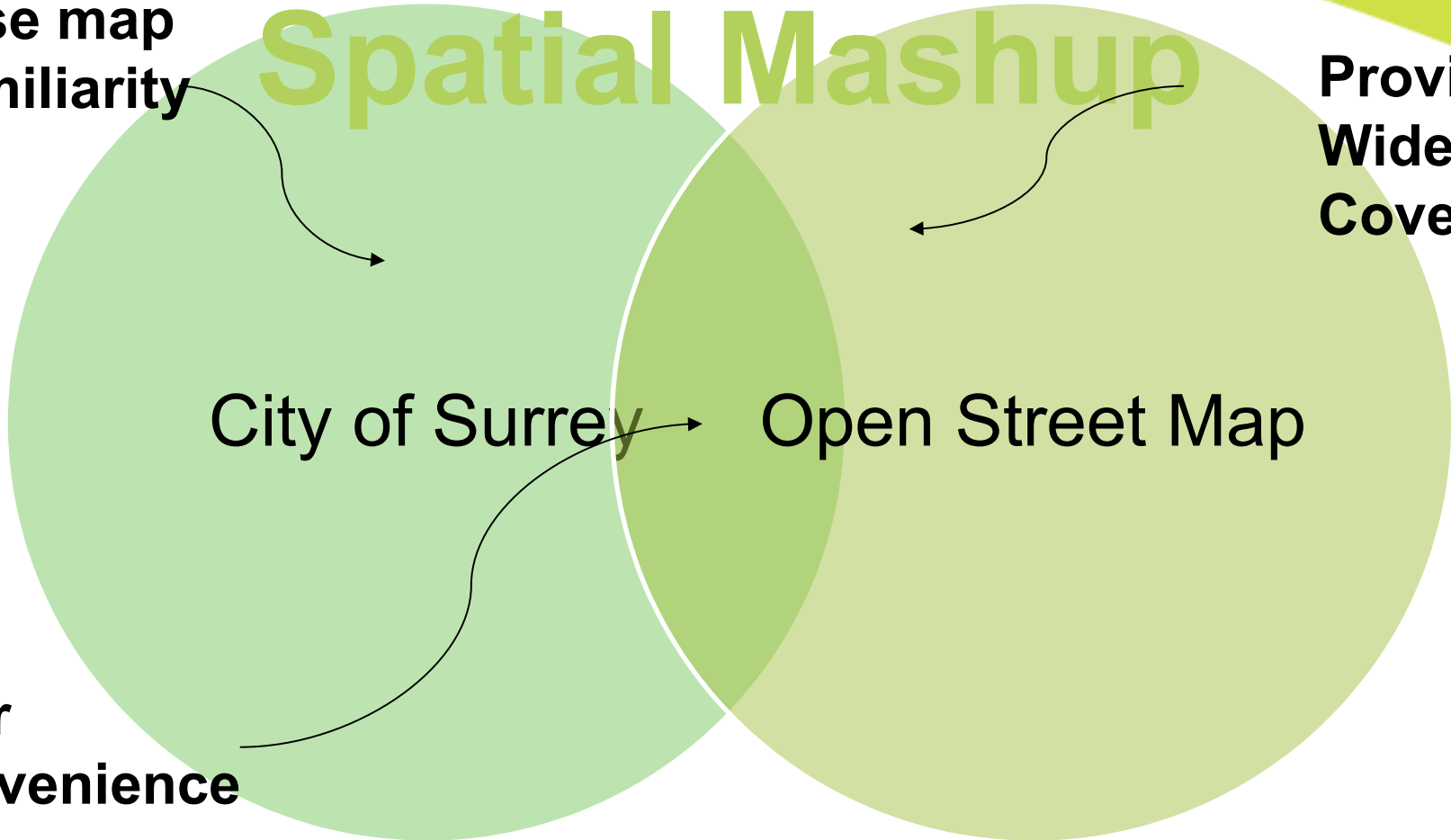
Spatial Mashup

**Province
Wide
Coverage**

City of Surrey

Open Street Map

**User
Convenience**



Why Fraser River Levels?

- No mashup available for water levels
 - Excellent meteorological mashups already available
- Support community preparedness
- Improved awareness

(public, engineering, emergency staff)

- Public safety
- 1,370 km long
- Drains >25%
of BC



Flood Protection

- South Westminster Dyking district (1920)
- By 1967, 500 homes in flood plain plus significant industrial presence
- Responsibility transferred from Province



Legend

- River Level 200-Year Level w/0.6 Freeboard
- Drainage Pump Stations
- 10m Elevation
- Contour 5m
- Depression 5m
- Dike Location
- Earth Dike (±2,000m)
- Concrete Retaining Wall (±350m)
- Concrete Wall (±2,200m)
- Concrete Wall w/ Metal Extension (±300m)
- Ditch
- At 200-Year Level no Freeboard
- Above 200-Year Level w/0.6m Freeboard



STOP LOG CROSSING NO. 14 REPLACED WITH EARTH DYKE



FRASER RIVER FLOOD PROTECTION

This information is provided for informational and communication purposes only. It does not constitute an offer of insurance or any other financial product. For more information, please contact your insurance broker.

COSMOS Stop log # 13 (26)



Demo

NOLA Water Analytics

Fraser River Water Levels

In this web application, you can find current observed water levels at 17 locations in the Fraser River watershed. It brings together data collected by the Water Survey of Canada, City of Surrey, and Corporation of Delta into an easy to use, map based tool for flood management.

START EXPLORING



FOUNDRY SPATIAL





McBride
08KA005 - FRASER RIVER

MAY 20 13:01

5.47m STAGE +6% VS MEDIAN +0.23m(24h)
+0.46m(48h)
+0.49m(72h)

444.4m³/s DISCHARGE 2011-2015 RECORD

[View Chart](#)

18 Stream Gauges

McBride
08KA005 - FRASER RIVER

MAY 20 13:01

5.47m STAGE +6% VS MEDIAN +0.23m(24h)
+0.46m(48h)
+0.49m(72h)

444.4m³/s DISCHARGE 2011-2015 RECORD

[Compare](#)

Chase
08LE031 - SOUTH THOMPSON RIVER

MAY 20 13:10

3.18m STAGE -13% VS MEDIAN +0.06m(24h)
+0.13m(48h)
+0.20m(72h)

469.2m³/s DISCHARGE 2011-2015 RECORD

[Compare](#)

McLure
08LB064 - NORTH THOMPSON

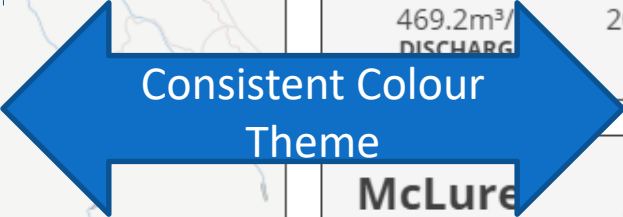
MAY 20 12:05

3.14m STAGE -8% VS MEDIAN +0.10m(24h)
+0.12m(48h)
+0.33m(72h)

1096.3m³/s DISCHARGE 2011-2015 RECORD

[Compare](#)

McBride

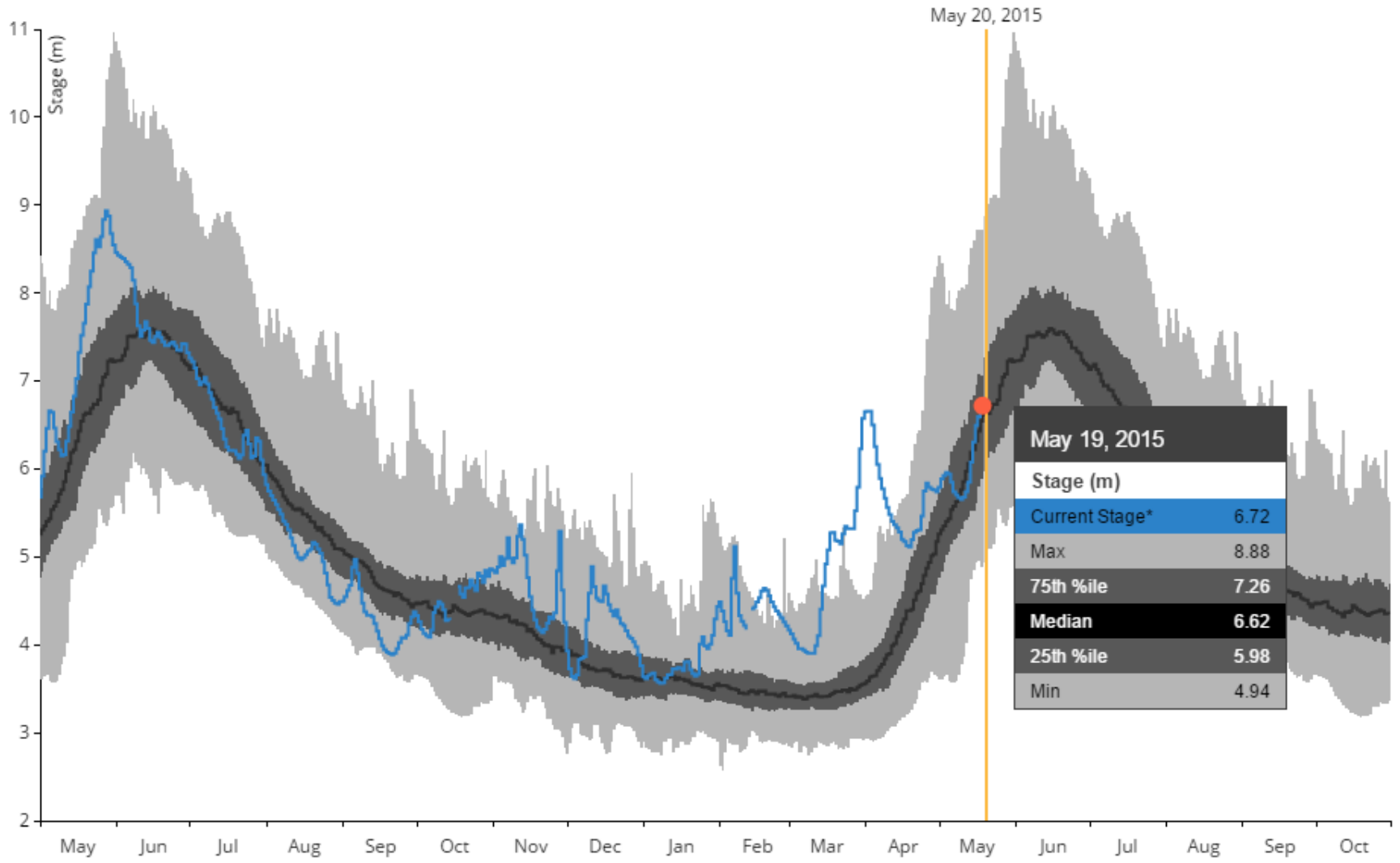


Show: **12m** 2m 2w **Mar-Aug**

Select a Year

Hope

Save Chart



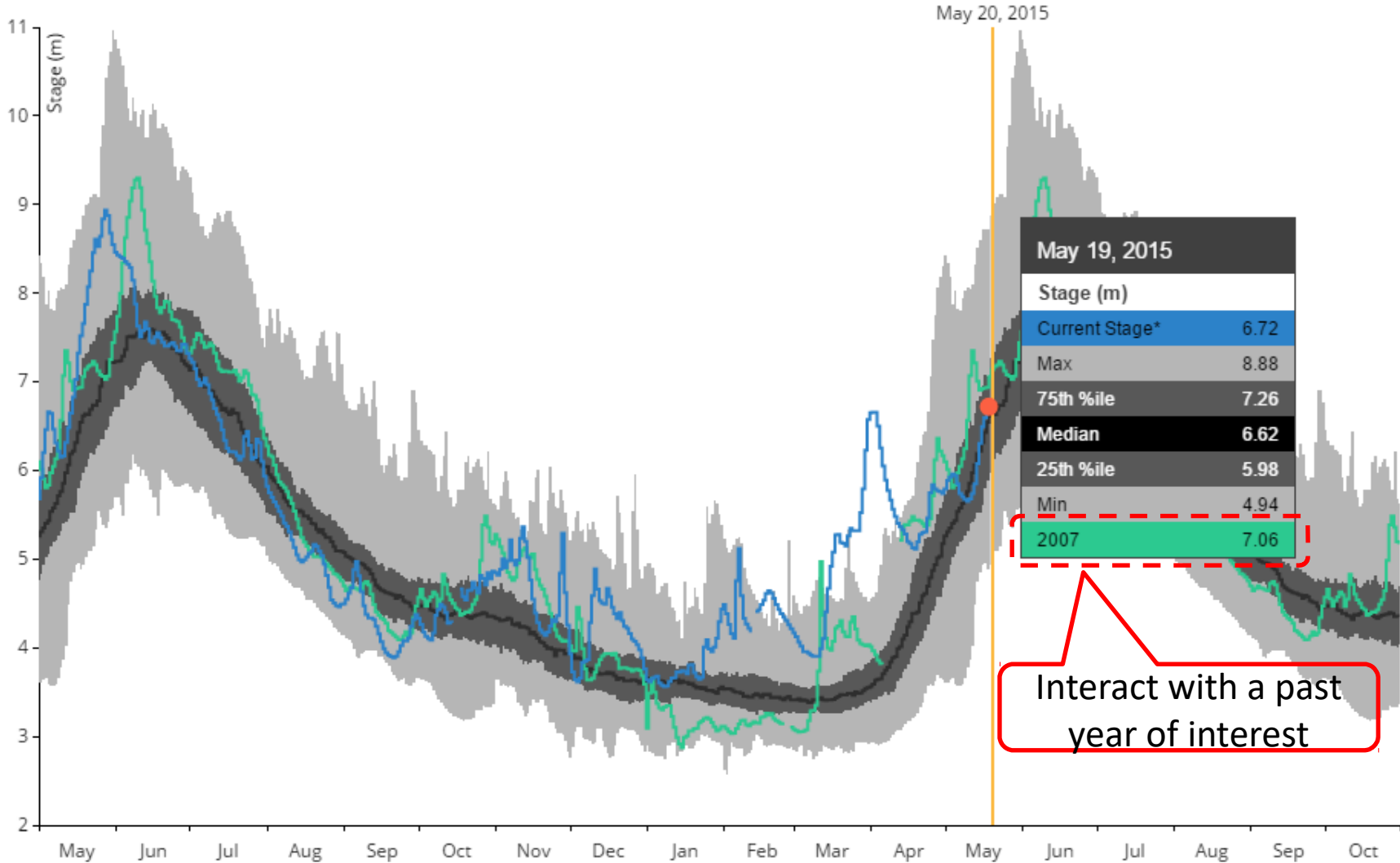
*Unverified Data

Show: **12m** 2m 2w **Mar-Aug**

2007 x

Save Chart

Hope



*Unverified Data

Interact with a past year of interest

Show:

12m

2m

2w

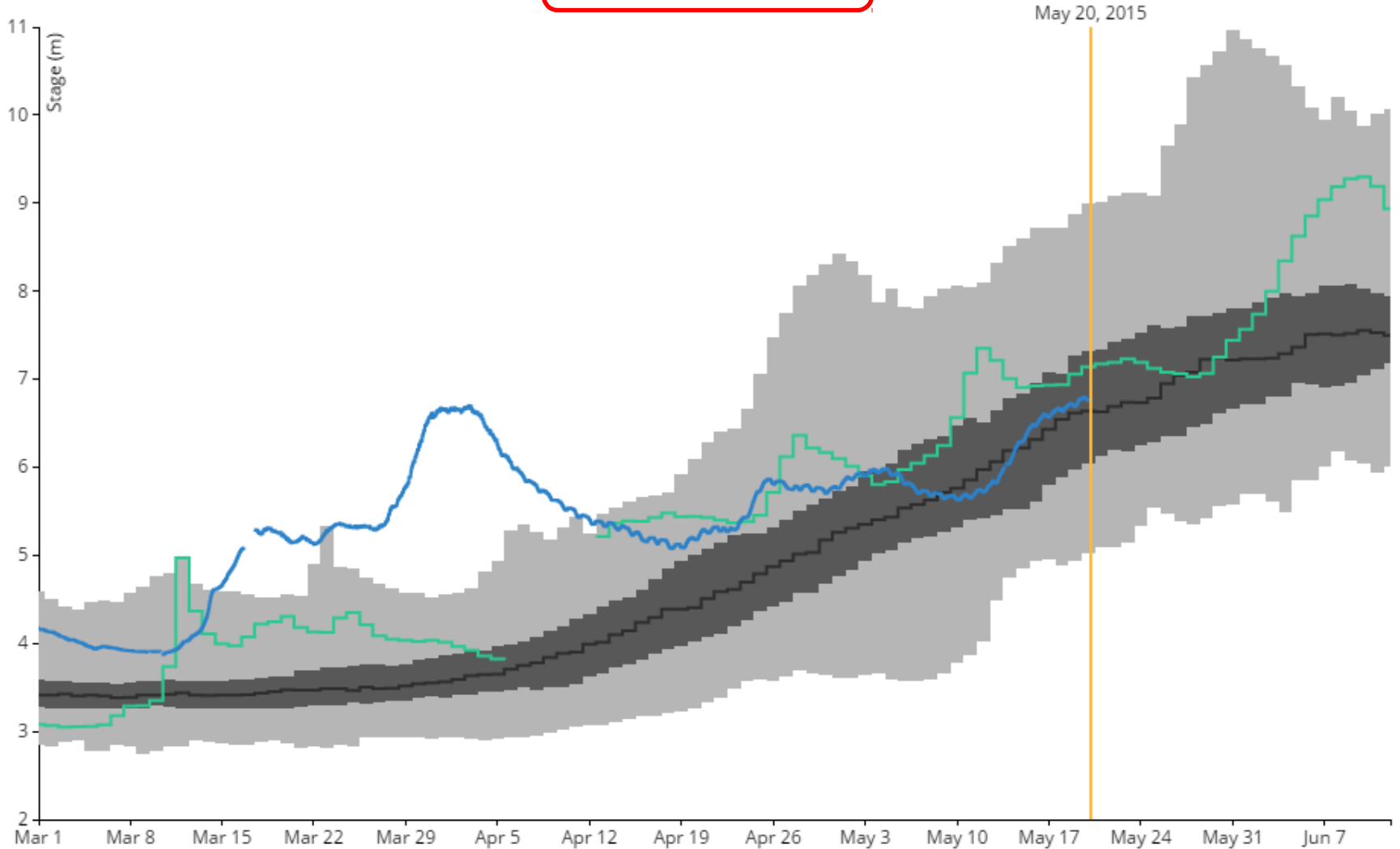
Mar-Aug

2007 x

Hope

Save Chart

Zoom Levels



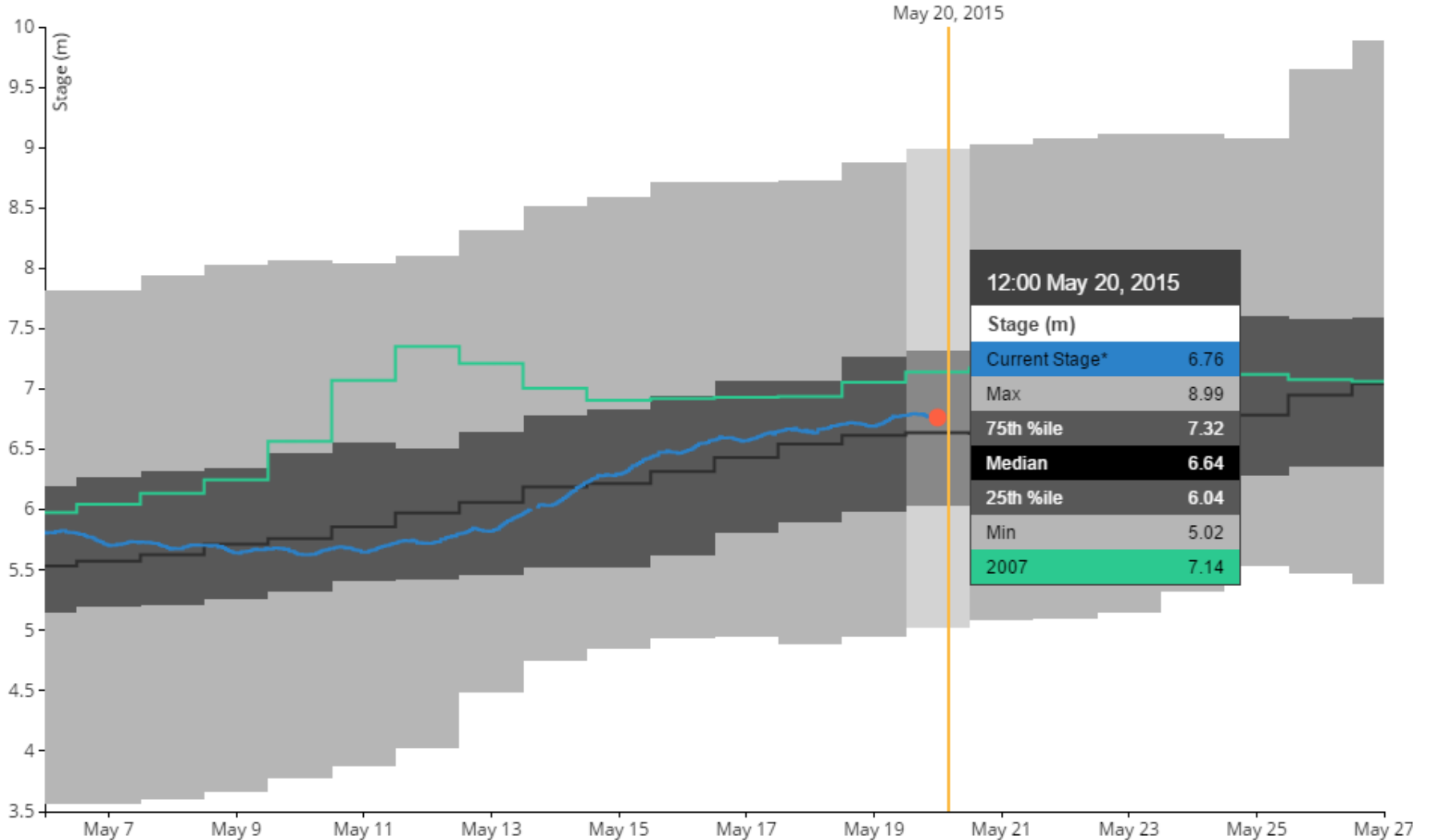
*Unverified Data

Show: 12m 2m 2w Mar-Aug

2007 x

Hope

Save Chart



*Unverified Data

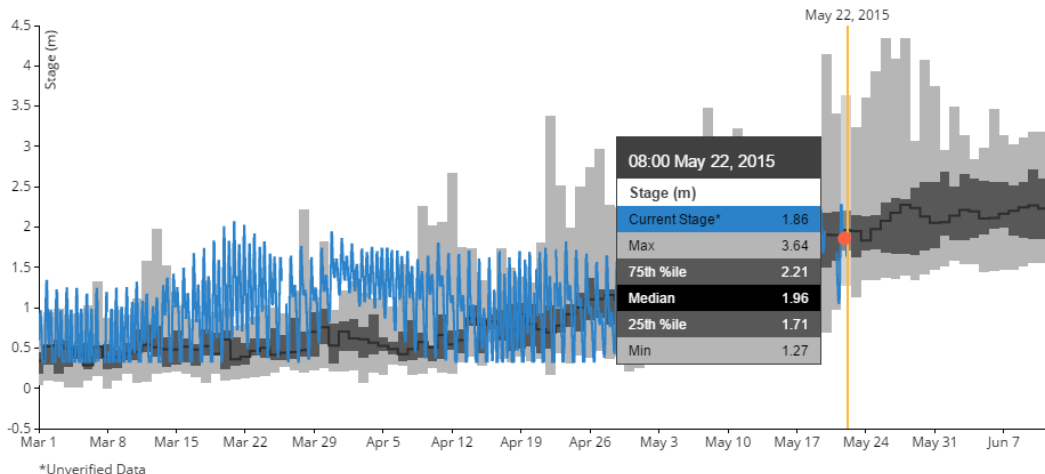
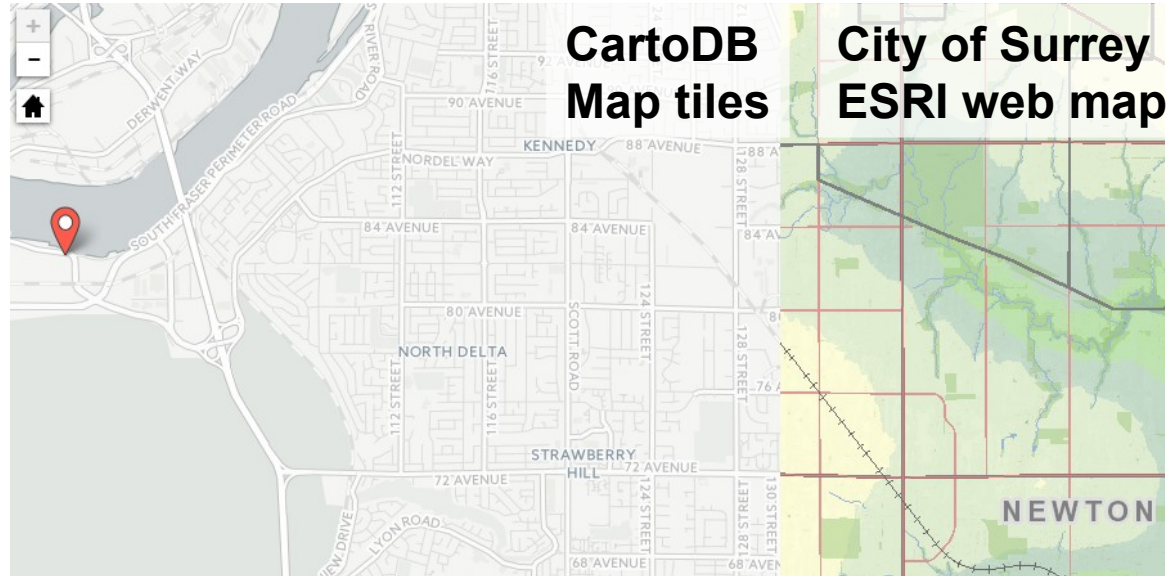
How

- (Mostly) Open data
- Web maps and interactive charts
- Clean and simple design
- Intuitive dashboard and map markers

Web Maps & Interactive Charts

No software license fees:

- Leaflet.js
- D3.js
- Linux



Data from each network presented in same manner (historical percentiles, current year observations)

Data Sources



6
locations

SCADA / ftp



2
locations

SCADA / ftp



9
locations

Web API



1
location

Web scraper

Anyone Else?



Image Source: <http://www.data.gov.bc.ca/>

Fraser River Opportunities

- Further regional collaboration & Standardization
- Predictions and forecast
- Increase open data availability
 - Develop partnerships to expand network
- Focus on meeting a specific need, and knock it out of the park

Flood Management Datasets

- IoT does not drive all data collection for flood management
- Remote Sensing Data is helpful for offline use in flood management
 - Continue to harvest new data products
 - As usage increases, value increases and costs are decreasing
 - frequency of updates and the quality of the data
 - 2009 to 2013, 2013-2016
 - Change detection
- Machine readable data catalogues part of IoT
 - Data Explorers “discover” City data
 - Crowdsourced creation of new data applications
 - UBC, SFU, UWO, BCIT,
 - New applications and data products are created

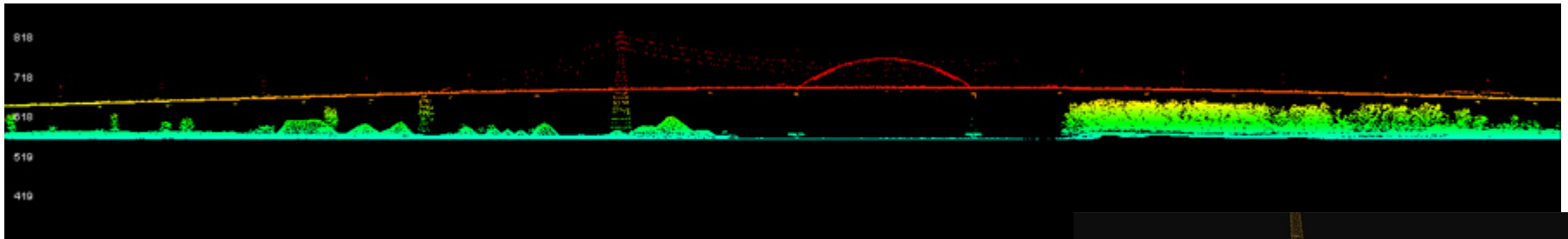


2013 Airborne Remote Sensing Program

New GIS layers were possible such as 0.5m contour lines

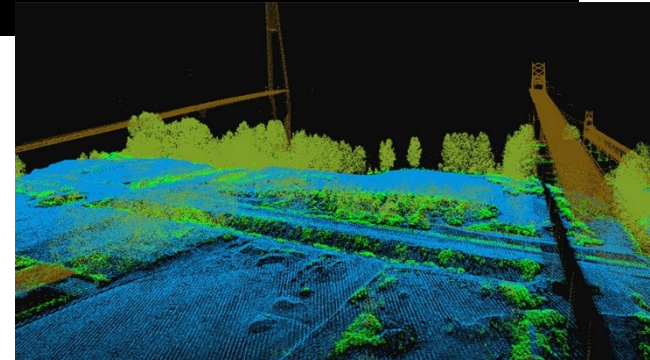
Specific projects have benefited through improved terrain models:

- Reduce amount of ground survey
- Much higher resolution of ground pick up in difficult areas such as intersections, steep slopes and highways



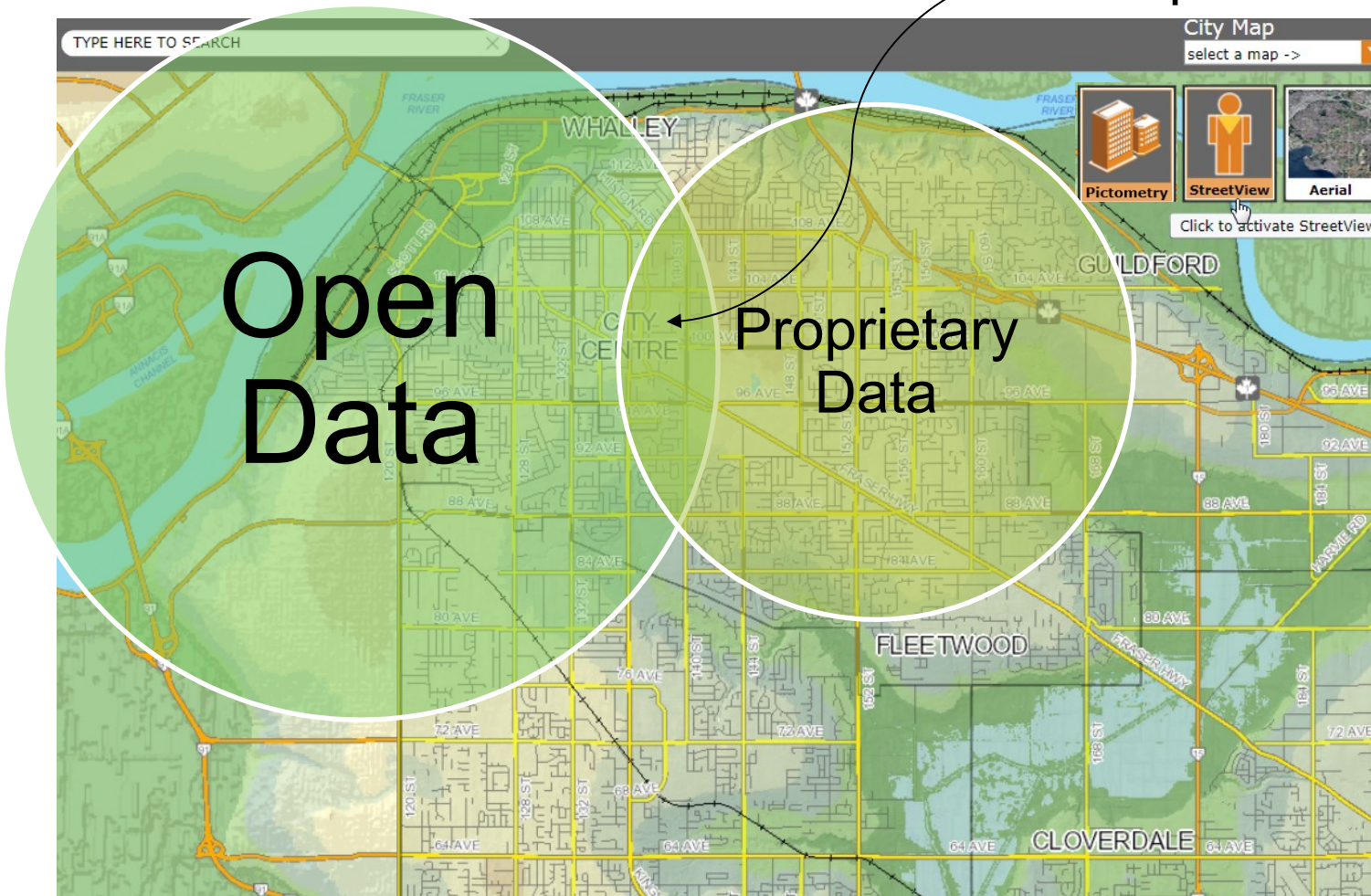
Example profile from: <http://www.qcoherent.com/products/images/image5.jpg>

Better than mashups are integrated data collections
→ Potential regional LiDAR acquisition in 2016 pending funding



Integrate Multiple Web Apps

Fact-based decisions
and performance



Remote Sensing

- Oblique Imagery
- Online database of multiple years → Essential for understanding rapid changes



Offline Examples

Providing derivative data products through Open Data:

- Erosion Identification
- Visualizing Terrain
 - Subtle terrain features

Fact-based decisions
& performance



**Airborne
LiDAR**

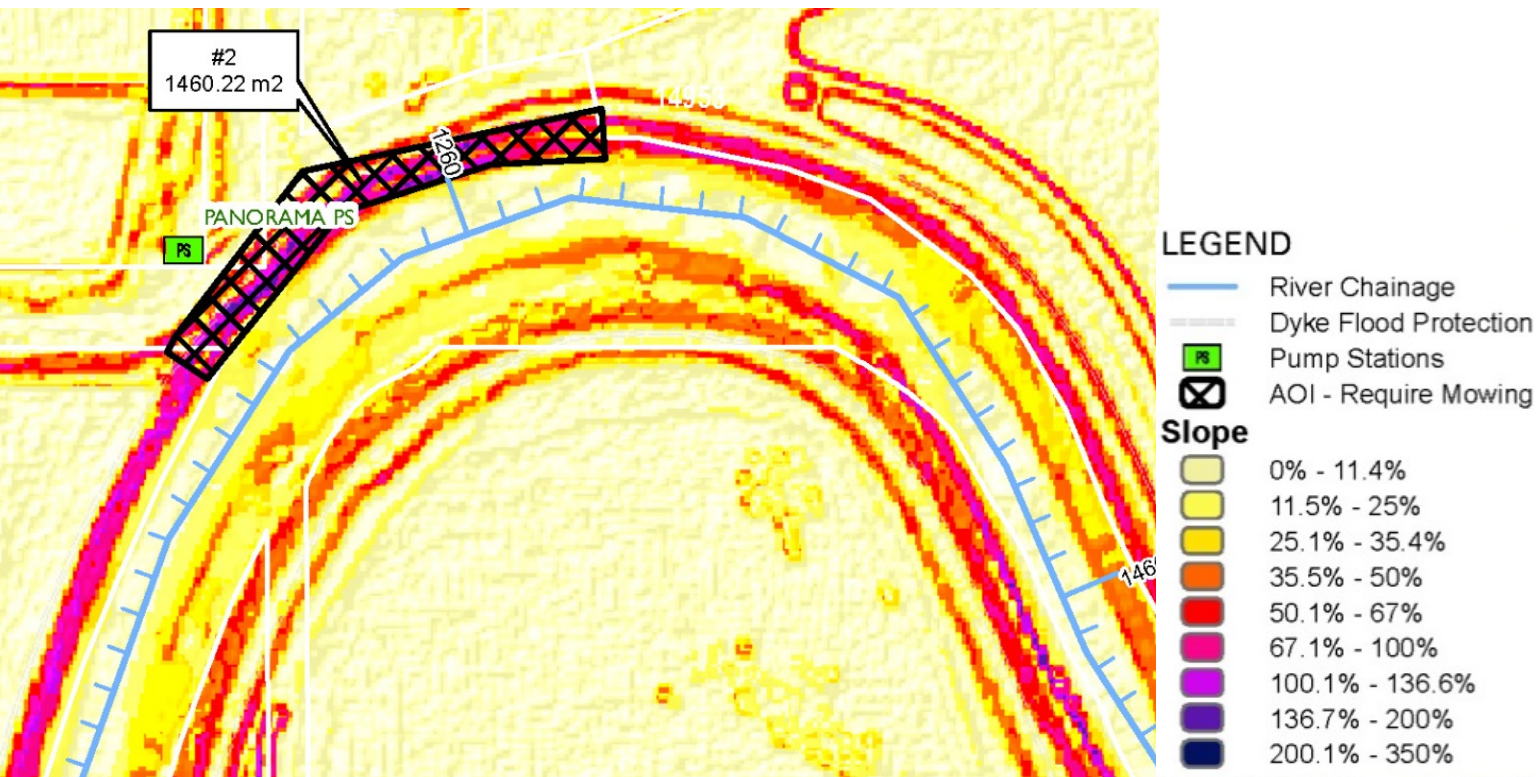
**Marine
SONAR**

10 cm hillshade model based on
25 pts/m² LiDAR point cloud

Combining Datasets

LiDAR & SONAR improves understanding of:

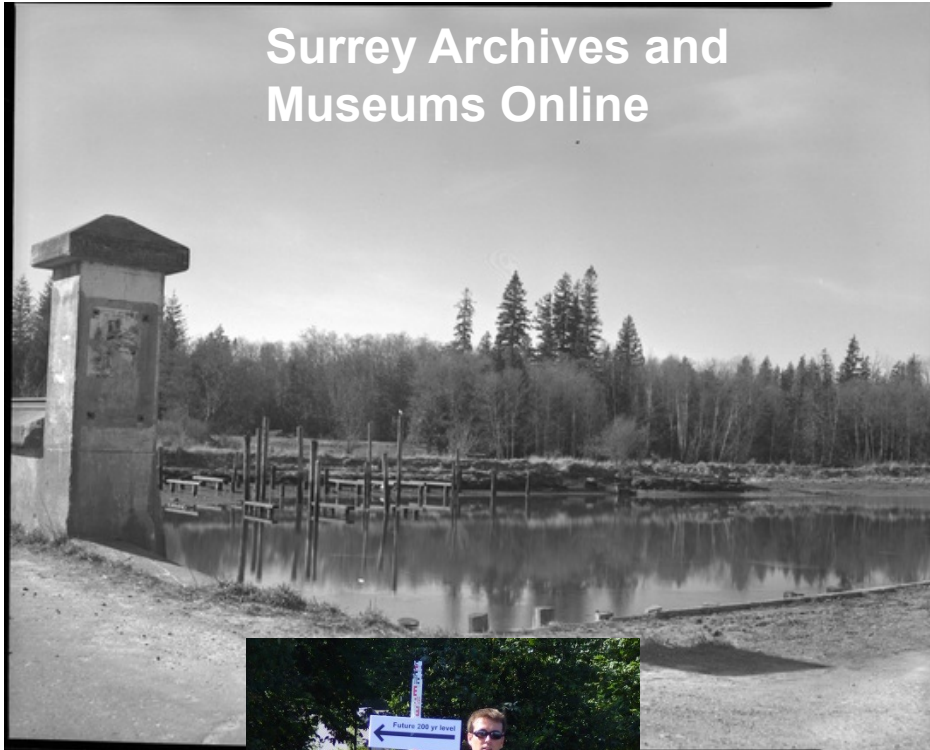
- Slope erosion
- Geotechnical Stability



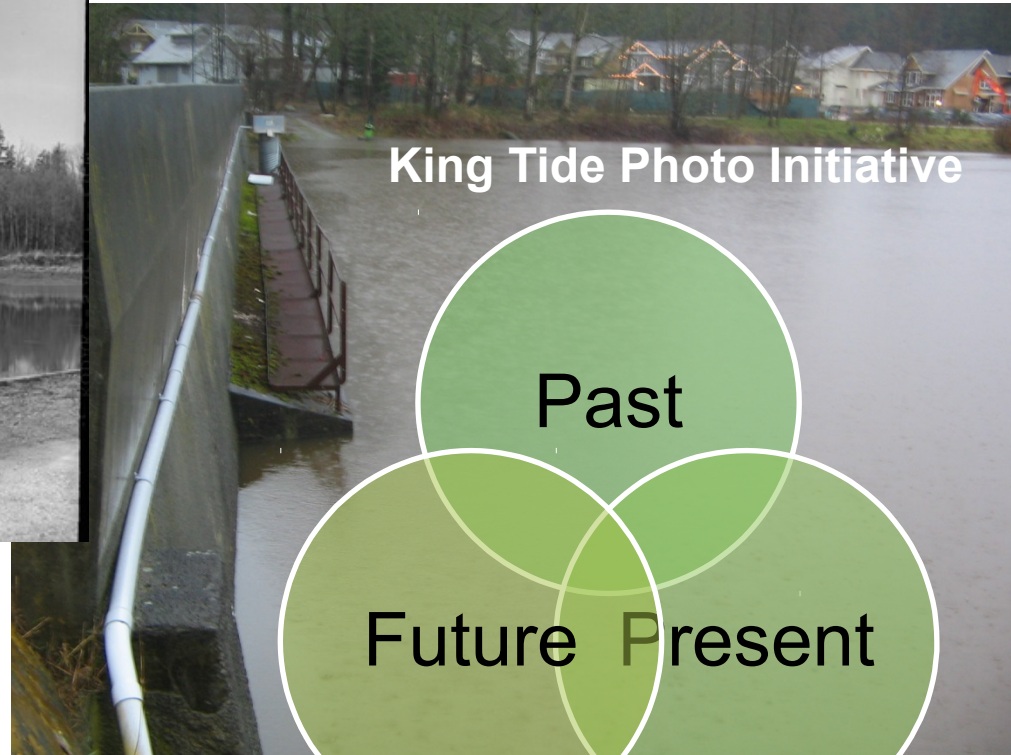
Community Engagement

Building a Narrative

Surrey Archives and
Museums Online



King Tide Photo Initiative



Past

Future Present

3D Printing

- Combination of many different datasets available as Open Data
- Tool for public engagement on sea level rise



Future

- Increased standardization & online data availability
- Improved emergency communication & decision making
 - Less central command & control of information
- More mashups of regional, national and global data
 - Develop partnerships to expand network
- 4th dimension of time increasingly important with Climate Change
- Crowdsourcing analysis through academia & citizen data explorers
 - Create value in positive and unforeseen ways
- Improved citizen interaction & engagement in flood management

Acknowledgements

- Foundry Spatial (Ben Kerr, Chris Davis, Hailey Eckstrand)
- Delta Corp (Hugh Fraser, Jesse Hausner) for setting up data transfer
- CoS GIS staff for Open Data Initiatives
- CoS Operations Staff who maintain data feeds

Questions



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