Building Full Geodatabase Functionality for a Wastewater Collection System

by
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Abstract

The Leucadia Wastewater District's (LWWD) GIS system was built upon a legacy of shape files linked to database tables full of operational, engineering, and management data. LWWD migrated to geodatabase format, but did not implement all of the new tools necessary to take full advantage of the powerful functionality available to wastewater utilities.

Infrastructure Engineering Corporation (IEC) re-designed the geodatabase data model for LWWD and added geometric network functionality, attribute domains, and more efficient table joins. The end result is a streamlined geodatabse that eliminates data redundancy, preserves data accuracy and integrity, and serves as a central data repository for all of LWWD's wastewater collection system data. The resulting geodatabse is a true interdepartmental wastewater collection system tool with the potential to serve as a basis for future enterprise asset management and financial control projects.

Bio

Scott Humphrey, P.E.

Mr. Humphrey has a civil engineering background with an emphasis on water and wastewater hydraulic modeling and master planning. He is knowledgeable in computer hydraulic modeling using WaterCAD, SewerCAD, H20NET, H2OMap Sewer, H2OMap Water, INFOSewer, INFOWater, HYDRA, and XP-SWMM. He is knowledgeable in Geographic Information Systems (GIS) using ArcGIS (ArcINFO) and Autodesk Map.

Bio

Jon Wells, P.E.

Mr. Wells has seven years of experience in master planning and hydraulic analysis. He has extensive experience and knowledge in the integration of GIS tools with hydraulic modeling software. He is proficient in wastewater hydraulic modeling using SewerGEMs, H20Map Sewer, InfoSWMM, and MOUSE software with an emphasis in dynamic flow studies. He is knowledgeable in water hydraulic modeling using H20Net, H20MapWater, and InfoWater. In addition to his experience with hydraulic analysis, Mr. Wells has experience with user rate studies, connection fee studies, and cost-of-service analysis for water and wastewater utilities.

LEUCADIA WASTEWATER DISTRICT

IEC

Bio

Leo Schempp, LWWD

Mr. Schempp is the Field Services Manager for the Leucadia Wastewater District. He has extensive operational experience in wastewater collection systems and treatment plants. He is a former Naval officer and a graduate of the University of New Mexico, BS Chemical Engineering.

Project Background

➢ Leucadia Wastewater District (LWWD), Carlsbad, CA

➢ GIS developed as an "evolution" of shape files imported into a personal Geodatabase.

➢ Numerous table joins to external access databases.

➢ Data was stored in multiple locations across LWWD server(s).

Project Background (cont.)

➢ IEC was originally contracted to create a wastewater system hydraulic model using the latest GIS data set.

- The conversion process discovered a major network connectivity issue.

➢ IEC was contracted as a side task to evaluate and make recommendations to "enhance" the District's GIS.

Task 1 - Evaluation

- Feature datasets did not exist
  - i.e. no ability to develop Geometric network
- No attribute domains
- Annotation was not feature linked
- Numerous table joins to external access databases.
- Data was stored in multiple locations across LWWD server(s).

Task 2 – Update GIS

➢ Create feature datasets

- Develop Geometric Network

- Organize data:

  • Landbase

  • Wastewater

  • Storm

  • Miscellaneous

➢ Through the Geometric Network we were able to fix spatial errors and develop full network connectivity. Used Flip Lines routine from team Water.

➢ Create attribute domains

- Diameter

- Material

- Basin

➢ Tables were consolidated into geodatabase.

➢ Data was stored in one location (i.e. personal geodatabase).

Contents | Preview | Metadata

Name	Type
Landbase	Personal Geodatabase Feature Data...
Miscellaneous	Personal Geodatabase Feature Data...
Stormwater	Personal Geodatabase Feature Data...
Topo	Personal Geodatabase Feature Data...
Wastewater	Personal Geodatabase Feature Data...
PI_PLN_L	Personal Geodatabase Table
tblLWD_Easements	Personal Geodatabase Table
tblLWD_FoodEstab	Personal Geodatabase Table
tblLWD_PLUGTRAP	Personal Geodatabase Table
tblLWD_SPCMAINT	Personal Geodatabase Table
tblLWD_SSO	Personal Geodatabase Table

GIS_Data
  Databases
  Facilities
    LWD_sewer
      Landbase
        CityBnd
        LWD_Parcel
        LWD_Roads
        lwdbound
        mapsheet
      Miscellaneous
        ptCarEnc_RawFood
      Stormwater
        CBD_BatiquitosDetentionBasin
        CBD_BatiquitosStormConduit
        CBD_BatiquitosStormStructures
        CBD_BatiquitosSWPSites
        ENC_Catchbasin
        ENC_Cleanout
        ENC_DischargePoint
        ENC_Fitting
        ENC_GravityMain
        ENC_Lateral
        ENC_NetworkStructure
        ENC_StormDrainStructure
      Topo
        TOPO_Index
        TOPO_Intermediate
      Wastewater
        Anno_2_31
        NodesAnno
        Traps___PlugsAnno
        WW_Geo_Net
        WW_Geo_Net_Junctions
        WW_Nodes
        WW_Pipes
      PI_PLN_L
      tblLWD_Easements
      tblLWD_FoodEstab
      tblLWD_PLUGTRAP
      tblLWD_SPCMAINT
      tblLWD_SSO
  Facilities_old
  Sussex Data
  LWD_Frank

Linking of Scanned As-built images to GIS

➤ LWWD had an extensive third party image database for their scanned "as-built" record drawings.

➤ .tif images were stored in separate folders grouped by project.

➤ Image table from third party vendor was imported into Geodatabase and link was created through .mxd document properties and layer display properties.

Linking of Scanned As-built images to GIS

Linking of Scanned As-built images to GIS

File Edit View Insert Selection Tools Window Help

1:685

InfoWater

InfoSWMM

Refresh Output Data

Editor ▾   Task: Create New Feature   Target:
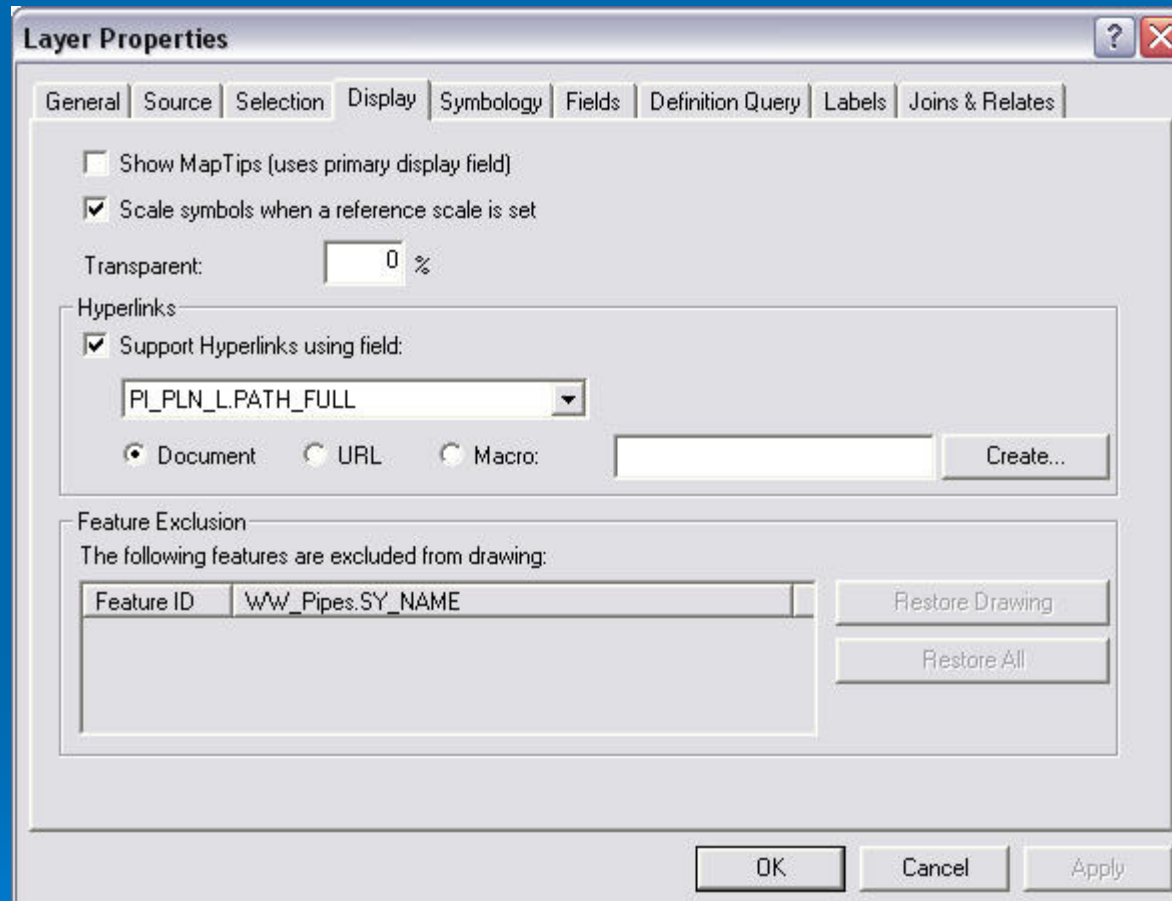
LWWD Layers
- ☑ Manhole Labels
  - ☑ Default Annotation Class
- ☑ Food Establishment's Layer
- ☐ Mapbook Pages
- ☑ LWD Boundaries
  - District Boundary
  - Sphere of Influence
- ☑ Restaurants
- ☑ Traps & Plugs
  - Type
  - ● PLUG
  - ● TRAP
- ☑ Nodes
  - ◆ <all other values>
  - TYPE
  - Summit Manhole
  - Cleanout
  - Manhole
  - Split
  - Pump
- ☑ Links
  - ☐ Forcemains
  - ☑ Pipes - Scans
  - ☑ Pipes - Small Scale
    - <all other values>
    - Diameter (inches)
    - 6
    - 8
    - 9
    - 10
    - 12
    - 14
    - 15

Display Source Selection

368-2C-29.tif - Windows Picture and Fax Viewer

PROFILE SEWER LINE (CONT)

RANCHO SANTA FE ROAD

PLAN SEWER LINE (CONT)

1

2

0-1620

PRIVATE

Attribute Operation Annotation Contour

Drawing ▾   Arial   10   B I U

Message Validation Result

Message Validation Result

Pipes ...

6260516.665 1975310.241 Feet
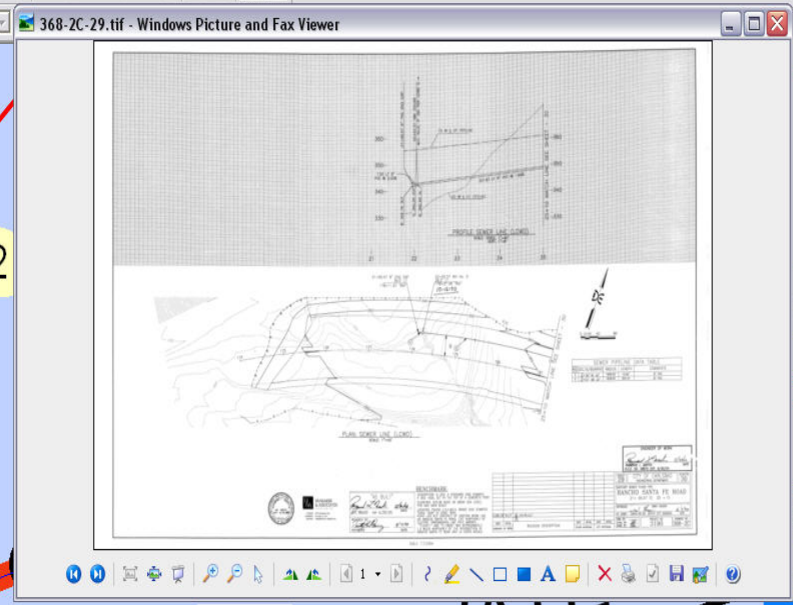
Hydraulic Model Creation

➤ Direct Link to GDB through InfoSWMM from MWHSoft, Inc.

- IDs and Descriptions from GIS match model

- Facility updates are easily incorporated

- Model results are easily exported back to GIS for presentation

Hydraulic Model Results
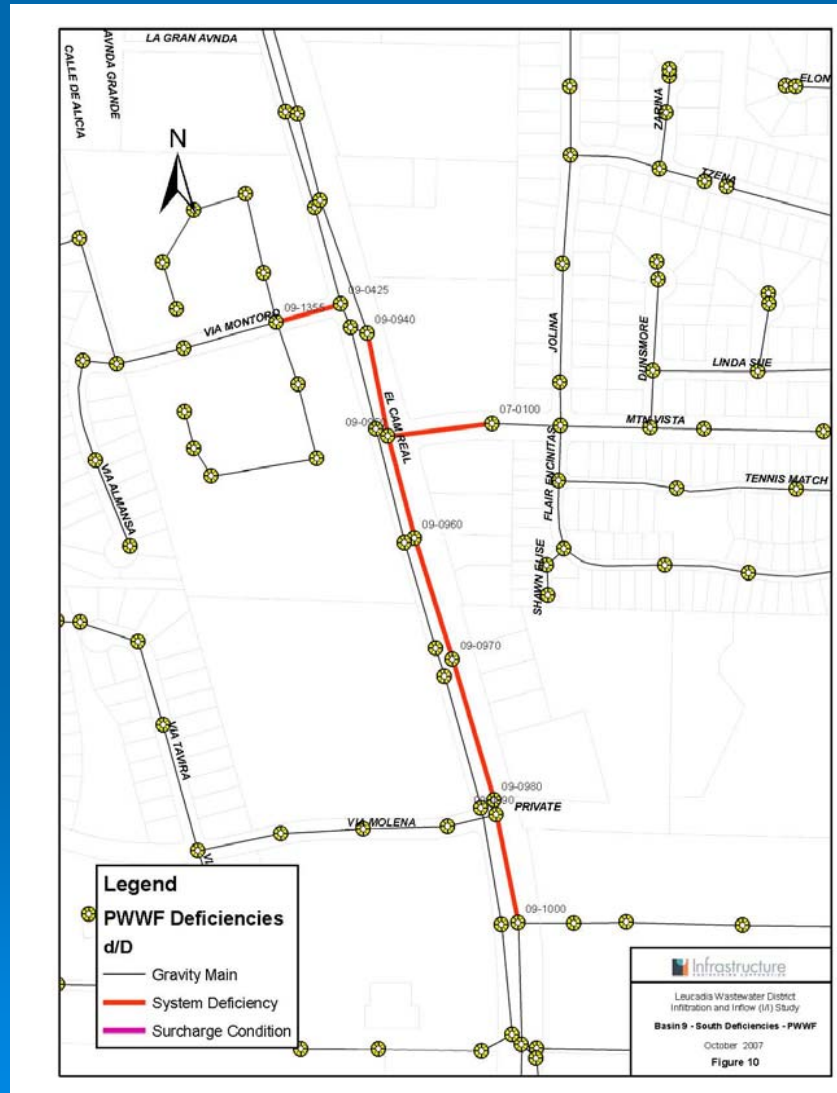
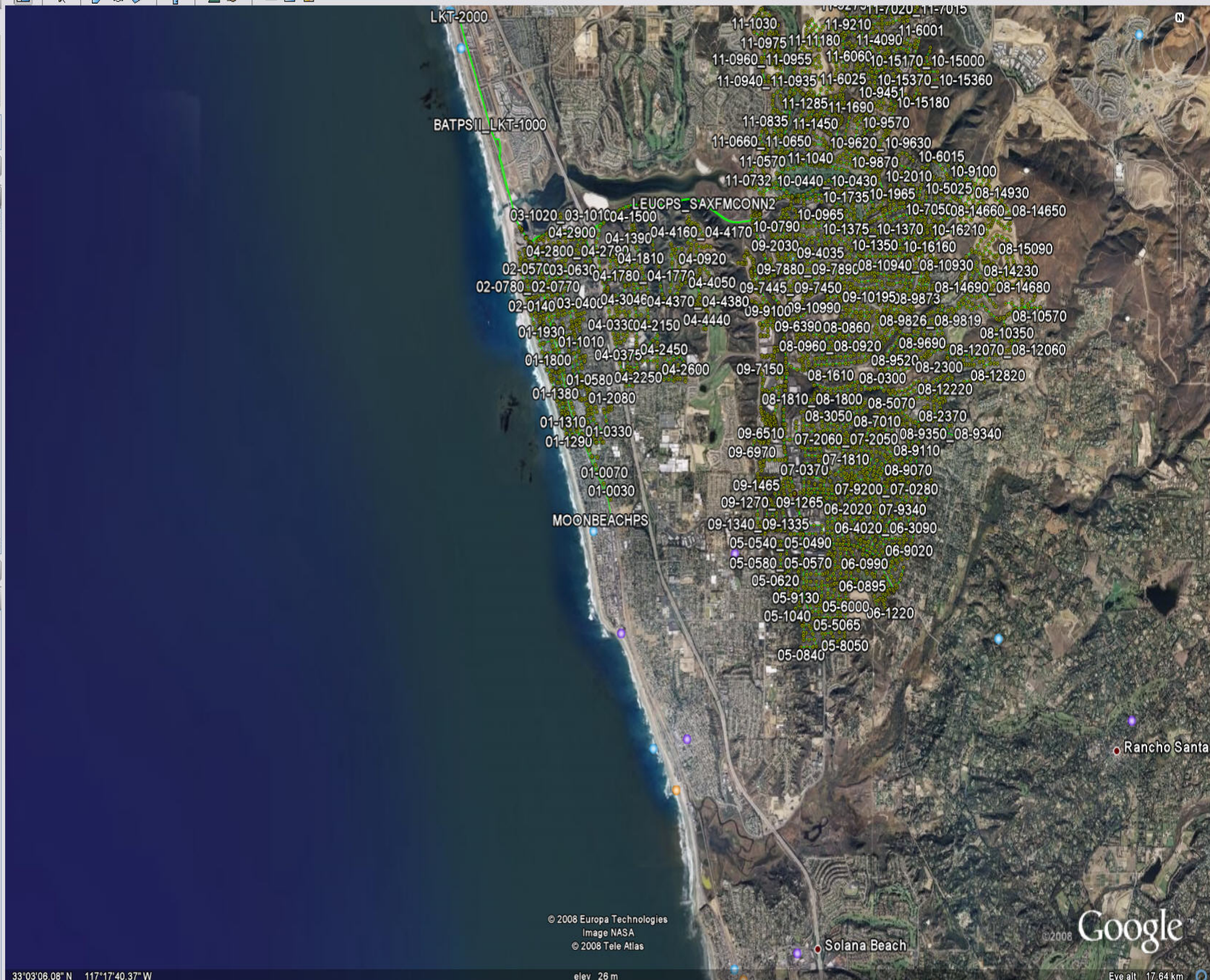# "Visual" Applications

➢ Google Earth
- Export to KML

Conclusions

➢ GDB builds in tremendous flexibility and efficiency if set up properly
➢ Creates central repository for spatial data and relational data
➢ Client/public can "visualize"
➢ Easily updated
➢ Can serve multiple business needs
  - CMMS
  - Hydraulic Modeling
  - Sewer System Management
  - Mapping

Contact Information

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