Test driving PostGIS

With the release of Update 1 (summer 2018) Bentley Map has added PostGIS support. PostGIS is an extension of the PostgreSQL database, which proclaims to be “the world’s most advanced open source relational database”. Open source has always had a lot of faithful followers in the geospatial community, and many of Bentley’s users have been asking for it. Now that it is here, let’s take it for a quick test drive.

Note that even though I consider myself an experienced Bentley Map user and I have a decent mileage with spatial database extensions in Oracle and SQL Server, I am a novice when it comes to PostGIS and the database is builds upon, PostgreSQL. For this test drive, I completely rely on internet sources, which I will list at the end of this article.

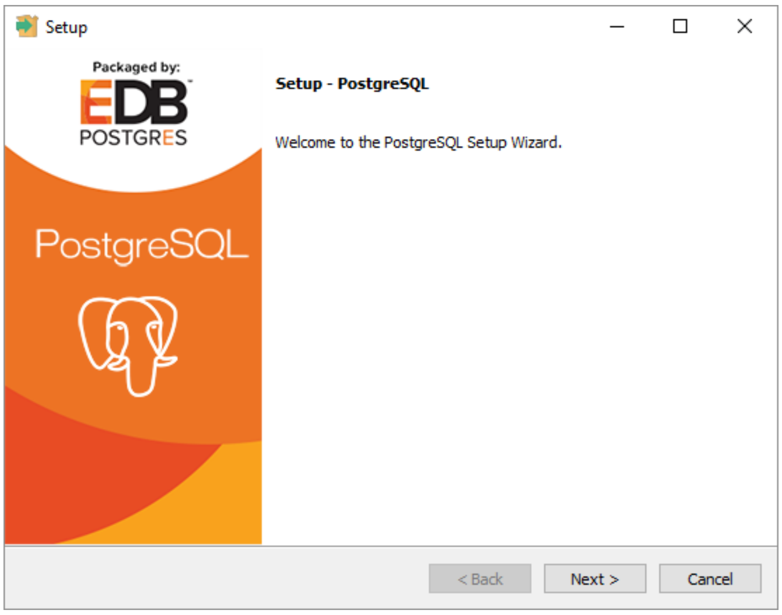
These are the products I have used:

- Bentley Map CONNECT Edition Update 1 (already installed)
- PostgreSQL 10.5 for Windows 64 bit
- PostGIS Bundle 2.4.4 for the above PostgreSQL version

Installing PostgreSQL

The first thing I will need to do is install and configure the PostgreSQL database. There are several graphical installers to choose from. Following the installation instructions I found on-line, I downloaded the *EnterpriseDB* Windows 64-bit installer for PostgreSQL 10.5. (I am not too sure about the 10.5, as most of the instructions seem to be for PostgreSQL 9.5, but let’s see how things pan out).

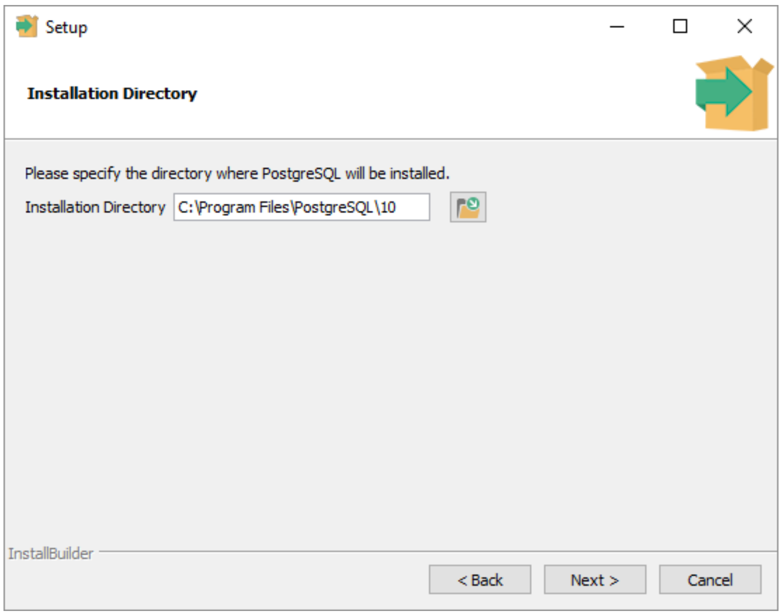
Double-clicking the PostgreSQL *EnterpriseDB* installer opens your average setup wizard. For this test drive I am going to rely on the standard options, which my internet sources suggest should be sufficient:



Setup - PostgreSQL

Welcome to the PostgreSQL Setup Wizard.

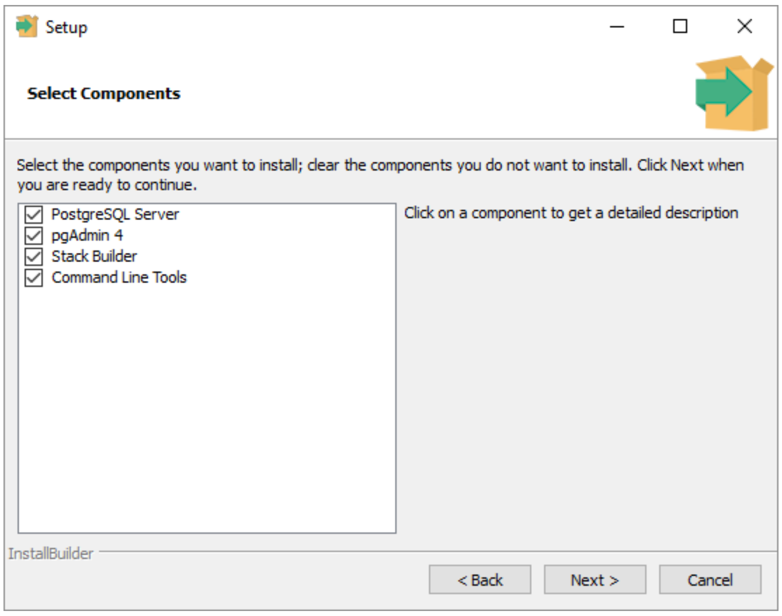
Installation folder (which I will leave as is):



Please specify the directory where PostgreSQL will be installed.

Installation Directory: C:\Program Files\PostgreSQL\10

Components (leaving all selected):

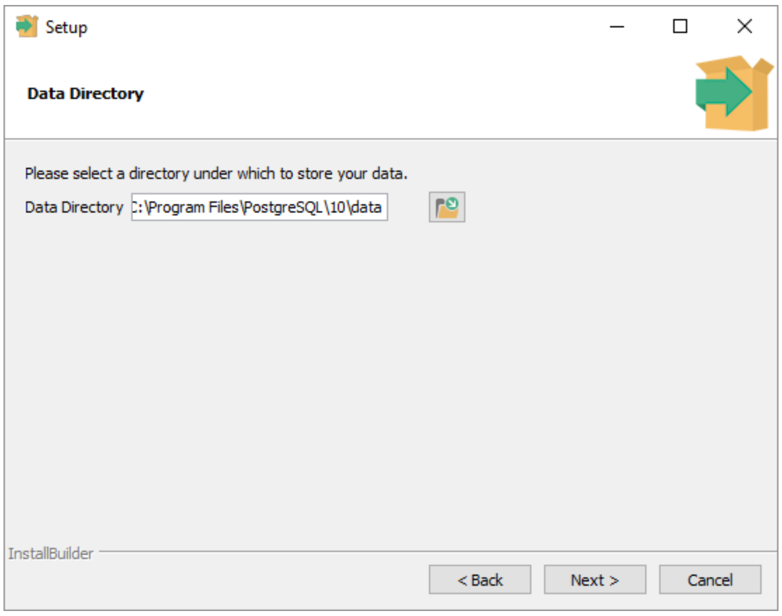


Select the components you want to install; clear the components you do not want to install. Click Next when you are ready to continue.

- ☑ PostgreSQL Server
- ☑ pgAdmin 4
- ☑ Stack Builder
- ☑ Command Line Tools

Click on a component to get a detailed description

Data Directory (where I assume the database files will go):

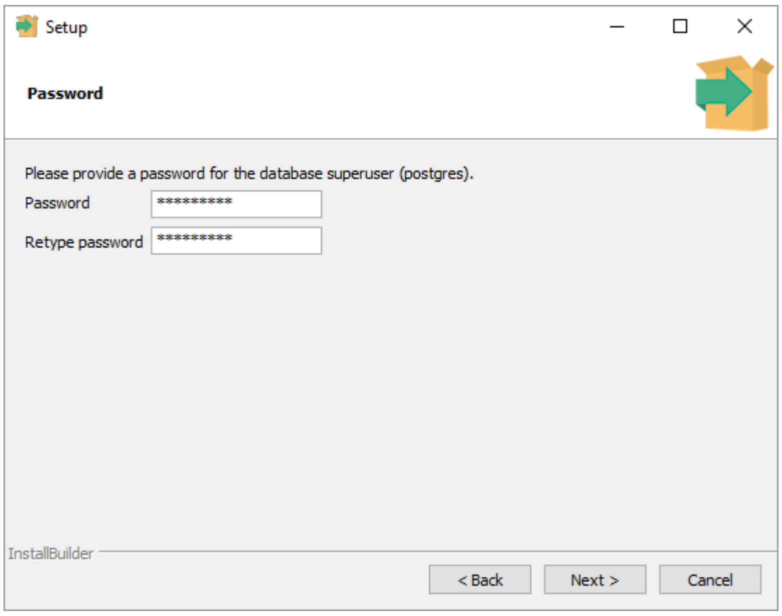


Data Directory

Please select a directory under which to store your data.

Data Directory C:\Program Files\PostgreSQL\10\data

Database password (obviously important in real life situations):



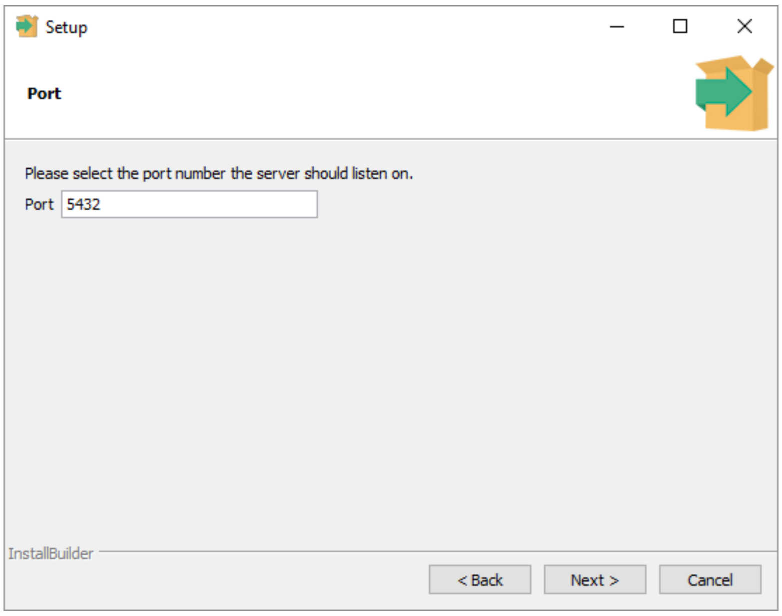
Password

Please provide a password for the database superuser (postgres).

Password **********

Retype password **********

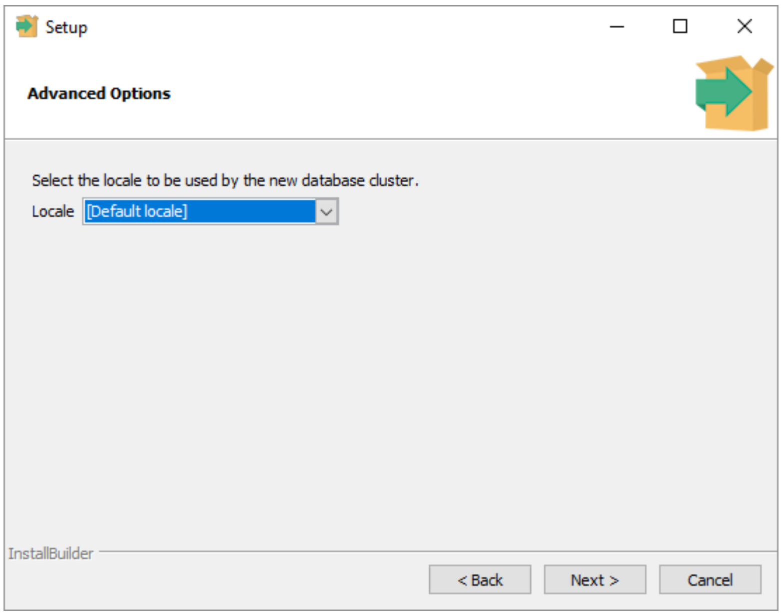
Port (again important, I am assuming the default will work for me in this case):



Please select the port number the server should listen on.

Port 5432

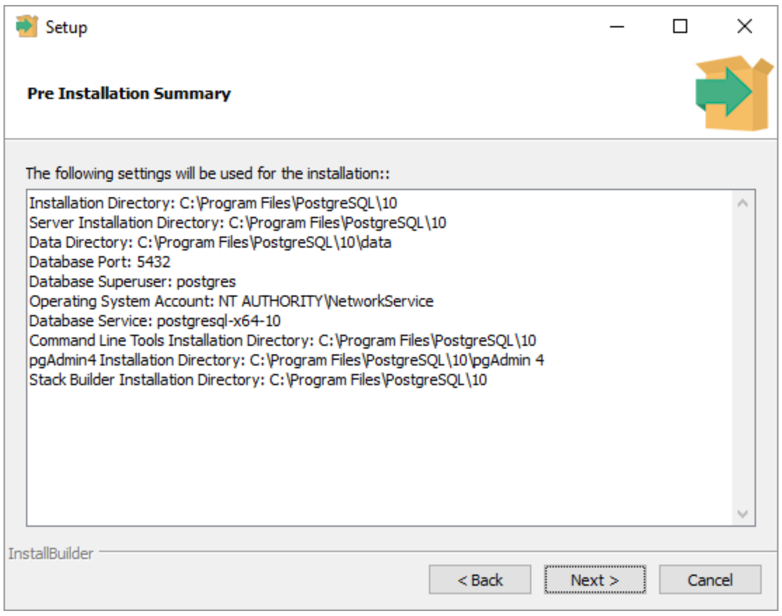
Advanced Options (American English in this case works for me):



Select the locale to be used by the new database cluster.

Locale [Default locale]

Summary of the settings…

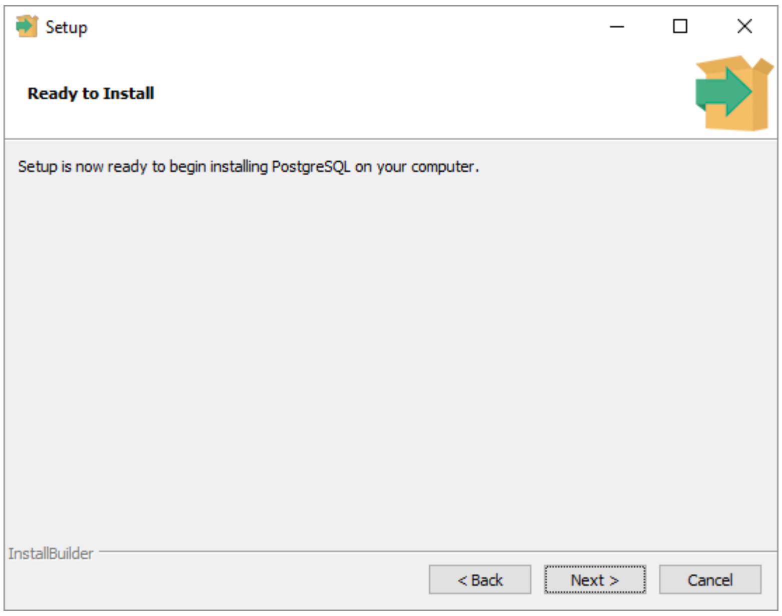


Pre Installation Summary

The following settings will be used for the installation::

```
Installation Directory: C:\Program Files\PostgreSQL\10
Server Installation Directory: C:\Program Files\PostgreSQL\10
Data Directory: C:\Program Files\PostgreSQL\10\data
Database Port: 5432
Database Superuser: postgres
Operating System Account: NT AUTHORITY\NetworkService
Database Service: postgresql-x64-10
Command Line Tools Installation Directory: C:\Program Files\PostgreSQL\10
pgAdmin4 Installation Directory: C:\Program Files\PostgreSQL\10\pgAdmin 4
Stack Builder Installation Directory: C:\Program Files\PostgreSQL\10
```

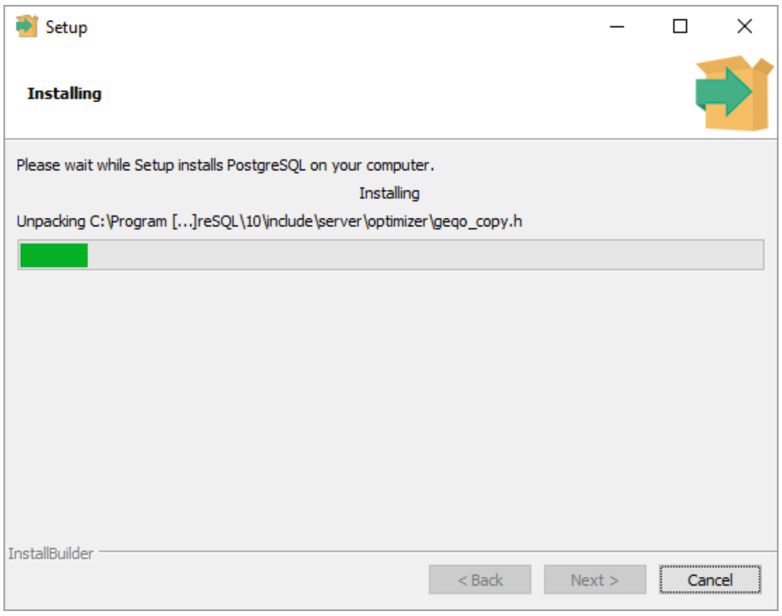
And off we go…



Ready to Install

Setup is now ready to begin installing PostgreSQL on your computer.

In progress…

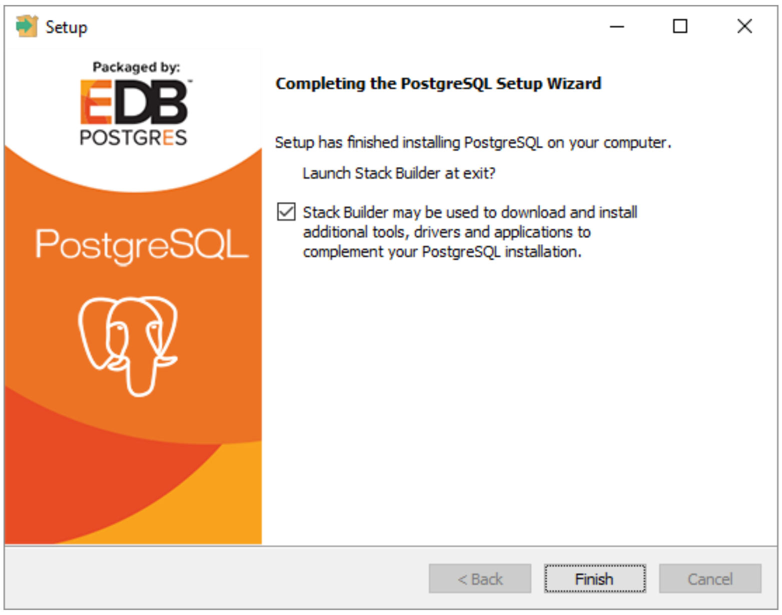


Please wait while Setup installs PostgreSQL on your computer.

Installing

Unpacking C:\Program […]reSQL\10\include\server\optimizer\geqo_copy.h

In the final stage of the installation, the installer asks whether to launch the so-called *Stack Builder*. This *Stack Builder* is what we are going to need to install PostGIS.



Completing the PostgreSQL Setup Wizard

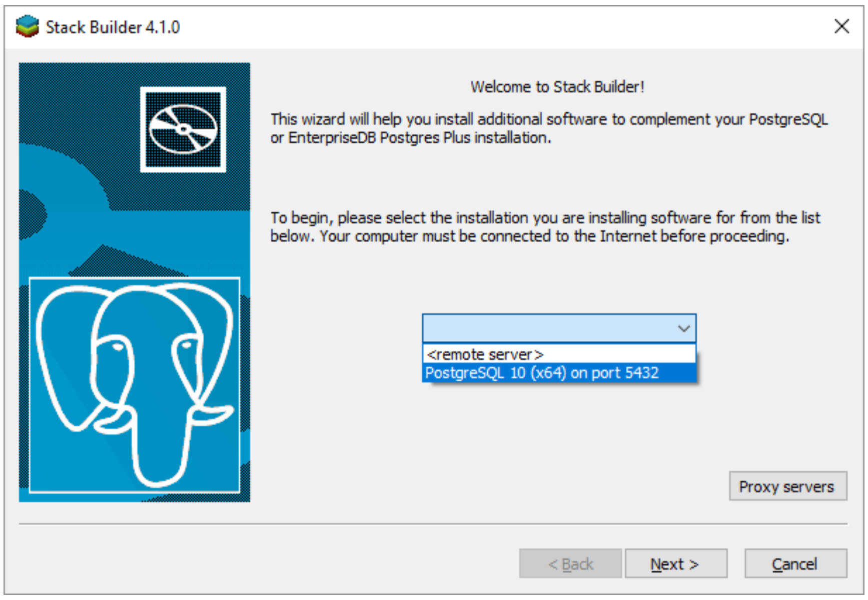
Setup has finished installing PostgreSQL on your computer.

Launch Stack Builder at exit?

☑ Stack Builder may be used to download and install additional tools, drivers and applications to complement your PostgreSQL installation.

Adding PostGIS

With the PostgreSQL database freshly installed, the launched Stack Builder is going to help add and activate the PostGIS part:


Stack Builder 4.1.0

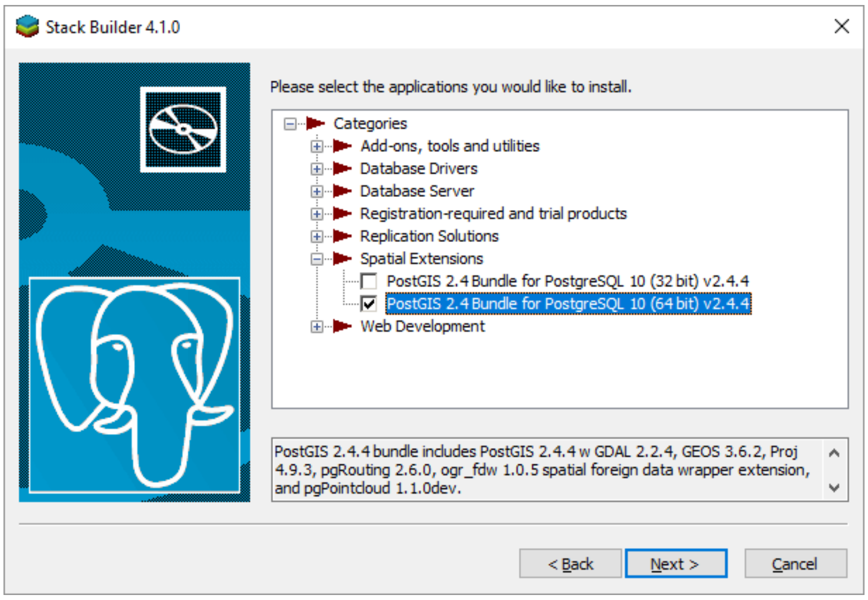
Welcome to Stack Builder!

This wizard will help you install additional software to complement your PostgreSQL or EnterpriseDB Postgres Plus installation.

To begin, please select the installation you are installing software for from the list below. Your computer must be connected to the Internet before proceeding.

<remote server>
PostgreSQL 10 (x64) on port 5432

This opens the list with options/extensions, and under Spatial Extensions I find the 64-bundle for PostGIS.

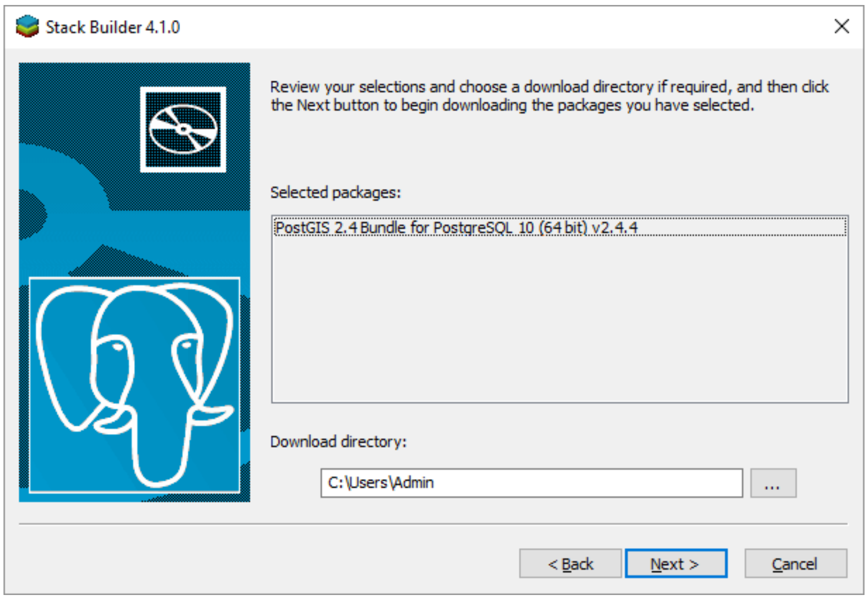

Stack Builder 4.1.0

Please select the applications you would like to install.

- Categories
  - Add-ons, tools and utilities
  - Database Drivers
  - Database Server
  - Registration-required and trial products
  - Replication Solutions
  - Spatial Extensions
    - [ ] PostGIS 2.4 Bundle for PostgreSQL 10 (32 bit) v2.4.4
    - [✓] PostGIS 2.4 Bundle for PostgreSQL 10 (64 bit) v2.4.4
  - Web Development

PostGIS 2.4.4 bundle includes PostGIS 2.4.4 w GDAL 2.2.4, GEOS 3.6.2, Proj 4.9.3, pgRouting 2.6.0, ogr_fdw 1.0.5 spatial foreign data wrapper extension, and pgPointcloud 1.1.0dev.

… and ready.



Stack Builder 4.1.0

Review your selections and choose a download directory if required, and then click the Next button to begin downloading the packages you have selected.

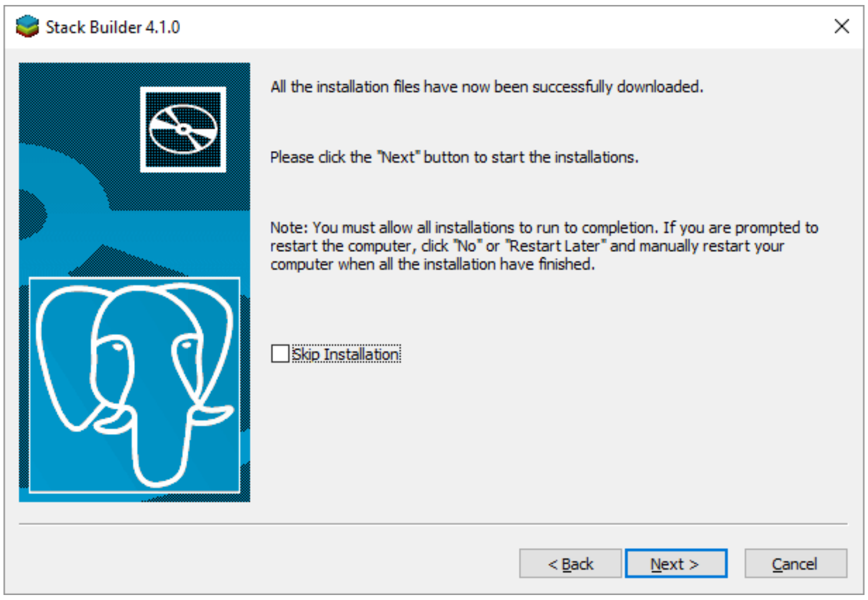
Selected packages:

PostGIS 2.4 Bundle for PostgreSQL 10 (64 bit) v2.4.4

Download directory:

C:\Users\Admin

After downloading the installation package, it is ready to install PostGIS.



Stack Builder 4.1.0

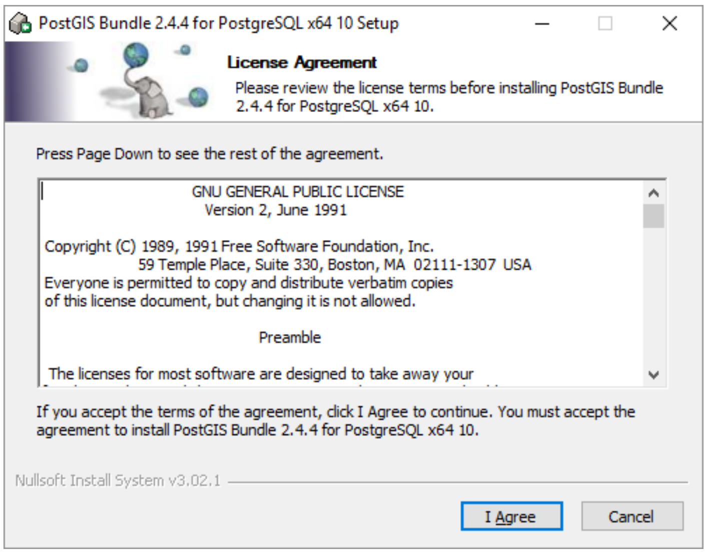
All the installation files have now been successfully downloaded.

Please click the "Next" button to start the installations.

Note: You must allow all installations to run to completion. If you are prompted to restart the computer, click "No" or "Restart Later" and manually restart your computer when all the installation have finished.

☐ Skip Installation

PostGIS, coming from a different source than PostgreSQL, has its own license to accept.


PostGIS Bundle 2.4.4 for PostgreSQL x64 10 Setup

License Agreement

Please review the license terms before installing PostGIS Bundle 2.4.4 for PostgreSQL x64 10.

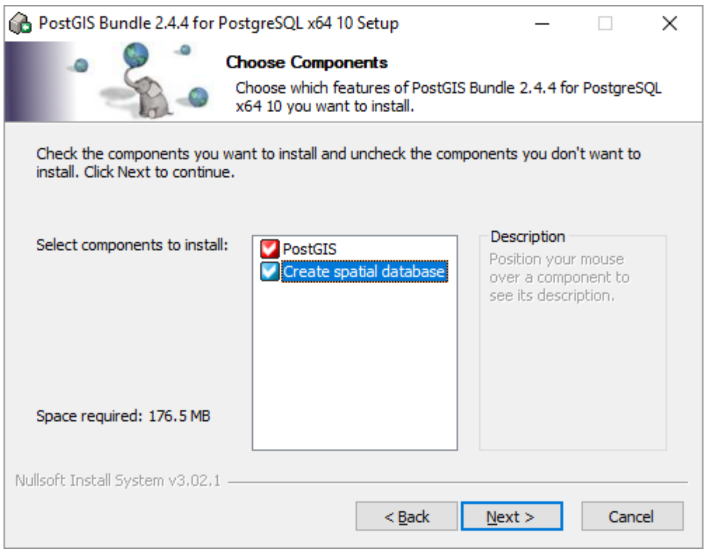
Press Page Down to see the rest of the agreement.

```
                GNU GENERAL PUBLIC LICENSE
                   Version 2, June 1991

Copyright (C) 1989, 1991 Free Software Foundation, Inc.
                 59 Temple Place, Suite 330, Boston, MA  02111-1307  USA
Everyone is permitted to copy and distribute verbatim copies
of this license document, but changing it is not allowed.

                          Preamble

 The licenses for most software are designed to take away your
```

If you accept the terms of the agreement, click I Agree to continue. You must accept the agreement to install PostGIS Bundle 2.4.4 for PostgreSQL x64 10.

Nullsoft Install System v3.02.1

Before installing, its asks to confirm and gives the option to setup a spatial database, which I will check because I want a database to test with.


PostGIS Bundle 2.4.4 for PostgreSQL x64 10 Setup

Choose Components

Choose which features of PostGIS Bundle 2.4.4 for PostgreSQL x64 10 you want to install.

Check the components you want to install and uncheck the components you don't want to install. Click Next to continue.

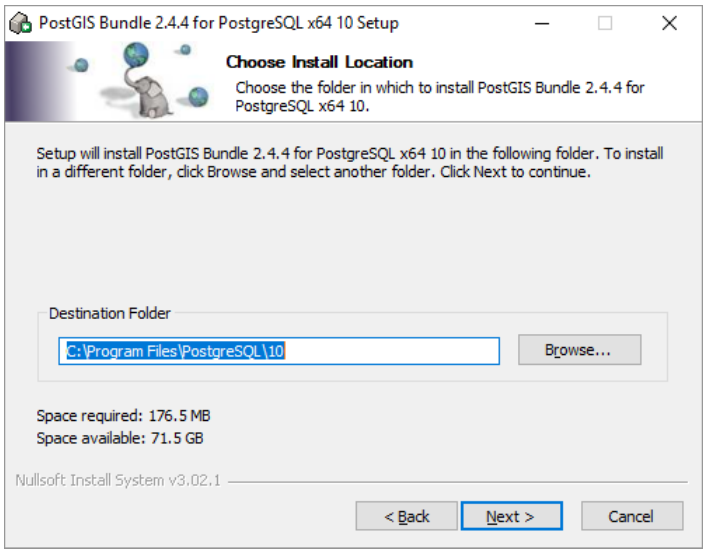
Select components to install:
- [✓] PostGIS
- [✓] Create spatial database

Description
Position your mouse over a component to see its description.

Space required: 176.5 MB

Nullsoft Install System v3.02.1

Install location for PostGIS is next (I stick with the default).



PostGIS Bundle 2.4.4 for PostgreSQL x64 10 Setup

Choose Install Location

Choose the folder in which to install PostGIS Bundle 2.4.4 for PostgreSQL x64 10.

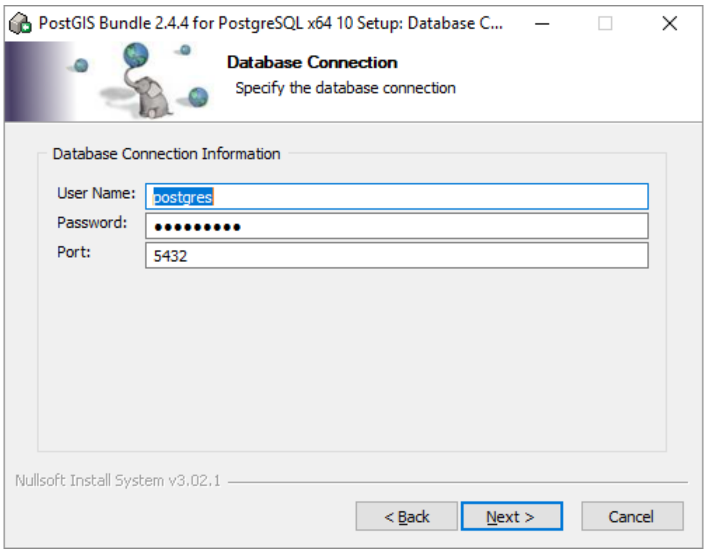
Setup will install PostGIS Bundle 2.4.4 for PostgreSQL x64 10 in the following folder. To install in a different folder, click Browse and select another folder. Click Next to continue.

Destination Folder: C:\Program Files\PostgreSQL\10

Space required: 176.5 MB
Space available: 71.5 GB

Nullsoft Install System v3.02.1

The PostGIS installation needs access to the PostgreSQL database, using the password I defined in the previous step.



PostGIS Bundle 2.4.4 for PostgreSQL x64 10 Setup: Database C...

Database Connection

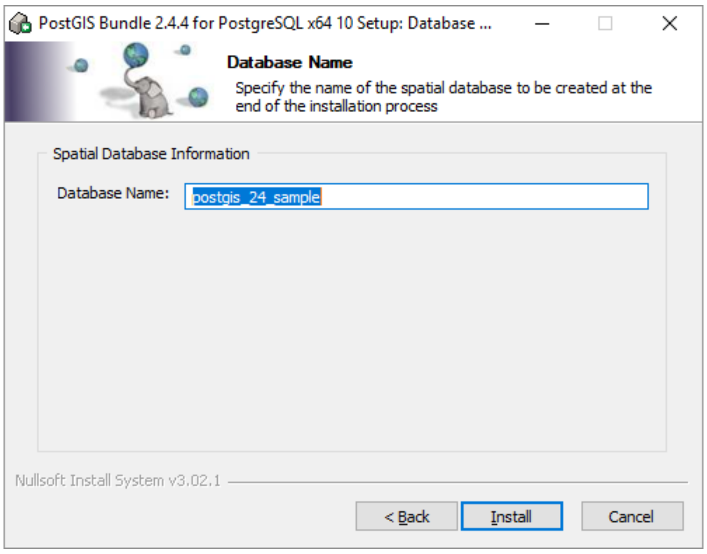
Specify the database connection

Database Connection Information

User Name:	postgres
Password:	●●●●●●●●●
Port:	5432

Nullsoft Install System v3.02.1

Next, a name for the spatial database schema is proposed.


PostGIS Bundle 2.4.4 for PostgreSQL x64 10 Setup: Database ...

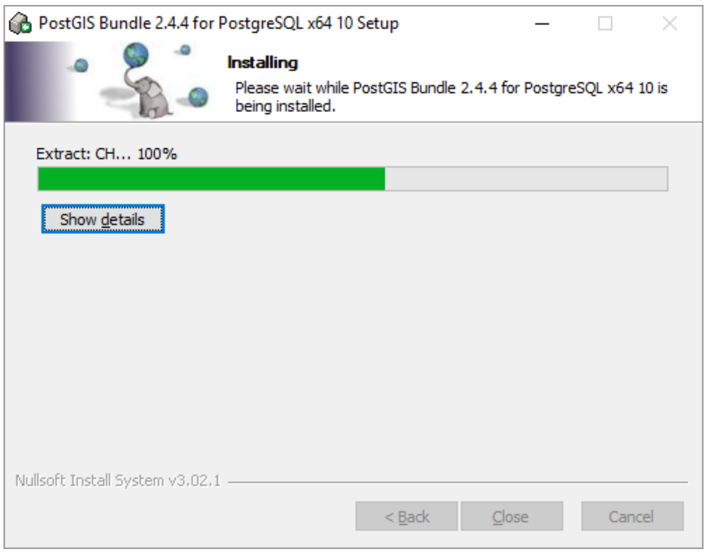
Database Name

Specify the name of the spatial database to be created at the end of the installation process

Spatial Database Information

Database Name: postgis_24_sample

In progress…

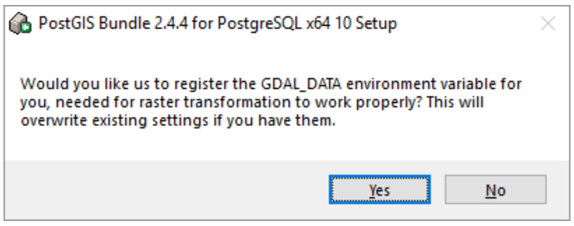

PostGIS Bundle 2.4.4 for PostgreSQL x64 10 Setup

Installing

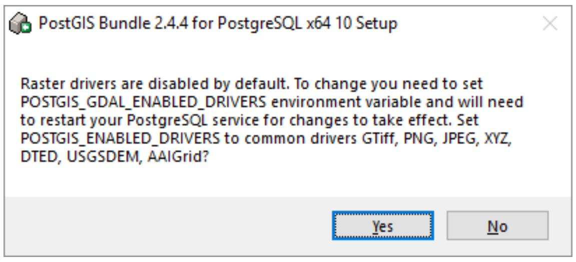
Please wait while PostGIS Bundle 2.4.4 for PostgreSQL x64 10 is being installed.

Extract: CH... 100%

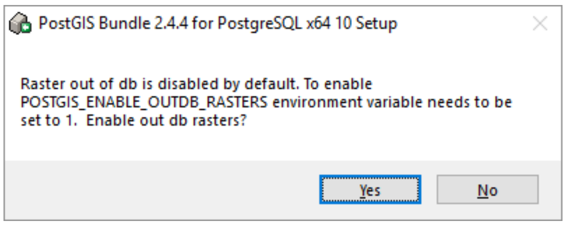
At the end of the installation, there will be a request to enable three settings for the raster options in PostGIS. Although I do not believe Bentley Map supports them at this point, I am going to enable them just in case…


PostGIS Bundle 2.4.4 for PostgreSQL x64 10 Setup

Would you like us to register the GDAL_DATA environment variable for you, needed for raster transformation to work properly? This will overwrite existing settings if you have them.

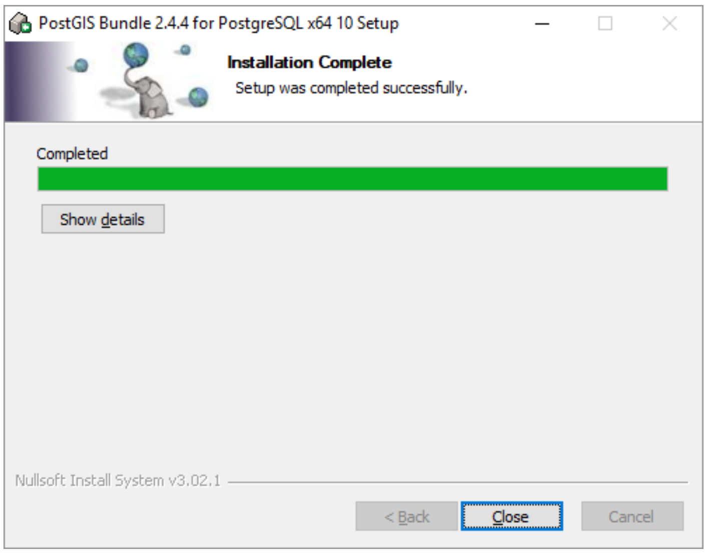

PostGIS Bundle 2.4.4 for PostgreSQL x64 10 Setup

Raster drivers are disabled by default. To change you need to set POSTGIS_GDAL_ENABLED_DRIVERS environment variable and will need to restart your PostgreSQL service for changes to take effect. Set POSTGIS_ENABLED_DRIVERS to common drivers GTiff, PNG, JPEG, XYZ, DTED, USGSDEM, AAIGrid?


PostGIS Bundle 2.4.4 for PostgreSQL x64 10 Setup

Raster out of db is disabled by default. To enable POSTGIS_ENABLE_OUTDB_RASTERS environment variable needs to be set to 1. Enable out db rasters?

And that completes the installation.

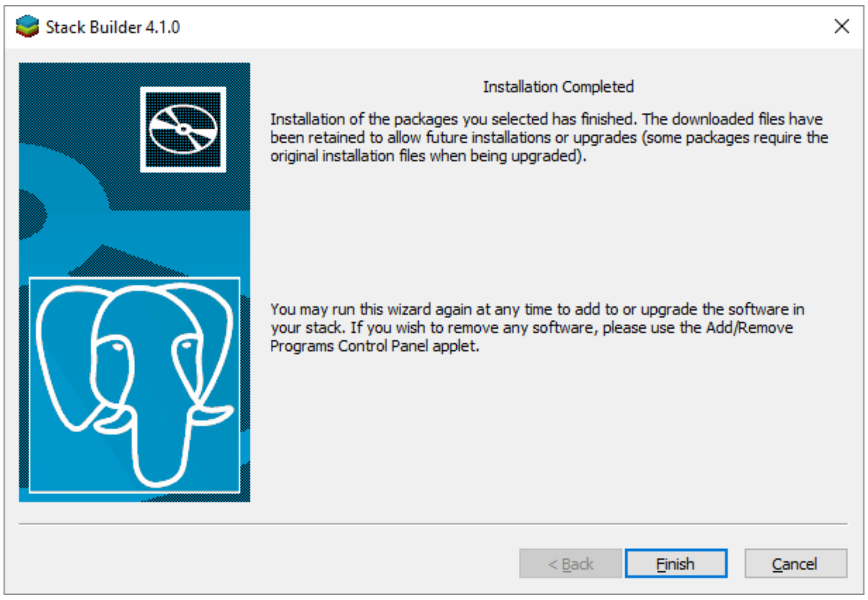

PostGIS Bundle 2.4.4 for PostgreSQL x64 10 Setup

Installation Complete

Setup was completed successfully.

Completed

Which brings me back to the Stack Builder, where things are shown as completed, too.

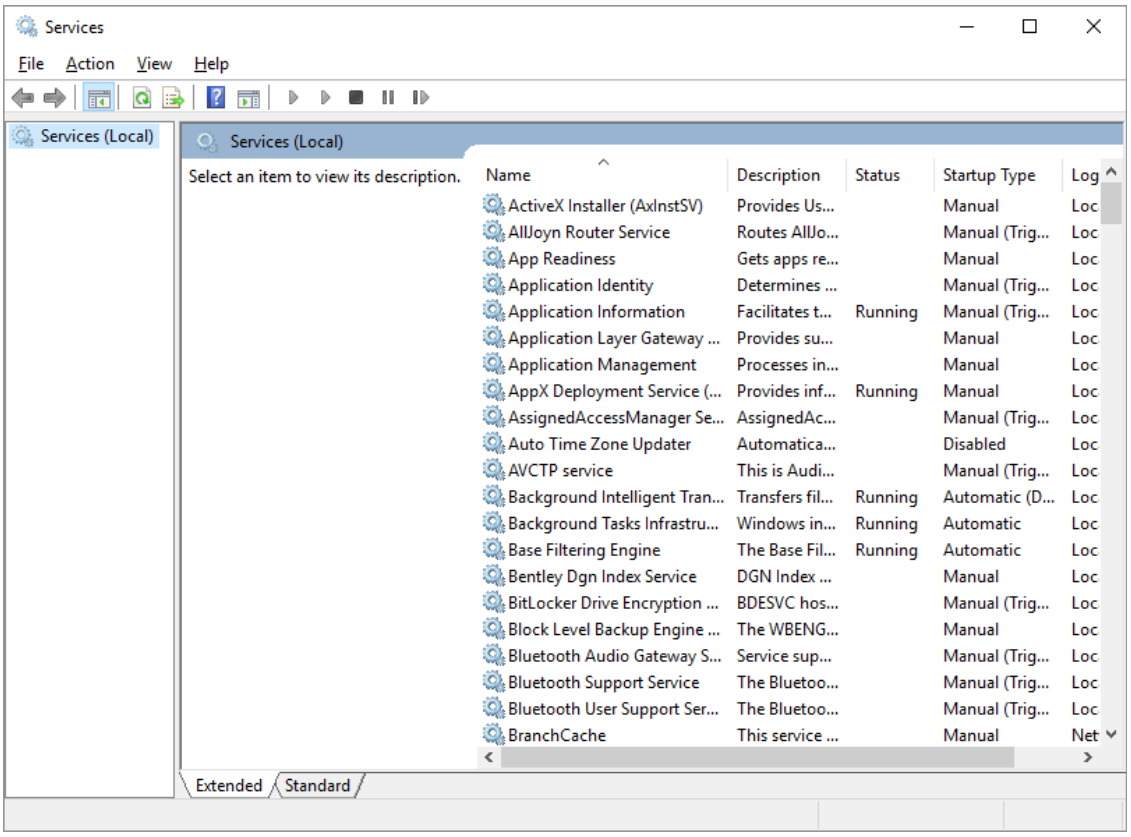


Installation Completed

Installation of the packages you selected has finished. The downloaded files have been retained to allow future installations or upgrades (some packages require the original installation files when being upgraded).

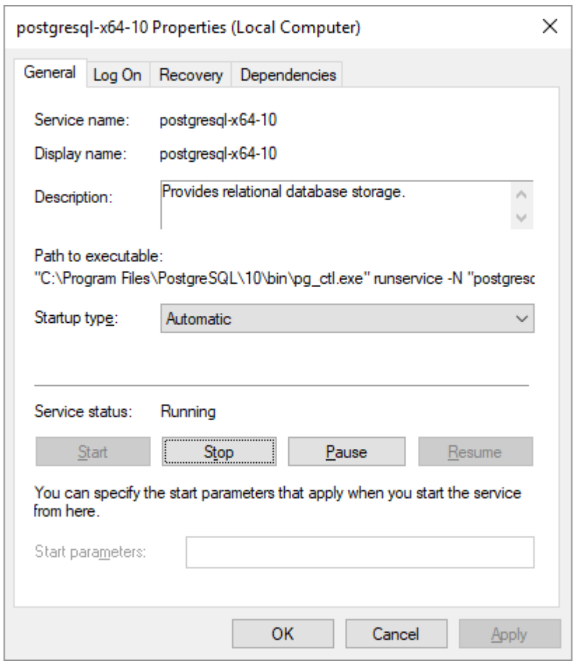
You may run this wizard again at any time to add to or upgrade the software in your stack. If you wish to remove any software, please use the Add/Remove Programs Control Panel applet.

One of the variables in the PostGIS installation indicates I need to restart the PostgreSQL service for the changes to take effect. So I run **services.msc** from the command window to open the Services management console:



Name	Description	Status	Startup Type	Log
ActiveX Installer (AxInstSV)	Provides Us...		Manual	Loc
AllJoyn Router Service	Routes AllJo...		Manual (Trig...	Loc
App Readiness	Gets apps re...		Manual	Loc
Application Identity	Determines ...		Manual (Trig...	Loc
Application Information	Facilitates t...	Running	Manual (Trig...	Loc
Application Layer Gateway ...	Provides su...		Manual	Loc
Application Management	Processes in...		Manual	Loc
AppX Deployment Service (...	Provides inf...	Running	Manual	Loc
AssignedAccessManager Se...	AssignedAc...		Manual (Trig...	Loc
Auto Time Zone Updater	Automatica...		Disabled	Loc
AVCTP service	This is Audi...		Manual (Trig...	Loc
Background Intelligent Tran...	Transfers fil...	Running	Automatic (D...	Loc
Background Tasks Infrastru...	Windows in...	Running	Automatic	Loc
Base Filtering Engine	The Base Fil...	Running	Automatic	Loc
Bentley Dgn Index Service	DGN Index ...		Manual	Loc
BitLocker Drive Encryption ...	BDESVC hos...		Manual (Trig...	Loc
Block Level Backup Engine ...	The WBENG...		Manual	Loc
Bluetooth Audio Gateway S...	Service sup...		Manual (Trig...	Loc
Bluetooth Support Service	The Bluetoo...		Manual (Trig...	Loc
Bluetooth User Support Ser...	The Bluetoo...		Manual (Trig...	Loc
BranchCache	This service ...		Manual	Net

Finding and double-clicking the PostgreSQL service opens the dialog to stop and start the service.


postgresql-x64-10 Properties (Local Computer)

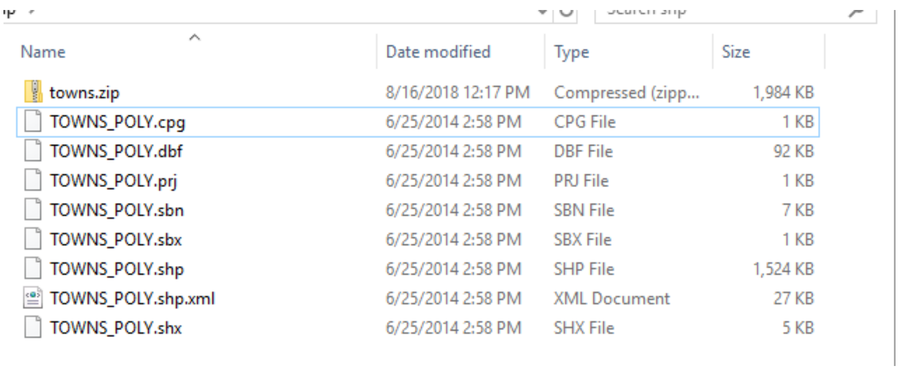
Service name: postgresql-x64-10
Display name: postgresql-x64-10
Description: Provides relational database storage.
Path to executable:
"C:\Program Files\PostgreSQL\10\bin\pg_ctl.exe" runservice -N "postgresc
Startup type: Automatic
Service status: Running

You can specify the start parameters that apply when you start the service from here.
Start parameters:

Loading test data in PostGIS

At this point I should have a fully functional spatial database, but no data to play with. Luckily there are data sources out there. The data I will use is from the “An almost Idiot’s Guide” on-line tutorial, community boundaries (“Towns”) from the state of Massachusetts in shapefile format (see references below). According to the tutorial, Shapefiles are easily loaded into PostGIS using the *shp2pgsql* tool that comes with the package.

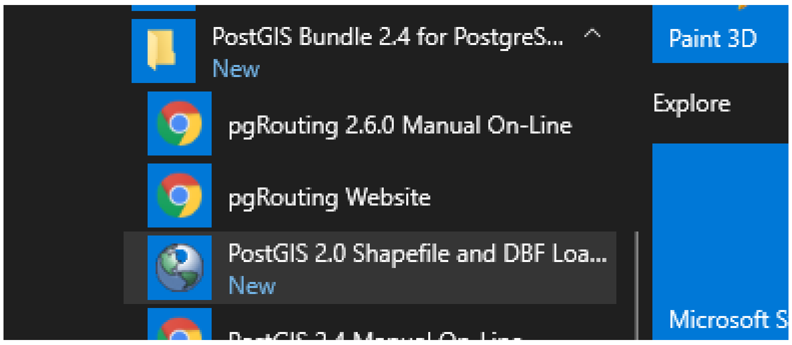
From the downloaded towns.zip package only the TOWNS_POLY shapefile is extracted, containing single-part polygons, with separate features for offshore islands.



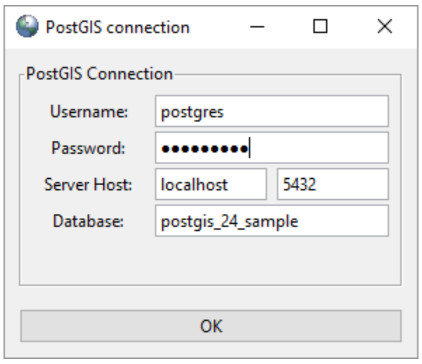
Name	Date modified	Type	Size
towns.zip	8/16/2018 12:17 PM	Compressed (zipp...	1,984 KB
TOWNS_POLY.cpg	6/25/2014 2:58 PM	CPG File	1 KB
TOWNS_POLY.dbf	6/25/2014 2:58 PM	DBF File	92 KB
TOWNS_POLY.prj	6/25/2014 2:58 PM	PRJ File	1 KB
TOWNS_POLY.sbn	6/25/2014 2:58 PM	SBN File	7 KB
TOWNS_POLY.sbx	6/25/2014 2:58 PM	SBX File	1 KB
TOWNS_POLY.shp	6/25/2014 2:58 PM	SHP File	1,524 KB
TOWNS_POLY.shp.xml	6/25/2014 2:58 PM	XML Document	27 KB
TOWNS_POLY.shx	6/25/2014 2:58 PM	SHX File	5 KB

It is important to determine the SRID, which is required to setup our Map environment. It can be found in the TOWNS_POLY.prj file and in this case is 26986 (NAD 1983 State Plane Massachusetts Mainland FIPS 2001).

There is a PostGIS Shapefile Import/Export Manager that can activated from the Windows menu (alternatively, this process can be driven from the command line).


PostGIS Bundle 2.4 for PostgreS...
New
pgRouting 2.6.0 Manual On-Line
pgRouting Website
PostGIS 2.0 Shapefile and DBF Loa...
New
Paint 3D
Explore
Microsoft S

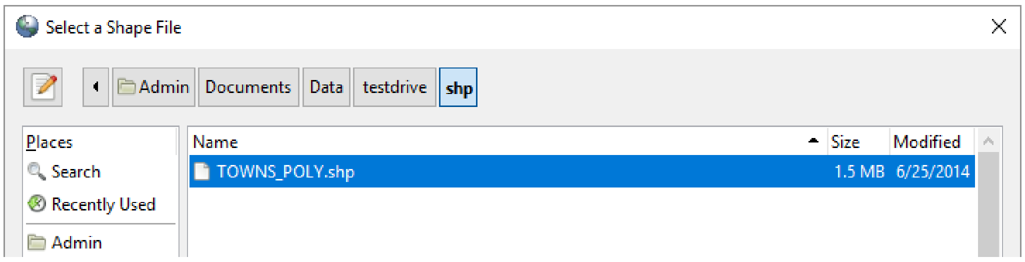
Once opened the UI can be used to define the PostGIS Connection…


PostGIS connection

PostGIS Connection

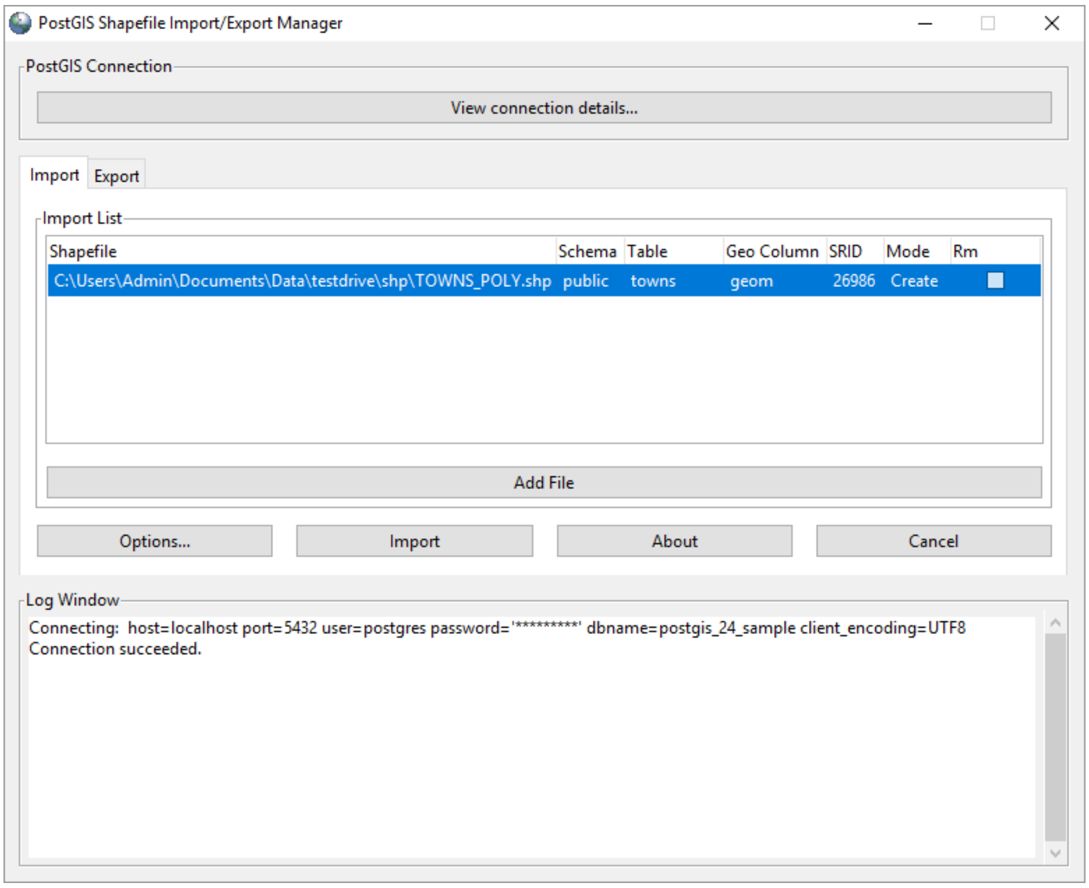
Username:	postgres	
Password:	•••••••••	
Server Host:	localhost	5432
Database:	postgis_24_sample	

…and the Shapefile – in this case TOWNS_POLY – that needs to be imported.


Select a Shape File

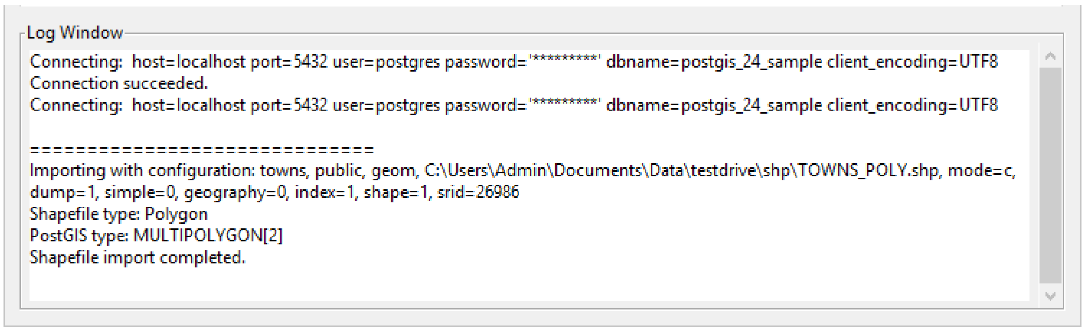
Name	Size	Modified
TOWNS_POLY.shp	1.5 MB	6/25/2014

With the correct table name and SRID defined, the **Import** button will load the data in PostGIS.



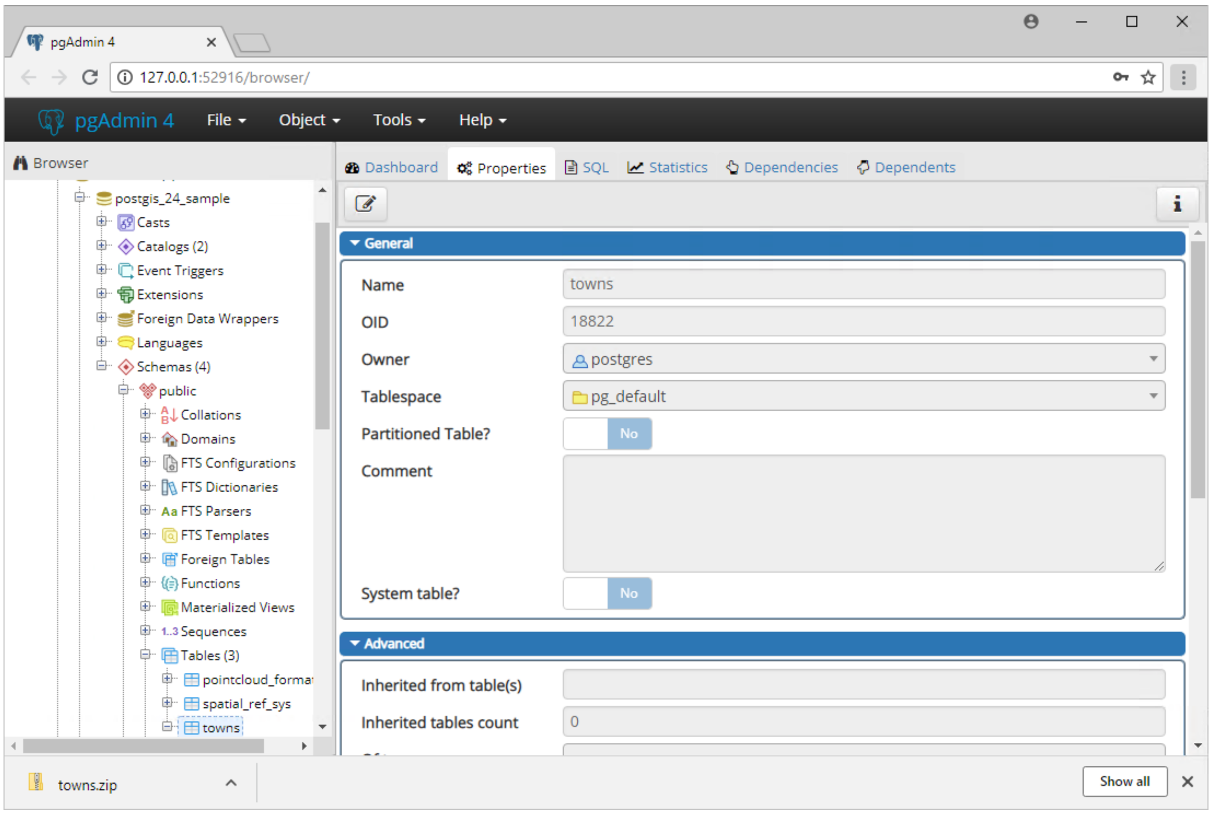
Shapefile	Schema	Table	Geo Column	SRID	Mode	Rm
C:\Users\Admin\Documents\Data\testdrive\shp\TOWNS_POLY.shp	public	towns	geom	26986	Create	☐

```
Connecting:  host=localhost port=5432 user=postgres password='*********' dbname=postgis_24_sample client_encoding=UTF8
Connection succeeded.
```



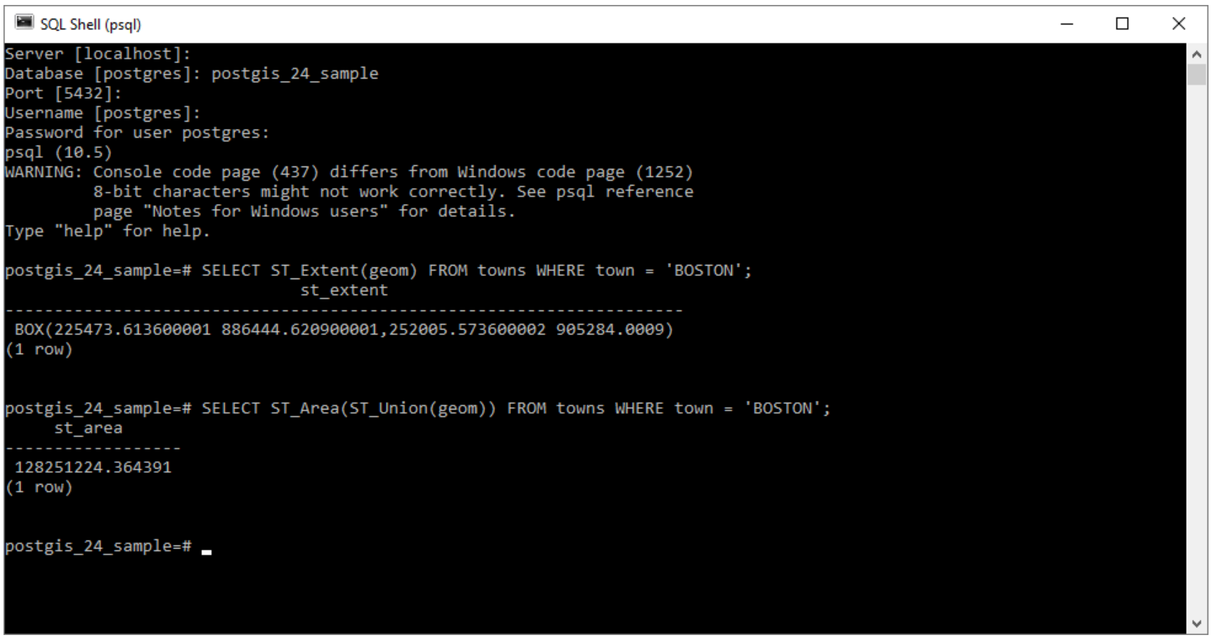
```
Connecting:  host=localhost port=5432 user=postgres password='*********' dbname=postgis_24_sample client_encoding=UTF8
Connection succeeded.
Connecting:  host=localhost port=5432 user=postgres password='*********' dbname=postgis_24_sample client_encoding=UTF8

==============================
Importing with configuration: towns, public, geom, C:\Users\Admin\Documents\Data\testdrive\shp\TOWNS_POLY.shp, mode=c,
dump=1, simple=0, geography=0, index=1, shape=1, srid=26986
Shapefile type: Polygon
PostGIS type: MULTIPOLYGON[2]
Shapefile import completed.
```

To test the data, I can check if the table is added in **PgAdmin**, the management tool for PostgreSQL. This a web-based tool that shows many similarities with mamagement tools for databases like Oracle and SQL Server.



Name: towns
OID: 18822
Owner: postgres
Tablespace: pg_default
Partitioned Table?: No
Comment:
System table?: No
Inherited from table(s):
Inherited tables count: 0

And the SQL Shell for PostgreSQL – **psql** – can be used to try out some spatial queries on the data:

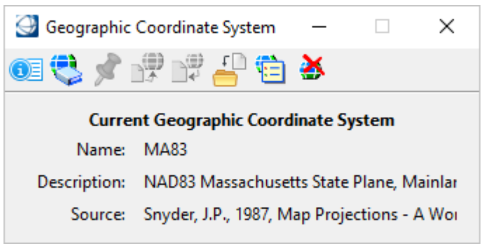


```
Server [localhost]:
Database [postgres]: postgis_24_sample
Port [5432]:
Username [postgres]:
Password for user postgres:
psql (10.5)
WARNING: Console code page (437) differs from Windows code page (1252)
         8-bit characters might not work correctly. See psql reference
         page "Notes for Windows users" for details.
Type "help" for help.

postgis_24_sample=# SELECT ST_Extent(geom) FROM towns WHERE town = 'BOSTON';
                              st_extent
---------------------------------------------------------------------
 BOX(225473.613600001 886444.620900001,252005.573600002 905284.0009)
(1 row)


postgis_24_sample=# SELECT ST_Area(ST_Union(geom)) FROM towns WHERE town = 'BOSTON';
     st_area
------------------
 128251224.364391
(1 row)


postgis_24_sample=# _
```

Viewing data in Bentley Map

Now that I have loaded some data into PostGIS, the real fun starts: trying to get it into Bentley Map. A quick and dirty way is to simply open a file with the correct coordinate system, connect to the PostGIS database and start querying the the data.

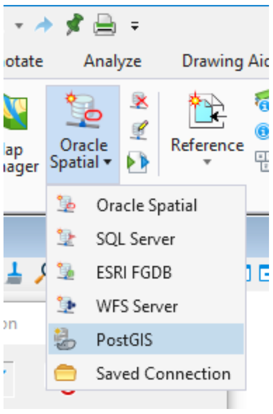
First, I select an empty dgn an select the right coordinate system.


Geographic Coordinate System

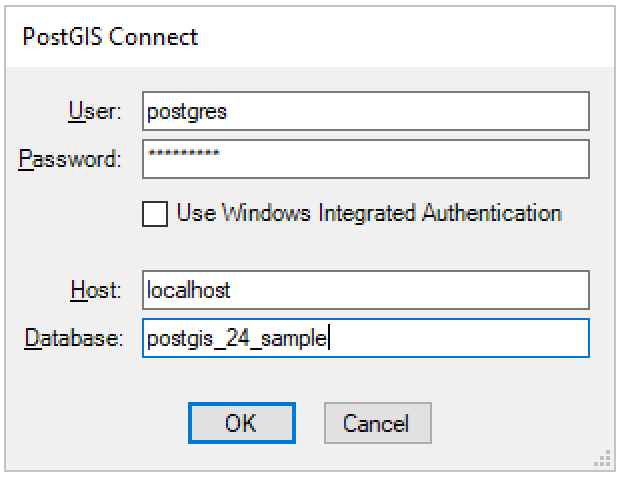
Current Geographic Coordinate System

Name:	MA83
Description:	NAD83 Massachusetts State Plane, Mainlar
Source:	Snyder, J.P., 1987, Map Projections - A Woı

Then PostGIS is selected as the spatial database to connect to.

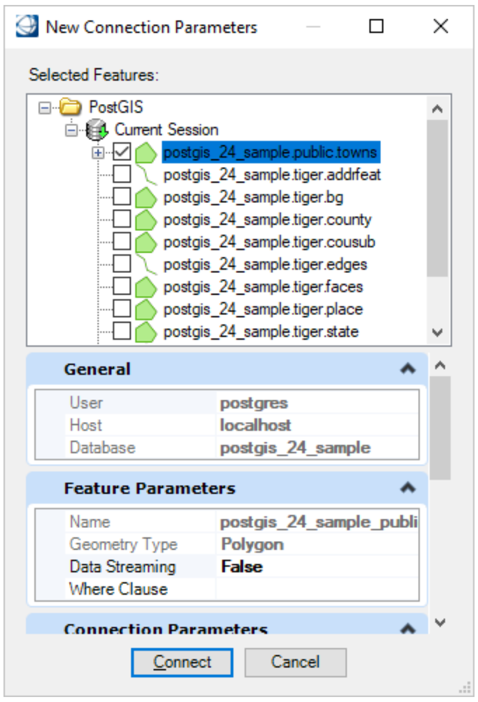


This opens a dialog to specify the connection parameters – user, password, host, database.


PostGIS Connect

User:	postgres
Password:	*********
	☐ Use Windows Integrated Authentication
Host:	localhost
Database:	postgis_24_sample

Then as a connection parameter, the towns table is selected with the data imported in the previous steps.



Selected Features:

- PostGIS
  - Current Session
    - [✓] postgis_24_sample.public.towns
    - postgis_24_sample.tiger.addrfeat
    - postgis_24_sample.tiger.bg
    - postgis_24_sample.tiger.county
    - postgis_24_sample.tiger.cousub
    - postgis_24_sample.tiger.edges
    - postgis_24_sample.tiger.faces
    - postgis_24_sample.tiger.place
    - postgis_24_sample.tiger.state

General

User	postgres
Host	localhost
Database	postgis_24_sample

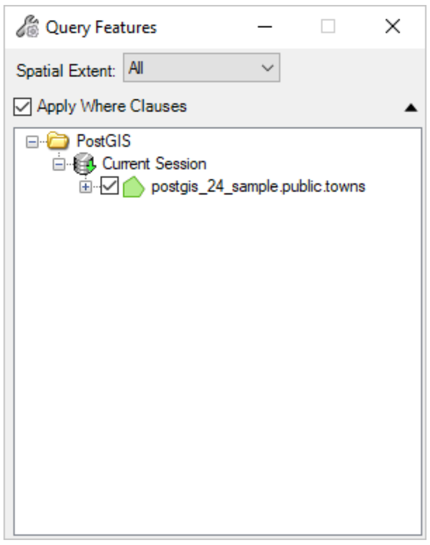
Feature Parameters

Name	postgis_24_sample_publi
Geometry Type	Polygon
Data Streaming	False
Where Clause	

Connection Parameters

Note how the default option to create a spatial database when adding PostGIS to PostgreSQL has added a sample database with data.

Query the features (using the "All" option to establish the extent of the data).

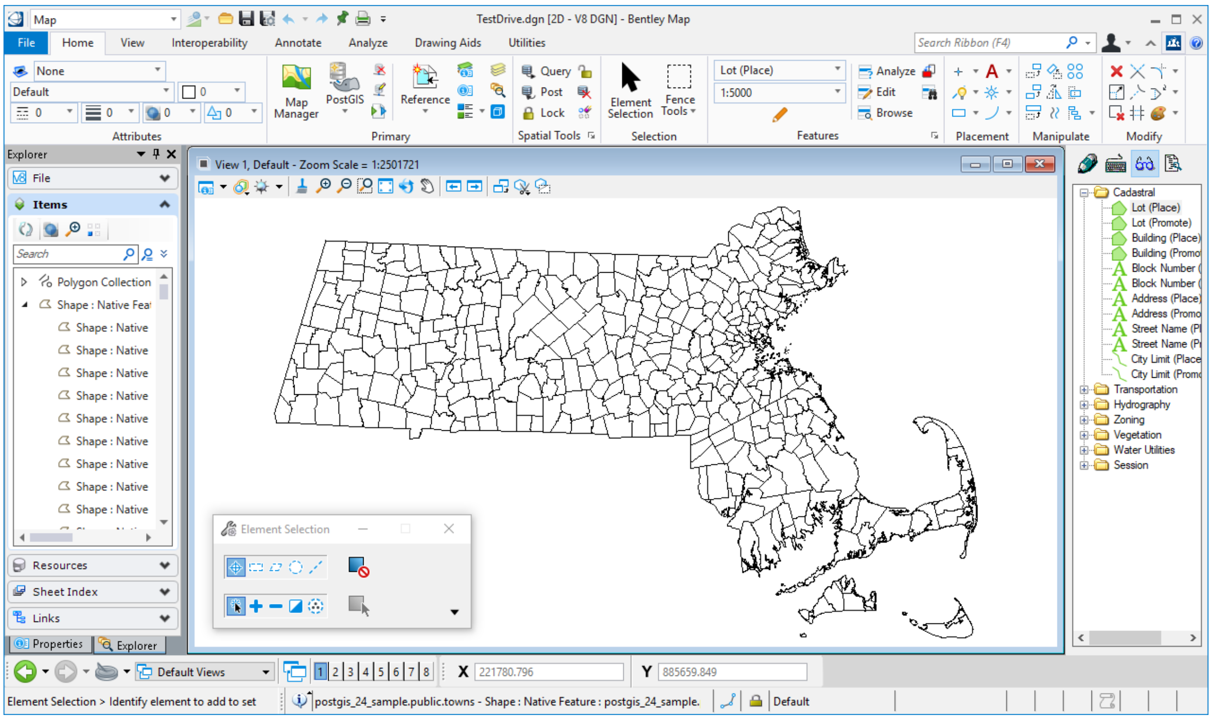


Spatial Extent: All

[✓] Apply Where Clauses

- PostGIS
  - Current Session
    - [✓] postgis_24_sample.public.towns

And the data will display…



Obviously, the more sustainable approach would be to create a schema, register the features, but that will be some other day…

References

Tutorial “An almost Idiot’s Guide”: http://www.bostongis.com/?content_name=postgis_tut01

Example data (MassGIS): https://docs.digital.mass.gov/dataset/massgis-data-community-boundaries-towns

Installation instructions: https://www.gpsfiledepot.com/tutorials/installing-and-setting-up-postgresql-with-postgis/

PostgreSQL Windows Installers: https://www.postgresql.org/download/windows/