GIS WEB APPLICATIONS STANDARDS

DRAFTED BY THE GIS WEB APPLICATIONS TASK TEAM UNDER THE PERVIEW OF THE ARCHITECTURE AND APPLICATIONS SUBCOMMITTEE OF THE ENTERPRISE GIS COMMITTEE

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OVERVIEW

A small team under the purview of the Enterprise GIS Committee developed these recommendations and standards. These recommendations should be considered along with other standards documents within the department with the guidance of DTS. It is the responsibility of the program manager to adhere to these recommendations but it would be prudent to provide these recommendations to any team member or developer pursuing a new GIS web application.

PURPOSE

The purpose of this document is to provide guidance to the development of GIS web applications. This is a living document that will change as industry and technology standards change, as web applications desire to remain current they should change to reflect current standards.

SCOPE

The standards defined within this document apply to all GIS Applications within the Department.

AUDIENCE

Anyone developing or overseeing the development of a GIS web application for use within the Department.

GENERAL GOALS

HIGH QUALITY USER EXPERIENCE

Simple and Usable – In an effort to anticipate user needs there is a tendency to build a multitude of functions into an application. Overcomplicating the user interface reduces the usability of the application. Actual usage needs should drive application functions.

INTUITIVE

a. Purpose of application is clearly communicated.
b. Controls are clearly labeled or otherwise indicated.
c. Leverage user knowledge of popular applications.

WORKFLOW

Refer to Software Development Life Cycle (SDLC) documentation (1)

BACKGROUND DATA (LAYERS/ATTRIBUTES)

Background data should strive for adherence to **Spatial Data Standards** (including metadata, datums, and projections) (2).

TYPES OF APPLICATIONS

A “GIS web application” does not have a single definition. Standards set forth in this document attempt to acknowledge and account for differences that exist between different types of web applications based on audience and accessibility. See **Application User Interface Standards** (3) for descriptions of different application types.

WEB PRESENCES

DWR PORTAL VISIBILITY

All publically accessible DWR web pages and applications must be available through the DWR Portal. The content manager must provide the DWR Webmaster with a navigation link to be placed into the DWR Portal directing visitors to the application or State Program managing the application. The navigation link must direct public visitors to either, 1) the State Program/Activity which will then contain a link to the web application, or 2) directly to the web application. If a navigation link from the DWR Portal directs visitors to the State Program, then a navigation link directly to the web application must be placed within the State Program's web pages.

LAUNCH PAGE

A launch page is a web page that precedes a map or logon page and provides context to the information provided in the application.

a. A launch page is required for all GIS web applications.
b. If the map viewer is embedded in a page with explanatory content then a launch page is not necessary.

LOGON PAGE

When an application requires a user to login the function should be provided on the logon page. The result of a successful login should open the application. Popup logins are discouraged.

a. For specifications on security see Section 6 "Security".
b. Links to launch must inform users the button will open a new window/new tab

LOOK AND FEEL

Refer to Application User Interface Standards for Look and Feel and the California Technology Agency's direction on Implementing an Accessible Website (4)

GRAPHICAL USER INTERFACE (GUI) FRAMEWORK

The GUI Framework refers to the functionality of the map interface, functions, navigation, header, footer, and widgets. For map content standards refer to Section 7 Map Data.

GIS APPLICATION NAME

Logically represents the intended use of the application or data represented.

LOOK AND FEEL

RESOLUTION

a. Should be optimized for 1024x768.
b. Should utilize highest resolution available.

CASCADING STYLE SHEETS

California public web pages are designed with a default style configuration which is applied through Cascading Style Sheets (CSS). CSS are a set of statements that specify the presentation, including fonts and colors, of the document in a centralized manner that requires minimal configuration.

DWR web applications should make use of the same central style sheets that are used by the public web pages. Using the same style sheets create a consistent look and reduces maintenance.

a. Whenever applicable, web applications must refer to styles statements already defined in central style sheets used by the public web pages.
b. If accessing the same CSS files used by the DWR public web pages is impossible, copies of the files shall be made and referenced by the application. Procedures need to be put in place to ensure that updates made to the web page CSS files are also made to the application CSS files.
c. If needed, additional style statements must be created in a new application-specific central style sheet.
d. Any additional style statements should use CSS shortcut techniques to avoid problems associated with conflicting requirements in nested statements. For example, separate out the implementation of size from the implementation of color, allowing a developer to choose to use one or both to meet any particular need.

COLOR SCHEMES

Refer to **DWR's Web Application User Interface Standards** (3)

BRANDING

Branding is useful in identifying that the GIS application in use is related to the Department, and more specifically with application branding to a specific Division or Program.
To allow for maximum viewable space to be used for map data and the GIS application it is necessary to reduce the amount of space used for branding. The application should either use the default DWR branding or follow the branding specifications below.

APPLICATION BRANDING

Application Branding is the preferred level of branding; this identifies the GIS application to a more specific section of the Department. Application branding replaces the default organizational logo with an application specific logo.

LOGO

A logo is required on the application, a DWR logo has been designed to fit within the space requirement that have been set. If an application logo has been designed it should be used in place of the DWR logo.

a. The application logo shall have a height of 50 pixels.

APPLICATION NAME

a. The application name will be displayed to the right of the logo
b. The application name can be text or a graphic

EXAMPLE OF APPLICATION BRANDING

Figure 1

MENU/NAVIGATION INTERACTION

MENUS

HEADER

The Header is located across the top of the application and serves as the main menu of the application; the application name and logo, login/logout, layers, measuring tool, and help, along with and additional widget, buttons all reside on the header.

BRANDING LOGO

The Branding logo will be placed in the upper-left corner of the header

LOGIN/LOGOUT

a. When an application requires a login, a logout link will be placed in the upper-right corner of the header.
b. Refer to Section 6 “Security” for details on Login/Logout procedures.

COLLAPSIBLE

The application header will have the ability to collapse down to a small icon, allowing the user the option of maximizing viewable space on the map.

Button

The ability to collapse a widget should be clearly shown with a double arrow such as: 

MUST BE DISPLAYED AT STARTUP

The header will always be shown at application startup. This allows the user to identify with the application and options available to them from the header.

TOOLS

Identify – The ability to identify feature on a map is a key element of a GIS application. All applications must provide the user with the ability to select a feature(s) on the map and display information about the feature.

Layers – The layer tool provides the ability to turn on and off the various layers available in the map. The layer tool is a must be available in all applications.

Legend – The legend tool provides a way to relate the symbology of the map to the individual map features. A legend tool must be available in all applications.

Search – Although not mandatory, a search tool is highly recommended. Capabilities can include searching by: attribute information, location or external sources (such as additional information on geolocated items within the map).

Help – Although not required, it is a good practice for an application to have a help page(s). If an application does offer a help function, access to it should be provided on the header as the right most selection.

Draw and Measure – The Draw and Measure tool is optional, but provides the user with the functionality to place points and text and draw lines, circles, and polygons on the map. In addition, it provides the ability to measure the area covered by the shape that was drawn.

Metadata – The Metadata tool is mandatory. This tool should provide the user with the metadata for active layers of the map.

NAVIGATION

The ability of the user to easily navigate an application plays a large part in the overall acceptance of an application. In the case of a GIS application this is extended to the ability to navigate around the map.

PRIMARY MAP NAVIGATION

This the main navigation tool present in the application (see figure 2). It should include buttons to pan up / down and left / right, a slide tool to control zoom level, and can optionally provide the following controls:

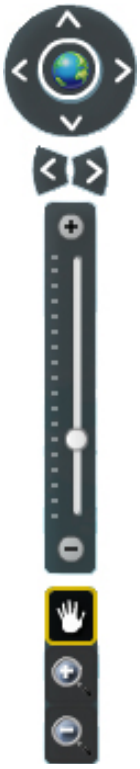

Figure 2: Primary Map Navigation Tool

Zoom – The zoom in / out buttons allow the user to draw a rectangle in the browser window and zoom in or out by the selected amount. These buttons are optional but recommended to be included in the primary map navigation functionality.

Pan – The pan button provides the user with the ability to pan around the map using the mouse. This feature is optional, but it is recommended that it be available to the user.

Extents – The previous and next extent buttons allow the user to jump between previous and current extents. These buttons are optional, with the caveat that if one is available they are both available.

Print – The print button provides the user with the ability to print. This feature is optional but recommended.

FORMS

See **Web Applications User Interface Standards** (3)

FUNCTIONALITY

Not all of these functions are required; when present these suggestions should be followed.

COLLAPSIBLE WIDGETS

The ability to collapse a widget should be clearly shown with a double arrow within a circle such as: 

DATA EXTRACTION/DOWNLOAD

Offering a data extraction or download function is optional, however, if the function is present the following data types should be offered:

Raster – Tagged Image File Format (TIFF), Portable Network Graphics (PNG), ASCII

Point / Vector – Shapefile (SHP), Keyhole Markup Language (KML), Feature class (GDB), AutoCAD Drawing File (DWG), Geography Markup Language (GML), ASCII, Layer file package (LPK)

Consideration should be given to the reprojection of data for download into a projection approved of by the DWR Spatial Data Standards (2) and relevant to specific program or industries needs.

Metadata – Metadata must be included with any data download offered.

MAP VIEWER FRAMEWORK

Currently, two map viewer frameworks are being supported.

FLEX

The ArcGIS Viewer for Flex is a ready-to-deploy viewer application. It is configurable, so you can easily add tools and data content without programming. You can also extend its functionality with custom widgets created with the ArcGIS API for Flex.

JAVASCRIPT

The ArcGIS API for JavaScript (JavaScript API) is a browser based API for developing high performance, easy to use mapping applications. The API allows you to easily embed maps in your Web pages. (5)

DISCLAIMERS AND USAGE

Any disclaimer concerning the data displayed in the application needs to be identified on the launch page before the application is displayed. For applications embedded in a webpage, the disclaimer should be presented above the map.

DATUM

A datum is a set of parameters and control points used to define the shape of the earth. Datums provide a frame of reference for measuring locations, and may be determined for local, regional, or worldwide extents. There are both horizontal and verticals datums.

a. **Horizontal Datum** – See Spatial Data Standards – Section 7.2. (2)
b. **Vertical Datum** – See Spatial Data Standards – Section 7.3. (2)

PROJECTION

A map projection transforms the three-dimensional shape of the earth onto a two-dimensional surface that can be printed on paper or viewed on a computer screen. There are many different kinds of map projections, each trying to preserve one or more real world properties such as area, shape, distance, and direction. No single projection preserves all these properties - some are focused on preserving particular properties while others may partially preserve multiple properties as a compromise projection. Because no one projection is perfect for all needs DWR supports the use of seven projections. Project requirements should dictate which projection to use for a specific application. All layers should be in the same projection, not being reprojected on the fly.

a. **Web Mercator** – Web Mercator has been adopted as the standard projection for web GIS applications throughout the internet. Because of its wide-spread use it is the preferred standard to be used for GIS web applications. Additionally, Web Mercator is recommended for ArcGIS tiled map services that overlay content from ArcGIS Online and other third-party basemap services. This projection is not intended for critical data analysis.
b. **Latitude and Longitude (unprojected)**
c. **UTM**
    a. **10**
    b. **11**
    c. **10.5 “California UTM”**
d. **Teale Albers**
e. **State Plane**

LABELS

SCALE DEPENDENCY

Adding scale dependencies to a layer is one of the easiest ways to improve performance of the application. Labels should be displayed only when they are meaningful within the context of the application. The ultimate goal is to minimize the amount of data at any given scale. The less data there is to process, the faster the response can be generated.

USE ANNOTATIONS

The annotation feature type is for the storage of text in the geodatabase. Storing text in the geodatabase provides the ability to edit the text and more efficient drawing speeds than dynamic labeling since the positions of text are fixed. Where possible, use annotations.

BASEMAPS

There are two recommended options for basemaps, creating your own basemap layer (creating a cached-tile service) or using a third party basemap. (6) (7)

CACHED-TILE SERVICE

Due to the static nature of a basemap, an opportunity is provided to boost performance by creating a cached-tile service.

THIRD PARTY BASEMAP

Several basemap services are available free of charge or at cost via the internet from ESRI and others. These services are an acceptable alternative to the creation and maintenance of an in-house basemap, provided they do not contain embedded advertisements. Creators should keep in mind the potential for changes in terms of service when using free third party services.

OPERATIONAL MAP LAYERS

There are at least four types of operational map layers:

EDITING AND DATA ACCESS LAYERS

These are the map layers that your users work with, for example, to edit features, perform queries, and select features for input to analysis. Common examples are the facilities layers edited in a utility or other map layers that can be queried and used by end users.

OBSERVATIONS OR SENSOR FEEDS

This can be any information that reflects status or situational awareness, for example, crime locations, traffic sensor feeds, real-time weather, readings from meters (such as stream gauges), observations from equipment or made by workers in the field, inspection results, addresses of customers, disease locations, air quality and pollution monitors, and so on. These information

sources are often displayed as status information in GIS Web maps. Also, they are frequently used as inputs into analytic operations that are computed on the ArcGIS Server.

METADATA

Metadata should be available for download for each layer available in the application.

QUERY RESULTS

In many cases, applications will make a query request to the server and return a set of records as results. These can include a set of individual features or attribute records. Users often display and work with these results as map graphics in their Web GIS map applications. This approach typically requires application programming to create a map layer of results.

RESULT LAYERS THAT ARE DERIVED FROM ANALYTIC MODELS

GIS analysis can be performed to derive new information that can be added as new map layers and explored, visualized, interpreted, and compared.

DYNAMIC MAP LAYERS

Server receives request for data from the client, constructs image based on the request and sends the result to the client. Dynamic map layers are slower than cached map layers but can be fast if optimized. Use for real-time data, frequently-changing data where caching is prohibitive, or maps used by a small numbers of users. For performance reasons, consideration should be made to limit the number of layers enabled by default and limit the number of layers that may be activated at one time by users.

CACHED MAP LAYERS (TILES)

When there are high volumes of traffic or the layer doesn't change often determine which layers may degrade loading speeds and see if they can be cached.

f. **Basemaps** - see section 6.5 Base Maps
g. **Operational Layers** - when there are high volumes of traffic or the layer doesn't change often

FEATURE SERVICE (CLIENT-SIDE GRAPHICS)

Feature layers differ from tiled and dynamic map service layers because they bring geometry information across to the client computer to be drawn by the client. Feature layers potentially cut down on round trips to the server. With feature access enabled a client can request features it needs and, perform selections and queries on those features without having to request additional information from the server. Feature layers and services decrease the processing burden on the server by moving the processing to the client's browser. Feature services are appropriate when the layer responds to user interaction, such as a mouse click or hover.

a. **Interactive operational layers for mashups**
b. **Layers that need to be symbolized on the fly**
c. **Query or geoprocessing results**

d. **Web editing: feature services**

USE SCALE DEPENDENCIES

To reduce clutter and improve map performance set layers to display at relevant scales.

ELIMINATE UNNECESSARY LAYERS

It is important to maintain the scope and purpose of the application. Only include layers that contain data pertinent to the purpose of the application.

LIMIT NUMBER OF LAYERS FOR PERFORMANCE

Use best practices when showing operational map layers. By limiting the number of layers operational at a given time, the performance level of the application will be better maintained and will provide a better user experience. (6) (8)

SYMBOLOGY

DWR and the State do not have a standard symbology defined. When a standard is defined or adopted this document will be updated. Each program and industry has their own symbology standards that are valid for their needs. GIS web applications should use symbology that matches the corresponding program or industry's standard symbology to encourage better cohesiveness between project and program materials. In the future, as more symbology standards are created these would have a cascading effect on the GIS web applications that correspond to the projects and programs as they would continue to match the newest project and program working materials.

LEGEND

Explain symbology in a legend. Without a legend, the meaning of a map is unclear. A legend is required on all applications.

COLOR-BLIND ACCESSIBLE

Symbols should be chosen and/or designed as to not rely on color alone to distinguish between symbols. Symbols can vary in color, contrast, size, shape, pattern, and label. For additional information on accessibility recommendations, see the California Technology Agency's *Recommendation on Accessibility Standards for California State Web Pages* (9).

LOGIN/LOGOUT

PROPER LOGIN PROCEDURE

AUTHENTICATION/AUTHORIZATION

When an application requires that access be limited the authentication information will be gathered on the launch page.

AUTHENTICATION/AUTHORIZATION MECHANISM

An authentication and authorization mechanism is available that conforms to DWR's SOA infrastructure (10)This is the only approved method of authentication /authorization for web applications.

USER RECOGNITION

Each page within the application should identify the logged in user.

USER NAME

Display "First name" and "Last name" (John Smith) in the upper right-hand corner of the application window using the same font style as applied to bolded page content.

LOGOUT PROCEDURE

The application should provide a logout button in the header to the right of the user name. The logout button should destroy the any session data and close the window and direct the user to the launch page. Best practice suggests a warning be prompted before continuing logout procedure. (11) (12) (13)

SESSION TIMEOUT

Session timeouts are recommended to limit duration of an idle open session. It is recommended that a session timeout of no longer than 24 hours be set.

GEODATABASES

ORACLE

Oracle is the preferred Relational Database Management System (RDMS) of DWR.

- Version 11g.

MS SQL SERVER

Microsoft SQL Server will be accepted for existing geodatabases. All future geodatabases should be developed for the preferred standard of Oracle.

POSTGRESQL

PostgreSQL geodatabases can only be used for non enterprise geodatabases.

http://resources.arcgis.com/content/enterprisegis/9.3/services_performance
http://resources.arcgis.com/content/enterprisegis/10.0/services_performance

MINIMUM SPECIFICATIONS

MINIMUM PC SUPPORT

- CPU - Core 2-1.67Ghz
- RAM - 1GB
- Connection - 1.5Mbps

BROWSER

- IE 8 is the department standard supported browser. Consider browser preferences for users when developing GIS Web Applications either for public consumption or for potential public consumption. The application must support IE 8 however, the latest versions of other browsers such as Chrome, Firefox and Safari are frequently used by the public and the application should support these other browsers.

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