

## **How Web Based GIS Was Used In Waste Disposal Option Discussions To Develop A Better Recommendation – 15421**

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### **ABSTRACT**

Arriving at a consensus from individuals or parties who look at the world from varying perspectives often involves compromises. For the Paducah Gaseous Diffusion (PGDP) site, the need to compromise has become readily apparent when trying to look at the big picture from the viewpoint of a project engineer, Department of Energy (DOE) official, politician, public citizen, economic development official, or environmental regulator to name a few. Each interested party has its own wishes and desires as it pertains to a particular outcome for a project, area, or the overall site end-state vision. The Paducah Citizens Advisory Board (CAB) is using Geographic Information Systems (GIS) as a tool to help illustrate the intricacies of the PGDP site. This picture allows all parties the opportunity see how DOE Environmental Management (EM) cleanup decisions will affect the greater community by defining the spatial context of the issue in which all parties are interested.

### **INTRODUCTION**

Consensus decision making differs from the method where a decision maker looks at various alternatives and makes a choice based on the path of least resistance. This process seeks to solve problems and avoid conflict. Decision making through compromise does not necessarily look to develop a policy in which the result is a win-win solution for all. Rather this practice aims to enable parties with different viewpoints to feel as if they can move forward, having fulfilled their sense of purpose. [1]

GIS is becoming an integral part of decision making itself, helping to shape and influence the context in which decisions are made. It is on this level that GIS may have its most profound effects. [6] The Paducah Citizens Advisory Board saw the benefit of GIS as a tool with the issue of waste disposal options at the PGDP. A visioning and consensus building process has proved difficult at best under the Federal Facilities Agreement (FFA) structure in which DOE EM operates under at the PGDP site. Often times it feels as if parties other than the triumvirate of the FFA (Kentucky regulators, Federal EPA, and DOE) are left out of the decision making process. Whether intentional or not, the perception of the process is that the big three of the FFA negotiate milestones without a community perspective and then present the result to the public. Often disdain or mistrust of the process or even the parties is the result.

In many areas, governments are turning to GIS technology to create information from the data they collect, then analyze that data to understand and develop better strategies for solving problems. With the development of the ArcGIS platform, governments at all levels are discovering that the power of location and spatial thinking can be applied to nearly every area to realize higher levels of service. [3] Spatial thinking often requires a spatial context for a clear picture to develop in the mind of persons not directly involved in the issue at hand. The old cliché a picture is worth a thousand words is true more often than not. This is where Web GIS

helps a broader audience develop the spatial context and pictures needed to help gain a broader understanding of the issues and how they affect the surrounding community and environment. DOE EM needs to fully recognize how the decisions it makes affects the communities beyond site boundaries. Community leaders should understand the complexities and technical challenges DOE faces at the site.

One way to help develop this mutual understanding between DOE and the community is through the sharing of information. Web GIS provides an easy way for governments to provide existing data, often times highly technical, to the public in the form of an interactive picture. Serving maps and associated data on the Internet allows an interested person or a group of people to interact with the data and take some measure of control over how it is displayed making it more meaningful to them. In other words, they can manipulate the data into a picture that is understandable to them. The capabilities of Web GIS applications have transformed one-way communication into a platform for supporting citizen participation in government. [5] For the Paducah Citizens Advisory Board and the Paducah Community, Web GIS became a valuable tool for understanding waste disposal options and how those options would affect not only the PDGP site, but the immediate surroundings and the greater community. It was especially important helping the public understand the complexities of the cleanup challenges at the PGDP site. The web map was also key to helping DOE and the regulators understand the community values as part of what the CERCLA process calls Modifying Criteria.

In order to facilitate the conversations, illustrate the complex cleanup issues including waste disposal options, share information, and provide context to what the community values as a future end-state cleanup vision, the Paducah Citizens Advisory Board developed a Web GIS map. This Web GIS map, or web map is called the PGDP Viewer and is located at <http://map-gis.paducahky.gov/pgdpviewer>. The following text describes how the PGDP Viewer was used in the process of educating the community leaders and led to developing a better informed recommendation by the Paducah CAB.

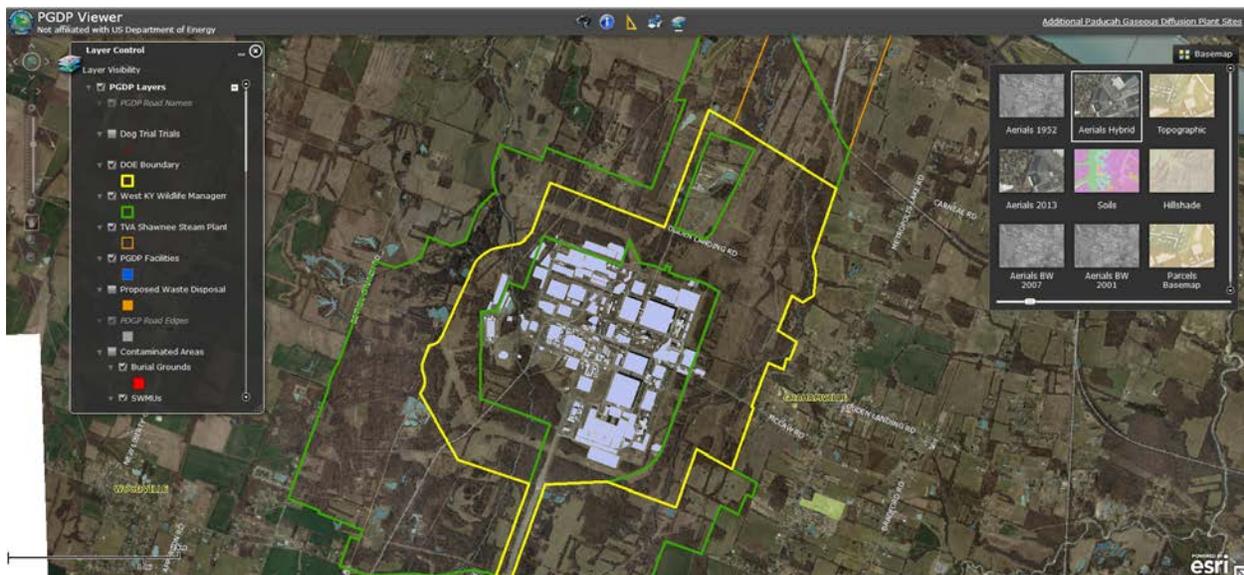


Fig. 1 PGDP Viewer Base Data – <http://map-gis.paducahky.gov/pgdpviewer>

## **DESCRIPTION**

The goal of the consensus vision and future use GIS web map is to provide a tool that fosters an understanding among all parties of where each individual or group stands on any particular issue at the site. The goal is that when decisions are made it is done with a common end-state picture in mind. The decision of off-site versus on-site waste disposal (aka CERCLA Cell, On-site Waste Disposal Facility) and its direct impact on future land use was a major driving force in this process. It is a prime example of how a major decision point can influence many of the other factors in and around the site and community. The PGDP Viewer provided an illustration of the complexities that the DOE and regulators face, as well as an illustration of the community's desires for redevelopment of the PGDP site and the surrounding area.

### **Understanding the issues**

DOE had presented the Paducah CAB with a couple of requests for community input. First was the desire for the community to provide an end state vision for the PGDP site when environmental remediation is completed over the next twenty to thirty years. This was a relatively new idea for the community as the PGDP had been an operating gaseous diffusion plant until May of 2013. Prior to closure, the community was apathetic toward events at the site and the area garnered little community interest. When it became clear that the plant would close, the community developed a keen interest in the future use options for the site. However, there were only a few in the community that understood the complexities of the environmental remediation, the waste stream issues, and the associated funding limitations. There are also complex relationships with control of land through leases, ownership, and adjacent state wildlife management areas. No real discussion had taken place by any involved party about how decisions could affect adjacent land and beyond. It is not just a land use problem, environmental remediation problem, future use problem, or an economic problem. It is a complex comprehensive issue that must be addressed as a whole to find an effective path forward. The community cannot provide input without a fair understanding of the challenges DOE EM faces. In order to foster a positive relationship with the community DOE needed meaningful input from the community.

The second DOE request was the desire for community input on waste disposal options for the estimated 4 million cubic yards of waste expected to be generated during the cleanup process. Various education sessions had been held in multiple locations within the community for over 10 years. Research found an education session as far back as the year 2000. These sessions have had mixed success throughout the years, but had been unsuccessful in providing meaningful input for the process to move forward comfortably. The efforts had also been unsuccessful in resulting in a CAB recommendation or consensus for moving forward. The CAB felt uncomfortable making a recommendation without further community input and the community did not feel confident it had enough participation nor a clear consensus on the issue at hand.

It became clear to the Paducah CAB that the waste disposal options were going to be a key piece in moving forward in any future use scenario. There are two main parts to this problem. First is the on-site or off-site waste disposal option question. The second part pertained to the on-site disposal option. If on site disposal is chosen, then which of five sites would be the preference,

and why? Challenges on this issue were many. Lacking on the DOE side was community input. Lacking on the community side was an understanding of the volume and types of waste, an understanding of the technical complexities of a waste facility, an understanding of the PGDP site itself, and an understanding of the environmental challenges DOE is facing.

### **Education Process Round 1**

The earliest evidence found during the research process suggests that the waste disposal options public conversations started as early the year 2000. There have been as many as six public meetings and many additional public forums where waste disposal options have been discussed for 2000 to 2012. The most comprehensive rounds of public involvement occurred between 2010 and 2011 by the Kentucky Research Consortium for Energy and Environment (KRCEE) and documented in a \$400,000 study entitled Community Visions for the Paducah Gaseous Diffusion Plant Site. This extensive study offered several key insights including the ones highlighted in the next paragraph.

Ultimately, community values identified through KRCEE's future use project support a balance between economic development and environmental stewardship. While local citizens clearly were very concerned about the potential economic impact of PGDP closure, they also were concerned that legacy and future decommissioning waste issues be addressed in scientifically sound and ethical ways. As the study progressed, it became apparent that stakeholder preferences for future land uses at the PGDP are influenced somewhat by the extent and degree of anticipated environmental remediation at the site, as well as other environmental factors. It also became apparent that community preferences for different cleanup options could be influenced by future land use choices. Of most immediate concern is the selection of a waste management alternative for future D&D wastes (e.g. a CERCLA cell). Given the increasing likelihood of plant closure, US DOE and the local community should initiate a formal process to help facilitate any transition. [2] The entire project, along with this study can be viewed at <http://www.ukrcee.org/>.

### **Developing the Web Map**

The solution sounds simple. Educate the community, and then the community can provide feedback to DOE. DOE can then develop a strategy that accomplishes their cleanup mission and complements the community's end-state vision. Simple, but the path to get there is long and muddy with lots of forks in the road. The first step in addressing the missing pieces was to figure how to provide information that conveyed all of the involved party's interests to all the stakeholders involved. Only then could all sides gain an appreciation of what all the other stakeholders were facing or thinking. An interactive web map was the best way to create a pictorial representation of all the issues at hand and provide a graphic with the ability to explain the many facets and dynamics of the PGDP site and surrounding areas.

The first steps taken in the web map development were to identify the PGDP site, its surroundings, the existing conditions, and the state of the environment at the PGDP site. Typical base map data including building footprints, facilities, utilities, roadways, and aerial photographs constituted the map's foundation. Boundaries were then added that defined ownership by various entities including the Commonwealth of Kentucky, the Tennessee Valley Authority (TVA), and

the DOE. Next, the contamination data such as groundwater plumes, solid waste management units (SWMUs), and burial grounds were added. Figure 2 below illustrates some of the key data that was included in this first stage of development. At this point, the PDGDP viewer helped tell the story of the on-site challenges that DOE faces, but that the civic leaders were only acutely aware of.



Fig. 2 PGDP Viewer Site Data – <http://map-gis.paducahky.gov/pgdpviewer>

With one side of the coin illustrated, it was time to focus on the second side. What did the community desire as an end-state vision? This rapidly became a multi-faceted issue as well. There was, and still is, not an easy, clear story to tell. Through the initial community education processes mentioned above, several community desires were evident. There was a strong desire for a recreational component, and a strong desire for a re-industrialization component. How did these desires interact with each other? What about existing community efforts? To a large degree these questions still have not been answered. However, a general framework of ideas was added to the map that help give context around the site. Figure two below delineates existing community efforts and the ideas the community envisioned. Items include highlighting existing industrial areas, potential new industrial areas, enhancing and maintaining a contiguous wildlife area, a new haul road from a proposed state highway extension to the plant, and place holders for ongoing missions at the site. This was obtained from a variety of sources including the Paducah Citizen's Advisory Board, civic leaders, the Paducah Chamber of Commerce, Paducah Economic Development, local government leaders, and Department of Energy staff. As with most visions or plans, this is a constantly evolving effort and the vision, as well as the participants, must be ready to adapt to any number of changes, be it funding levels or technical challenges.

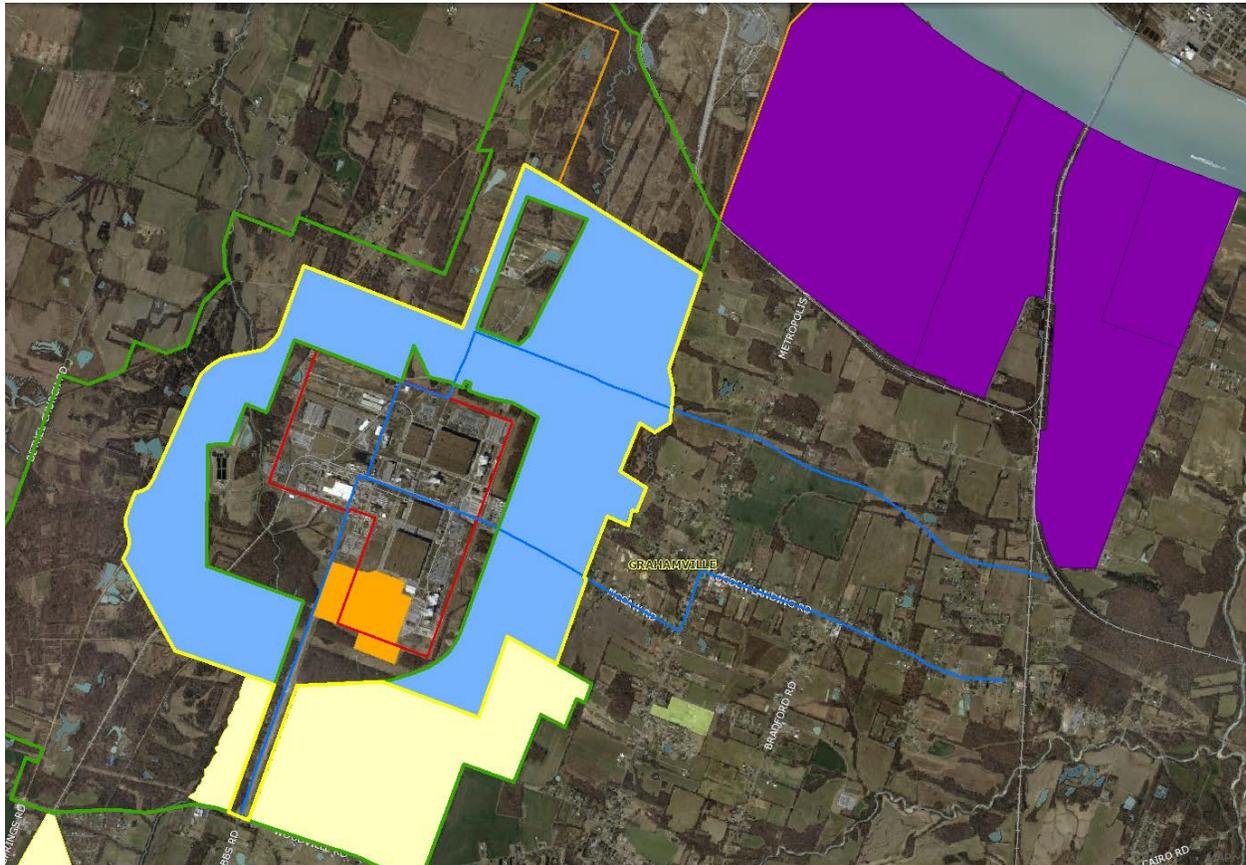


Fig. 3 PGDP Viewer Future Vision Data – <http://map-gis.paducahky.gov/pgdpviewer>

Figure 3 above outlines the main components of the framework. Existing and future industrial land uses are shown in purple. Blue represents recreational land currently owned by DOE and leased by the state of Kentucky as part of the West Kentucky Wildlife Management Area. The orange color represents an ongoing mission by DOE that has at least a twenty year life. The yellow represents an area the community is in the process of securing for immediate economic development while the existing industrialized plant is going through transition and environmental remediation. The two blue lines represent possible haul roads routes from the plant site to connect to a proposed new state highway (not shown). Not shown clearly in the graphic is the western boundary of the recreational areas of the West Kentucky Wildlife Management Area and the boundary of the TVA Shawnee Steam Plant to the north.

Figure 4 below is a snapshot of the PGDP Viewer with all data layers turned on. It is quite cluttered and easy to see how the many site complexities often over-run each other. The web map technology allows the user to take control of the picture and interact with it only displaying what information needs to be view for the particular topic of discussion. The PDGP Viewer leverages existing data provided by the Department of Energy at public meetings, existing data provided for free by the McCracken and Paducah GIS Consortium (MAP~GIS) and is housed on their server. Staff time used to create the site was donated by the local government and the site

was created by MAP~GIS staff. These efforts resulted in the PGDP Viewer being developed at no cost.



Fig. 4 PGDP Viewer All Layers - <http://map-gis.paducahky.gov/pgdpviewer>

## Education Process Round 2

In many instances timing is everything. The development of the PGDP Viewer occurred in various stages over a two year period of time from 2013 to 2014. During this time period the PGDP experienced a major change as the United States Enrichment Corporation (USEC) ceased operations at the plant. The community immediately gained a heightened awareness of the potential impact on the economy and landscape. Suddenly, a future use strategy became of paramount importance. Coupled with this scenario was the CERCLA process on waste disposal options for the PGDP. The process was such that the proposed plan was due to be released by the end of 2014. The Paducah CAB and the community wanted to provide input to DOE, EPA, and the state of Kentucky prior to the release of the proposed plan. The Paducah CAB wanted input from civic leaders, but civic leaders were not as informed on the intricacies of the waste disposal options. All of these forces culminated into the need to have more education sessions.

The Paducah Citizen's Advisory Board organized sessions with its membership and civic leaders to make sure all parties had the same information. The first three meetings, one with each group, were education sessions presented by DOE and its subcontractors. Session one was an overview of the waste disposal issue that defined and identified the types and amounts of waste that will be generated. The second session addressed the on-site disposal options versus off-site disposal options and the challenges associated with each. Session three took a close look at the five proposed sites and the pros and cons of each location. The fourth meeting was a field trip to Oak Ridge, Tennessee to meet with DOE, state regulators, local officials, and stakeholders for a peer exchange. The trip also included a tour of an existing CERCLA waste cell. The fifth and final

meeting included a wrap up session where each proposed disposal site was reviewed and participants were asked to pick which option they preferred, on-site or off-site disposal, and then rank the five proposed on-site disposal facilities.

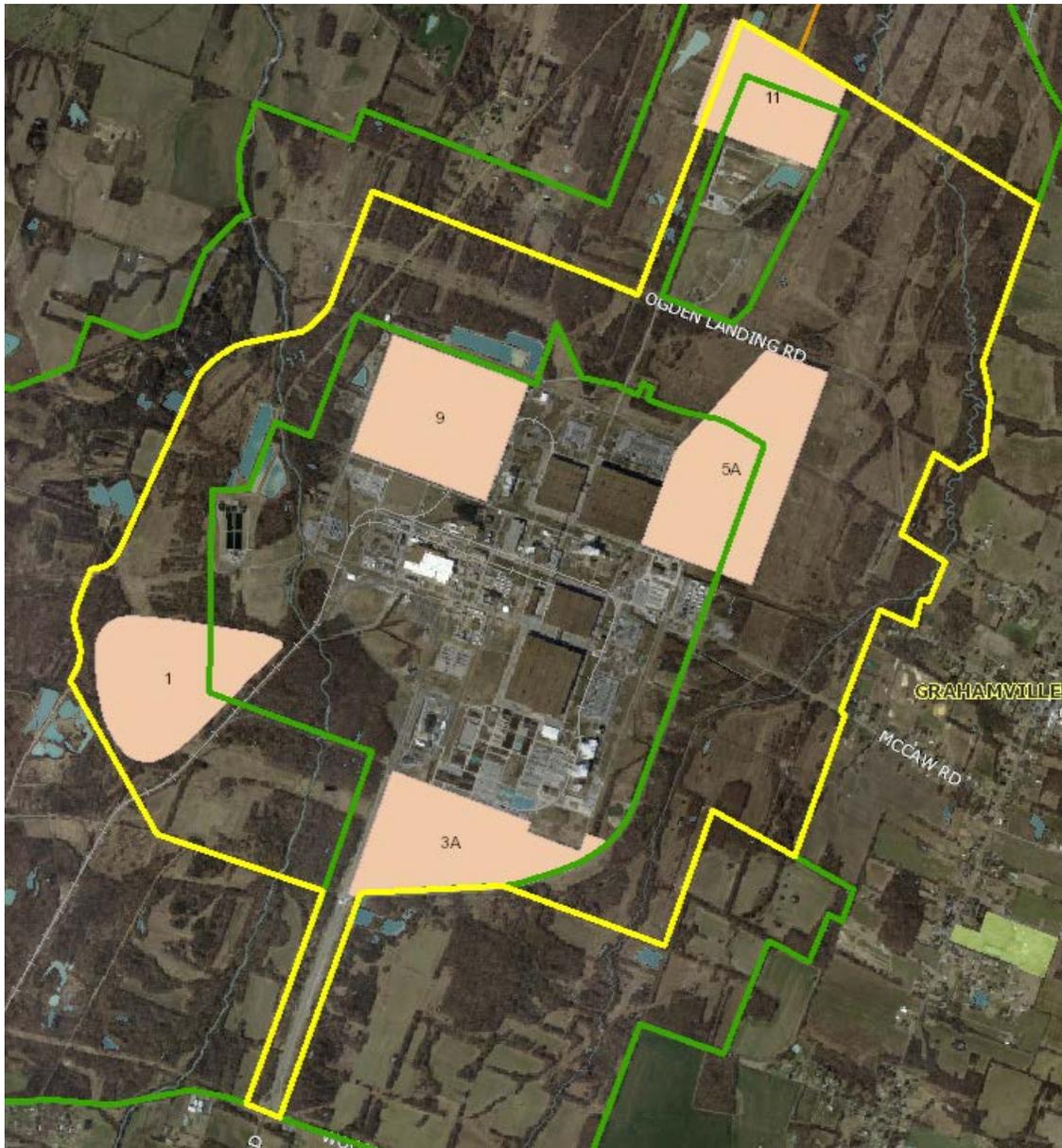


Fig. 5 Proposed Waste Disposal Cell Sites – <http://map-gis.paducahky.gov/pgdpviewer>

### Results and Recommendation

In order to develop a realistic future vision for the site, one had to understand the spatial context and realities in which the vision was being developed. The PGDP Viewer helped fill a need for understanding PGDP site complexities and the surrounding community. The PGDP Viewer was an integral part of waste disposal options discussions. This web map provided context for each

proposed waste disposal site with regards to how it related to the rest of the PGDP facility, and how each site related to the community's future use vision. Figure 5 above depicts the waste disposal locations at the Paducah site. With the combination of the education sessions and the GIS web map, the civic leaders and the Paducah CAB were able to come to a clear majority consensus. The Paducah CAB was able to accomplish something that had not been done in at least 14 years of effort. It was able to provide a recommendation to DOE on waste disposal options that included a clear set of community core values with a clear choice of an on-site disposal preference. The PGDP Viewer played a key role in this decision making process. A map was included as part of the recommendation.

The PGDP Viewer helped facilitate a larger understanding among meeting participants and resulted in two major accomplishments. Civic leaders were educated on the complexities of the site, and the community's ideas were brought to light for DOE to consider in its strategic planning. The community gained a better understanding of the magnitude of the waste stream that will be generated over the next twenty plus years with the PGDP Viewer providing a context for the community to refine its vision. DOE gained a better understanding of what the community desires as an end-state vision.

## **CONCLUSIONS**

Being able to analyze data more effectively, and see more clearly what it means, brings an additional dimension to decision making that's made possible with GIS. [5] The Paducah Citizens Advisory Board's web map application provided a spatial context to a complex problem that resulted in more engaging and informed participants. Better informed community leaders are now ready to face the questions that will arise with the release of the waste disposal options proposed plan and subsequent public meetings.

GIS technology was originally developed to help governments manage land. [5] Given this fact, it seems that GIS would be a natural fit in DOE EM's environmental remediation and public relation strategies. The Paducah CAB's experience with the waste disposal options issue suggests that GIS is a valuable tool in developing quality recommendations, educating interested stakeholders, and providing an interactive illustration for understanding complex issues. Constraints on access to data remain one of the greatest challenges to extending the use of Web GIS in government. Web GIS applications enhance the transparency of government operations and make it easier to measure the outcomes of government programs. [5] By bringing your organization's relevant information (and information from others) to bear on these needs, you ensure that lack of information is not a limiting factor in your organization's decision-making process. Awareness and understanding of business realities and priorities are organizational currency that you can convert into value. [4] DOE EM could leverage more of these advantages by developing public Web GIS applications at each of the sites they manage.

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