Institute of Water Research
Annual Technical Report
FY 2009

Introduction

The Institute of Water Research (IWR) at Michigan State University (MSU) continuously provides timely information for addressing contemporary land and water resource issues through coordinated multidisciplinary efforts using advanced information and networking systems. The IWR endeavors to strengthen MSU s efforts in nontraditional education, outreach, and interdisciplinary studies utilizing available advanced technology, and partnerships with local, state, regional, and federal organizations and individuals. Activities include coordinating education and training programs on surface and ground water protection, land use and watershed management, and many others. (An extended introduction can be found in our FY2001 Annual Technical Report.) We also encourage accessing our web site which offers a more comprehensive resource on IWR activities, goals, and accomplishments: http://www.iwr.msu.edu.

The Institute has increasingly recognized the acute need and effort for multi-disciplinary research to achieve better water management and improved water quality. This effort involves the integration of research data and knowledge with the application of models and geographic information systems (GIS) to produce spatial decision support systems (SDSS). These geospatial decision support systems provide an analytical framework and research data via the web to assist individuals and local and state government agencies make wise resource decisions. The Institute has also increasingly become a catalyst for region wide decision-making support in partnership with other states in EPA Region 5 using state-of-the-art decision support systems.

The Institute also works closely with the MSU Cooperative Extension Service to conduct outreach and education. USGS support of this Institute as well as others in the region enhances the Institute credibility and facilitates partnerships with other federal agencies, universities, and local and state government agencies. The Institute also provides important support to MSU-WATER, a major university initiative dealing with urban storm water issues with funding from the university Vice President for Finance. A member of the Institute's staff works half-time in facilitating MSU-WATER activities so the Institute enjoys a close linkage with this project. The following provides a more detailed explanation of the Institute's general philosophy and approach in defining its program areas and responsibilities.

Research Program Introduction

General Statement
To deal successfully with the emergence of water resource issues unique to the 21st century, transformation of our knowledge and understanding of water for the protection, conservation, and management of water resources is imperative. Radically innovative approaches involving our best scientific knowledge, extensive spatial databases, and "intelligent" tools that visualize wise resource management and conservation in a single holistic system are likewise imperative. Finally, holistic system analysis and understanding requires a strong and integrated multi-disciplinary framework.

Research Program
The management of water resources, appropriate policies, and data acquisition and modeling continue to be at the forefront of the State Legislatures agenda and numerous environmental and agricultural organizations. Our contribution to informing the debate involved numerous meetings, personal discussions, and most importantly, the enhancement of web-based information to aid in the informed decision-making process.

Unique Capabilities: Decision Support Systems as the Nexus
IWR, with its "extended research family," is exceptionally well-positioned to integrate research conducted within each of the three principal water research domains: hydrologic sciences, water resources, and aquatic ecosystems. Integrated decision support both reflects and forms the nexus of these three research domains. Expanding web accessibility to the decision support system nexus (formed by the intersection of the three research domains) will facilitate broad distribution of science-based research produced in these domains. A special emphasis is being placed on facilitation of science-based natural resource state and national policy evolution.

The Institute's extensive experience in regional and national networking provides exceptional opportunities for assembling multi-agency funding to support interdisciplinary water research projects and multi-university partnerships.

Using a Multi-Disciplinary Framework
Using a multi-disciplinary framework facilitates dynamic applications of information to create geospatial, place-based strategies, including watershed management tools, to optimize economic benefits and assure long-term sustainability of valuable water resources. New information technologies including GIS and computational analysis, enhanced human/machine interfaces that drive better information distribution, and access to extensive real-time environmental datasets make a new intelligent reality possible.

Effective watershed management requires integration of theory, data, simulation models, and expert judgment to solve practical problems. Geospatial decision support systems meet these requirements with the capacity to assess and present information geographically, or spatially, through an interface with a geographic information system (GIS). Through the integration of databases, simulation models, and user interfaces, these systems are designed to assist decision makers in evaluating the economic and environmental impacts of various watershed management alternatives.

The ultimate goal of these new imperatives is to secure and protect the future of water quality and supplies in the Great Lakes Basin and across the country and the world with management strategies based on an understanding of the uniqueness of each watershed.

Grant No. 05HQGR0172 Strategic Conceptual Plan for Submittal to the Army Corps of Engineers for the 516(e) Great Lakes Tributary Modeling Program

Basic Information

Title:	Grant No. 05HQGR0172 Strategic Conceptual Plan for Submittal to the Army Corps of Engineers for the 516(e) Great Lakes Tributary Modeling Program
Project Number:	2005MI97S
Start Date:	9/1/2005
End Date:	8/31/2009
Funding Source:	Supplemental
Congressional District:	8th
Research Category:	Water Quality
Focus Category:	Water Quality, Sediments, Models
Descriptors:	Spatial Decision Support System
Principal Investigators:	Jon Bartholic, Jeremiah A Asher, Ouyang Da, Glenn A O'Neil, Da Ouyang, Saichon Seedang, Yi Shi

Publications

1. Bartholic, J. 2006. "A Report from a Soil and Water Conservation Society Workshop." Soil and Water Conservation Society Workshop - Planning for Extremes, November 1-3, 2006. Milwaukee, WI.
2. O'Neil, G. 2006. "Using the Spatially Explicit Delivery Model and the Revised Universal Soil Loss Equation to Target High-Risk Sediment Loading Areas at Multiple Scales." Managing Agricultural Landscapes for Environmental Quality - Strengthening the Science Base (Soil and Water Conservation Society conference), October 11, 2006. Kansas City, MO.
3. O'Neil, G. 2009. "High Impact Targeting - A Web-based System for Optimally Targeting Sediment BMPs." Soil and Water Conservation Society Annual Conference, July 13, 2009. Dearborn, MI.

Title: Grant No. 05HQGR0172 Strategic Conceptual Plan for Submittal to the Army Corps of Engineers for the 516(e) Great Lakes Tributary Modeling Program
Project Number: 2005MI97S
Start: 09/01/2005(actual)
End: 08/31/2009 (actual)
Funding Source: USGS ("104S")
Congressional District: eighth
Research Category: Water Quality
Focus Categories: WQL, SED, MOD
Descriptors: Spatial Decision Support System
Primary PI: Jon Bartholic, Director, Institute of Water Research, Michigan State University, 101 Manly Miles Bldg., 1405 S. Harrison Rd., East Lansing, MI 48823, bartholi@msu.edu, (517) 353-3742
Project Class: Research

Introduction

Our cooperative efforts on U.S. Army Corps of Engineers' 516(e) program began in 2001 with a sub-contract from Wade-Trim in which we used the AGNPS model in the Cass River Watershed of the Saginaw Basin. Then, in Spring 2002, Jan Miller of the Corps asked IWR to "prepare a proposal for a 'big picture' evaluation of sediment loadings from all the tributaries in the Great Lakes as a tool for the 516(e) program."

To meet this need/opportunity a new approach, the SEDMOD/RUSLE (S/R) system, was developed and evaluated. The program took months to run using a 90-meter resolution grid datasets for all 8-digit watersheds across the basin. This resulted in a very useful product and published paper with Da Ouyang, Jon Bartholic, and Jim Selegean. The results were reported at a teleconference meeting in the Detroit, MI Corps office in August of 2003.

Concurrently, the web-accessible and U.S.-wide mapping system Digital Watershed (DW) was developed. With the emergence of these two technologies (S/R and DW), the concept for coupling them for the 516(e) program evolved and a long range strategic vision resulted.

During the period of 9/2005 to 9/2009 IWR brought the strategic vision into reality. This included extensive improvements in the modeling and resolution from 90-meter to 30-meter and to 10-meter. Advisory groups, including local Conservation Districts, evaluated and influenced new model developments. The web-accessible High Impact Targeting (HIT) system was part of this evolution. HIT is designed to facilitate land use and BMP selection at the local, county, or watershed level. Intensive work on several Michigan and Ohio watersheds has provided valuable lessons leading to further improvements. The accuracy of the S/R and DW systems in showing high potential sediment contributing sites was evaluated. Because of the massive analysis required to go

basin-wide, extensive efforts were made to speed up the S/R processing. Additionally, enhancements were made to improve the user-friendliness of DW.

These improved capabilities and interaction with users have resulted in a system that could serve as a basin-wide web-accessible tool to aid in sediment reduction at the local and watershed levels.

Problem and Research Objectives

Soil erosion and subsequent sediment loading from agricultural lands in the Great Lakes Basin is one of the greatest threats to water quality in the region. Nutrients from fertilizers attached to soil particles are flushed into Great Lakes tributaries, feeding algal blooms that exhaust the lakes' critical oxygen supply as the deposited sediments cover lake floor habitat. While these impacts on water quality have been the genesis for millions of dollars in research and conservation, sediment loading has logistical and economic impacts as well. Sediment deposits clog harbors and channels that allow for commercial and recreational boating traffic. As the agency with oversight on federal harbors, the U.S. Army Corps of Engineers is responsible for dredging these sediments and keeping the traffic moving. Therefore the Corps has supported efforts to keep sediments on the land, thereby reducing their annual dredging requirements and protecting water quality in the Great Lakes. When IWR and Corps began a partnership through the 516(e) program, few tools existed to prioritize and target such sediment reducing efforts. The development of user-friendly and readily-accessible tools to prioritize these efforts was the principle objective of this partnership.

Primary Objective:

Prioritize efforts to reduce sediment loading to the Great Lakes.

Sub-objectives:

- Assemble and consult an advisory team of key researchers and decision makers
- Generate models to prioritize watersheds and fields at risk for erosion and sedimentation
- Conduct field evaluations of the models
- Build a web-based tool to disseminate the model results and support cost-benefit analyses of targeting sediment reducing conservation practices
- Improve existing mapping tools to better facilitate watershed analysis
- Promote the tool through workshops and conference presentations

Methodology

In 2005 IWR published a paper describing how it utilized the S/R approach to generate erosion and sediment models for the entire Great Lakes Basin. SEDMOD (the Spatially Explicit Delivery Ratio – the 'S' in S/R) was used to estimate at a grid cell level (90-meter resolution) the percentage of eroded soil that would reach the stream network, given the slope, surface roughness, and soil type of the particular location. RUSLE (the Revised Universal Soil Loss Equation – the 'R' in S/R) estimated annual soil sheet erosion at the same spatial extent, given the slope, soil type, farming practice, and climate at the particular location. Combined, SEDMOD and RUSLE provide estimates of sediment loading to streams, and identify areas with higher rates and totals of sediment loading. With this data calculated for the entire basin, IWR provided the Corps with a means to prioritize sediment reduction at a macro scale (the 8-digit watershed).

In 2006, IWR assembled and advisory group, composed of federal, state and local environmental decision makers, to strategize how to build off of this macro-scale effort and refine the results for use at field-levels.

With inputs from the advisory group, support form the Corps, and leveraged funding from an NRCS Conservation Innovation Grant, IWR developed the High Impact Targeting (HIT) system (www.iwr.msu.edu/hit) for three pilot Michigan watersheds. HIT is a web-based system that allows users to compare erosion and sediment loading estimates at multiple watershed scales (8-digit through 12-digit) and view sub-field level resolution maps of high-risk areas (within the Digital Watershed on-line mapping system). In HIT's development, IWR generated finer resolution S/R models (10-meter and 30-meter) and incorporated more detailed inputs on soils, climate, and farming practice. Additionally, IWR utilized S/R to model the impacts of BMPs and incorporated these results into HIT, allowing users to perform cost-benefit analyses of sediment reduction efforts and identify where conservation dollars will yield the maximum benefit.

Concurrently, IWR enhanced Digital Watershed to improve users' watershed visualization and analysis capabilities. 3-D visualization and links to Google Maps and Microsoft Live Earth were incorporated within the map environment, and extensive search capabilities were added to the site's main interface.

In 2007 IWR coordinated with local partners to thoroughly evaluate the S/R models in the three piloted watersheds. Technicians from local conservation districts evaluated the model maps at over 200 locations, and reported an overall accuracy rate of around 70%.

In 2008 and 2009 IWR reviewed continued feedback from HIT users, the advisory group, and workshop and conference presentations to build a new Great Lakes Basin-wide version of HIT. HIT 2 (www.iwr.msu.edu/hit2) utilized programmatic improvements in the S/R modeling process to generate 30-meter resolution data for the entire basin, and disseminated that data through a sleek mapping interface based off of Microsoft Bing Maps.

Throughout this effort to support the Corps of Engineers and Great Lakes water quality, IWR has shared its results through workshops and conference presentations. These events include the Soil and Water Conservation Society's 2006 Managing Agricultural Landscapes for Environmental Quality conference, 2006 Planning for Extremes workshop, and 2009 Annual Meeting; the Michigan Association of Conservation Districts 2007 annual meeting; the 2008 Lake Michigan Watershed Academy III Conference; and Corps' Detroit District 2008 Sediment Workshop.

Principle Findings and Significance

IWR's partnership with Corps through the 516(e) program has shown that the S/R approach can be an effective method for identifying areas at risk for erosion and sediment loading; and that when disseminated through a user-friendly and web-based tool, tailored from inputs from local decision-makers, the results help users to more efficiently prioritize sediment reducing conservation efforts. Conservation districts in the piloted watersheds have utilized HIT in the development of EPA Watershed Management Plans. With the Basin-wide availability of HIT2, Michigan's Department of Natural Resources and Environment is encouraging all developers of watershed management plans to utilize HIT2 in their preparations. As the installation of conservation practices are guided by tools like HIT, more sediments will remain on the land, improving water quality in the Great Lakes and lightening the dredging load of the Corps of Engineers.

Publications

Bartholic, J. 2006. "A Report from a Soil and Water Conservation Society Workshop." Soil and Water Conservation Society Workshop – Planning for Extremes, November 1-3, 2006. Milwaukee, WI.

O'Neil, G. 2006. "Using the Spatially Explicit Delivery Model and the Revised Universal Soil Loss Equation to Target High-Risk Sediment Loading Areas at Multiple Scales." Managing Agricultural Landscapes for Environmental Quality - Strengthening the Science Base (Soil and Water Conservation Society conference), October 11, 2006. Kansas City, MO.

O'Neil, G. 2009. "High Impact Targeting – A Web-based System for Optimally Targeting Sediment BMPs." Soil and Water Conservation Society Annual Conference, July 13, 2009. Dearborn, MI.

Water Quantity and Water Quality Effects of BMPs Implementation in Urban Areas

Basic Information

Title:	Water Quantity and Water Quality Effects of BMPs Implementation in Urban Areas
Project Number:	2009MI134B
Start Date:	3/1/2009
End Date:	2/28/2010
Funding Source:	104B
Congressional District:	8th
Research Category:	Water Quality
Focus Category:	Groundwater, Water Quality, Management and Planning
Descriptors:	Best Management Practice, Groundwater Recharge, BMP effectiveness
Principal Investigators:	Amirpouyan Nejadhashemi, Dawn Reinhold

Publications

There are no publications.

Title: Water Quantity and Water Quality Effects of BMPs Implementation in Urban Areas
Project Number: 2009MI134B
Start: 03/01/09(actual)
End: 02/28/10 (actual)
Funding Source: USGS ("104B")
Congressional District: Eighth District
Research Category: Water Quality
Focus Categories: (choose 3): GW, WQL, M&P
Descriptors: Best Management Practice, Groundwater Recharge, BMP effectiveness
Primary PI : Amirpouyan Nejadhashemi, Assistant Professor, Michigan State University, Biosystems and Agricultural Engineering
Project Class: Research

Statement of the Problem:
In 1800, about five percent of the United States population lived in cities, whereas today more than 80% of the US population lives in urban areas (Hodgson, 2009). In Michigan, increased urbanization has caused and will continue to cause other concerns, such as altered hydrology, which has a resulting affect on water use in cities, impacted habitat of threatened and common species due to incompatible development, and declining habitat for migratory species, such as birds (The Nature Conservancy, 2008).

In order to mitigate the negative impacts of urbanization, storm water best management practices (BMPs) were introduced. However, selection of the most applicable and effective BMPs is one of the key challenges for protecting water quality. The goal of this study is to conduct a comprehensive literature review and organize and synthesize this information in a way that can easily assist stakeholders and policy makers in the decision-making process regarding BMP implementation strategies.

Project Objectives: The following project objectives are proposed to address these problems:

1. Synthesize current literature and databases regarding water quality and quantity studies on urban BMPs effectiveness, limitations, and key design features.
2. Develop user-friendly software (BMP-toolbox) to estimates BMP effectiveness on pollution mitigation and groundwater recharge based on site-specific characteristics.

Methods and Procedures:

- *Data Collection*
  A comprehensive literature review was conducted in order to retrieve effectiveness of various BMP. In this regard, more than 100 articles were reviewed (please see the references section).

- *Data Organization*
  The BMP effectiveness data that was gathered in the previous step was stored within a database environment (Microsoft Excel). The information including BMP description, Location of study, application, average annual precipitation, precipitation during the sampling, average annual temperature, period of study, soil type, vegetation species, percent of vegetation, filtration media, dimension of the BMP, percent impervious cover,

runoff coefficient, total runoff, percent slope, slope definition, BMP shape, average daily traffic, drainage area, flow depth during a two- year storm, two-year peak flow velocity, Manning's roughness coefficient, number of samples collected, influent/effluent type, annual influent load, mean influent concentration, arithmetic mean concentration for influent, median influent concentration, annual effluent load, mean effluent concentration, arithmetic mean concentration for effluent, median effluent concentration, performance concentration, performance quantity, arithmetic performance quantity, detention volume, detention surface area, brim-full emptying time, half brim-full emptying time, detention basin bottom area, bottom stage volume, standing water condition, flood control volume, design flood return periods, peak flow velocity, percent peak flow decrease, infiltration rate, evaporation rate, ground water recharge, drainage system availability, annual cost estimate, filter construction cost, excavation basin construction cost, structural materials cost, structural control devices cost, vegetation/landscaping cost, development cost, maintenance cost, total cost, and notes. The Excel source file is accessible through the BMP toolbox.

- *BMP-Toolbox Development*
  The BMP-toolbox was developed using a visual programming language (Microsoft Visual Studio 2008 Professional Edition). This toolbox will be linked to the database environment developed under the previous section. The BMP-toolbox will permit users to select a BMP or group of BMPs based on project requirements and limitations. The BMP Toolbox can aid in the selection of urban best management practice(s) based on contaminate type. The toolbox is capable of providing the following information:

  - BMP effectiveness in groundwater recharge
  - BMP water quality effectiveness
  - Influent water quality concentration
  - Effluent water quality concentration
  - Design specifications
  - A summary of all related studies for the selected BMP
  - A summary of statistical analysis for the selected BMP

Any incompleteness in the original database will result in an empty field in the generated report by the BMP-toolbox (the Excel source file).

The program structure (Figure 1) and all program code is presented in appendix A.

Acknowledgment:
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Appendix A:

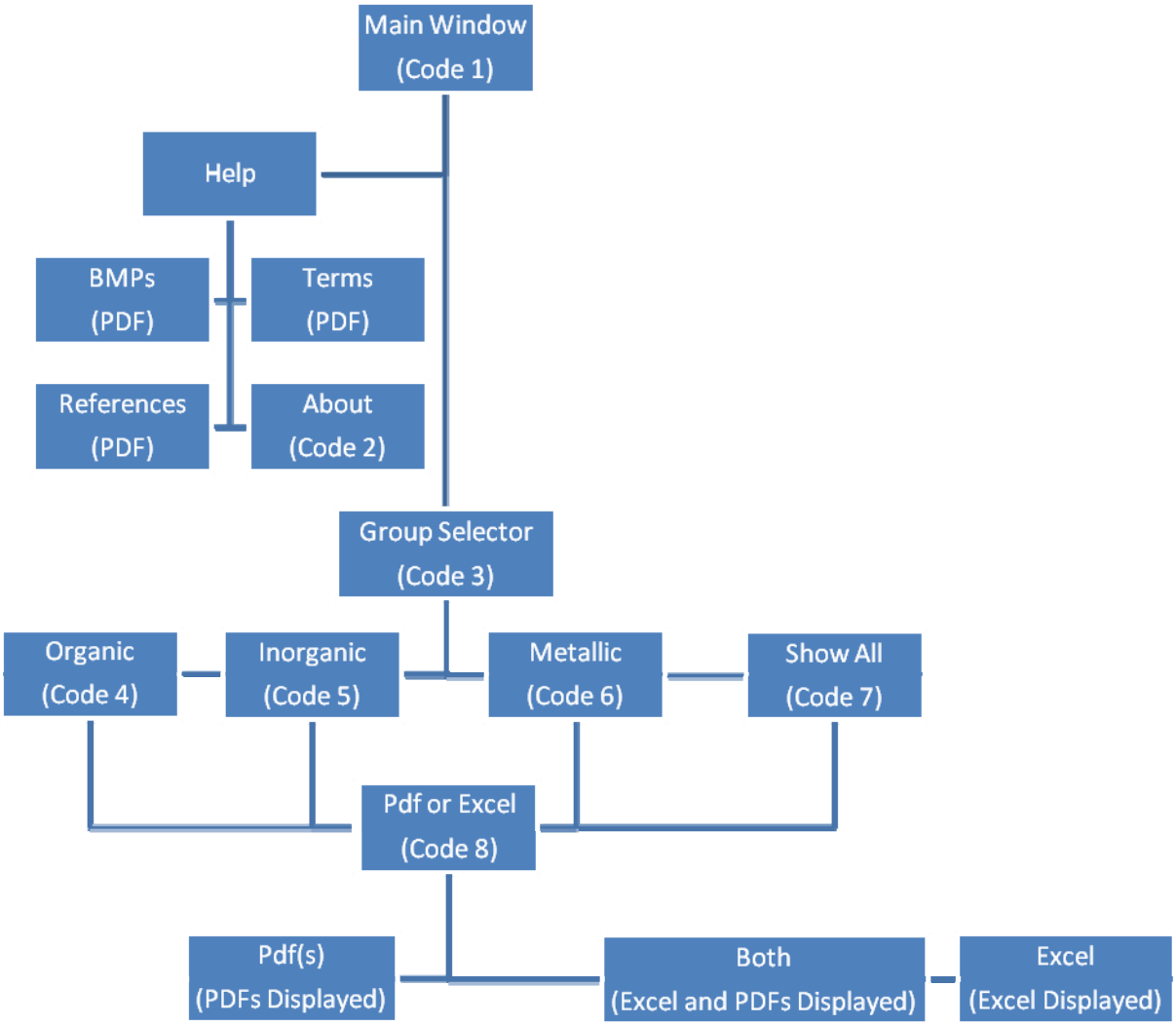

Figure 1. BMP Toolbox

Code 1

```
Public Class frmMain
    Private Sub MainForm_Load(ByVal sender As System.Object, ByVal e
As System.EventArgs) Handles MyBase.Load

    End Sub
    Private Sub Button1_Click(ByVal sender As System.Object, ByVal e
As System.EventArgs) Handles btn_Select_Group.Click
        frmGroupSelector.Show()
    End Sub

    Private Sub btnAbout_Click(ByVal sender As System.Object, ByVal
e As System.EventArgs) Handles btnAbout.Click
        frmAbout.Show()
    End Sub

    Private Sub btn_Help_Click(ByVal sender As System.Object, ByVal
e As System.EventArgs)
        MsgBox("No help files are currently available.", , "Help
Error")
    End Sub

    Private Sub Button2_Click(ByVal sender As System.Object, ByVal e
As System.EventArgs) Handles Button2.Click
        System.Diagnostics.Process.Start("C:\Program Files\MSU -
EML\BMP Toolbox\Resources\BMP Toolbox\Other\BMP Definitions.pdf")
    End Sub

    Private Sub Button1_Click_1(ByVal sender As System.Object, ByVal
e As System.EventArgs) Handles Button1.Click
        System.Diagnostics.Process.Start("C:\Program Files\MSU -
EML\BMP Toolbox\Resources\BMP Toolbox\Other\Terms.pdf")
    End Sub

    Private Sub Button3_Click(ByVal sender As System.Object, ByVal e
As System.EventArgs) Handles Button3.Click
        System.Diagnostics.Process.Start("C:\Program Files\MSU -
EML\BMP Toolbox\Resources\BMP Toolbox\Other\References.pdf")
    End Sub

    Private Sub lbl_Contiue_Click(ByVal sender As System.Object,
ByVal e As System.EventArgs) Handles lbl_Contiue.Click

    End Sub
End Class
```

Code 2

```
Public Class frmAbout

    Private Sub lbllinkUSGS_LinkClicked_1(ByVal sender As
System.Object, ByVal e As
System.Windows.Forms.LinkLabelLinkClickedEventArgs) Handles
lbllinkUSGS.LinkClicked
        System.Diagnostics.Process.Start("http://www.usgs.gov/")
    End Sub

    Private Sub LinkLabel1_LinkClicked_1(ByVal sender As
System.Object, ByVal e As
System.Windows.Forms.LinkLabelLinkClickedEventArgs) Handles
LinkLabel1.LinkClicked
        System.Diagnostics.Process.Start("mailto:" &
"pouyan@msu.edu")
    End Sub

    Private Sub LinkLabel2_LinkClicked_1(ByVal sender As
System.Object, ByVal e As
System.Windows.Forms.LinkLabelLinkClickedEventArgs) Handles
LinkLabel2.LinkClicked
        System.Diagnostics.Process.Start("mailto:" &
"prohask2@msu.edu")
    End Sub

    Private Sub PictureBox1_Click_1(ByVal sender As System.Object,
ByVal e As System.EventArgs) Handles pctMSU.Click
        System.Diagnostics.Process.Start("http://www.msu.edu/")
    End Sub

    Private Sub PictureBox1_Click(ByVal sender As System.Object,
ByVal e As System.EventArgs) Handles PictureBox1.Click
        System.Diagnostics.Process.Start("http://www.usgs.gov/")
    End Sub

    Private Sub frmAbout_Load(ByVal sender As System.Object, ByVal e
As System.EventArgs) Handles MyBase.Load

    End Sub

    Private Sub Label6_Click(ByVal sender As System.Object, ByVal e
As System.EventArgs) Handles Label6.Click

    End Sub

    Private Sub Label2_Click(ByVal sender As System.Object, ByVal e
As System.EventArgs) Handles Label2.Click

    End Sub
```

```
    Private Sub Information_Click(ByVal sender As System.Object,
ByVal e As System.EventArgs) Handles Information.Click

    End Sub
End Class
```

Code 3

```
Public Class frmGroupSelector

    Private Sub Organic_Cont_Button_Click(ByVal sender As
System.Object, ByVal e As System.EventArgs) Handles
btn_Organic.Click
        frmOrgCont.Show()
        Me.Hide()
    End Sub

    Private Sub Inorganic_Cont_Button_Click(ByVal sender As
System.Object, ByVal e As System.EventArgs) Handles
btn_Inorganic.Click
        frmInOrgCont.Show()
        Me.Hide()
    End Sub

    Private Sub Metallic_Cont_Button_Click(ByVal sender As
System.Object, ByVal e As System.EventArgs) Handles
btn_Metallic.Click
        frmMetCont.Show()
        Me.Hide()
    End Sub

    Private Sub Show_All_Cont_Button_Click(ByVal sender As
System.Object, ByVal e As System.EventArgs) Handles
btn_ShowAll.Click
        frmAllCont.Show()
        Me.Hide()
    End Sub

End Class
```

Code 4

```
Public Class frmOrgCont
    Private Sub frmOrgCont_Load(ByVal sender As System.Object, ByVal
e As System.EventArgs) Handles MyBase.Load

        chkReviewed.Checked = False
        lstselected.Items.Clear()
        txtOptions.Text = lstoptions.Items.Count.ToString()
        txtSelected.Text = lstselected.Items.Count.ToString()

    End Sub
    Private Sub lstoptions_SelectedIndexChanged(ByVal sender As
System.Object, ByVal e As System.EventArgs) Handles
lstoptions.SelectedIndexChanged

        Dim want As String
        want = lstoptions.SelectedItem.ToString()
        If lstselected.Items.Contains(want) = False Then
            lstselected.Items.Add(want)
            txtSelected.Text = txtSelected.Text + 1
        ElseIf lstselected.Items.Contains(want) = True Then
            MsgBox("You've already selected that item.", , "Error")
        End If

    End Sub
    Private Sub chkReviewed_CheckedChanged(ByVal sender As
System.Object, ByVal e As System.EventArgs) Handles
chkReviewed.CheckedChanged
        If chkReviewed.Checked = True Then
            btnAccept.Enabled = True
        ElseIf chkReviewed.Checked = False Then
            btnAccept.Enabled = False
        End If
    End Sub

    Private Sub Button3_Click(ByVal sender As System.Object, ByVal e
As System.EventArgs) Handles btnRemove.Click
        lstselected.Items.Remove(lstselected.SelectedItem)
        Dim numselected As Integer = txtSelected.Text
        If lstselected.Items.Count < numselected Then
            txtSelected.Text = txtSelected.Text - 1
            numselected = numselected - 1
        End If

    End Sub

    Private Sub btnRemoveall_Click(ByVal sender As System.Object,
ByVal e As System.EventArgs) Handles btnRemoveall.Click
        lstselected.Items.Clear()
        txtSelected.Text = 0
    End Sub
```

```
    Private Sub btnAccept_Click(ByVal sender As System.Object, ByVal
e As System.EventArgs) Handles btnAccept.Click
        frmExcelpdf.show()
        Me.Hide()

    End Sub

    Private Sub lstselected_SelectedIndexChanged(ByVal sender As
System.Object, ByVal e As System.EventArgs) Handles
lstselected.SelectedIndexChanged

    End Sub
End Class
```

Code 5

```
Public Class frmInOrgCont
    Private Sub frmNonOrgCont_Load(ByVal sender As System.Object,
ByVal e As System.EventArgs) Handles MyBase.Load

        chkReviewed.Checked = False
        lstselected.Items.Clear()
        txtOptions.Text = lstoptions.Items.Count.ToString()
        txtSelected.Text = lstselected.Items.Count.ToString()

    End Sub
    Private Sub lstoptions_SelectedIndexChanged(ByVal sender As
System.Object, ByVal e As System.EventArgs) Handles
lstoptions.SelectedIndexChanged

        Dim want As String
        want = lstoptions.SelectedItem.ToString()
        If lstselected.Items.Contains(want) = False Then
            lstselected.Items.Add(want)
            txtSelected.Text = txtSelected.Text + 1
        ElseIf lstselected.Items.Contains(want) = True Then
            MsgBox("You've already selected that item.", , "Error")
        End If

    End Sub
    Private Sub chkReviewed_CheckedChanged(ByVal sender As
System.Object, ByVal e As System.EventArgs) Handles
chkReviewed.CheckedChanged
        If chkReviewed.Checked = True Then
            btnAccept.Enabled = True
        ElseIf chkReviewed.Checked = False Then
            btnAccept.Enabled = False
        End If
    End Sub

    Private Sub Button3_Click(ByVal sender As System.Object, ByVal e
As System.EventArgs) Handles btnRemove.Click
        lstselected.Items.Remove(lstselected.SelectedItem)
        Dim numselected As Integer = txtSelected.Text
        If lstselected.Items.Count < numselected Then
            txtSelected.Text = txtSelected.Text - 1
            numselected = numselected - 1
        End If

    End Sub

    Private Sub btnRemoveall_Click(ByVal sender As System.Object,
ByVal e As System.EventArgs) Handles btnRemoveall.Click
        lstselected.Items.Clear()
        txtSelected.Text = 0
    End Sub
```

```
    Private Sub btnAccept_Click(ByVal sender As System.Object, ByVal
e As System.EventArgs) Handles btnAccept.Click
        frmExcelpdf.show()
        Me.Hide()

    End Sub

    Private Sub lstselected_SelectedIndexChanged(ByVal sender As
System.Object, ByVal e As System.EventArgs) Handles
lstselected.SelectedIndexChanged

    End Sub
End Class
```

Code 6

```
Public Class frmMetCont
    Private Sub frmMetCont_Load(ByVal sender As System.Object, ByVal
e As System.EventArgs) Handles MyBase.Load

        chkReviewed.Checked = False
        lstselected.Items.Clear()
        txtOptions.Text = lstoptions.Items.Count.ToString()
        txtSelected.Text = lstselected.Items.Count.ToString()

    End Sub
    Private Sub lstoptions_SelectedIndexChanged(ByVal sender As
System.Object, ByVal e As System.EventArgs) Handles
lstoptions.SelectedIndexChanged

        Dim want As String
        want = lstoptions.SelectedItem.ToString()
        If lstselected.Items.Contains(want) = False Then
            lstselected.Items.Add(want)
            txtSelected.Text = txtSelected.Text + 1
        ElseIf lstselected.Items.Contains(want) = True Then
            MsgBox("You've already selected that item.", , "Error")
        End If

    End Sub
    Private Sub chkReviewed_CheckedChanged(ByVal sender As
System.Object, ByVal e As System.EventArgs) Handles
chkReviewed.CheckedChanged
        If chkReviewed.Checked = True Then
            btnAccept.Enabled = True
        ElseIf chkReviewed.Checked = False Then
            btnAccept.Enabled = False
        End If
    End Sub

    Private Sub Button3_Click(ByVal sender As System.Object, ByVal e
As System.EventArgs) Handles btnRemove.Click
        lstselected.Items.Remove(lstselected.SelectedItem)
        Dim numselected As Integer = txtSelected.Text
        If lstselected.Items.Count < numselected Then
            txtSelected.Text = txtSelected.Text - 1
            numselected = numselected - 1
        End If

    End Sub

    Private Sub btnRemoveall_Click(ByVal sender As System.Object,
ByVal e As System.EventArgs) Handles btnRemoveall.Click
        lstselected.Items.Clear()
        txtSelected.Text = 0
    End Sub
```

```
    Private Sub btnAccept_Click(ByVal sender As System.Object, ByVal
e As System.EventArgs) Handles btnAccept.Click
        frmExcelpdf.show()
        Me.Hide()

    End Sub

    Private Sub lstselected_SelectedIndexChanged(ByVal sender As
System.Object, ByVal e As System.EventArgs) Handles
lstselected.SelectedIndexChanged

    End Sub
End Class
```

Code 7

```
Public Class frmAllCont
    Private Sub frmAllCont_Load(ByVal sender As System.Object, ByVal
e As System.EventArgs) Handles MyBase.Load

        chkReviewed.Checked = False
        lstselected.Items.Clear()
        txtOptions.Text = lstoptions.Items.Count.ToString()
        txtSelected.Text = lstselected.Items.Count.ToString()

    End Sub
    Private Sub lstoptions_SelectedIndexChanged(ByVal sender As
System.Object, ByVal e As System.EventArgs) Handles
lstoptions.SelectedIndexChanged

        Dim want As String
        want = lstoptions.SelectedItem.ToString()
        If lstselected.Items.Contains(want) = False Then
            lstselected.Items.Add(want)
            txtSelected.Text = txtSelected.Text + 1
        ElseIf lstselected.Items.Contains(want) = True Then
            MsgBox("You've already selected that item.", , "Error")
        End If

    End Sub
    Private Sub chkReviewed_CheckedChanged(ByVal sender As
System.Object, ByVal e As System.EventArgs) Handles
chkReviewed.CheckedChanged
        If chkReviewed.Checked = True Then
            btnAccept.Enabled = True
        ElseIf chkReviewed.Checked = False Then
            btnAccept.Enabled = False
        End If
    End Sub

    Private Sub Button3_Click(ByVal sender As System.Object, ByVal e
As System.EventArgs) Handles btnRemove.Click
        lstselected.Items.Remove(lstselected.SelectedItem)
        Dim numselected As Integer = txtSelected.Text
        If lstselected.Items.Count < numselected Then
            txtSelected.Text = txtSelected.Text - 1
            numselected = numselected - 1
        End If

    End Sub

    Private Sub btnRemoveall_Click(ByVal sender As System.Object,
ByVal e As System.EventArgs) Handles btnRemoveall.Click
        lstselected.Items.Clear()
        txtSelected.Text = 0
    End Sub
```

```
    Private Sub btnAccept_Click(ByVal sender As System.Object, ByVal
e As System.EventArgs) Handles btnAccept.Click
        frmExcelpdf.show()
        Me.Hide()
    End Sub

    Private Sub lstselected_SelectedIndexChanged(ByVal sender As
System.Object, ByVal e As System.EventArgs) Handles
lstselected.SelectedIndexChanged

    End Sub
End Class
```

Code 8

```
Public Class frmExcelpdf

    Private Sub btnpdf_Click(ByVal sender As System.Object, ByVal e
As System.EventArgs) Handles btnpdf.Click
        'this runs a list for frmAllCont first
        If frmAllCont.lstselected.Items.Count > 0 Then
            If frmAllCont.lstselected.Items.Contains("1- Methyl
Naphthalene, Sediment") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\1-
Methyl Naphthalene, Sediment.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("1,2,5,6-
Dibenzanthracene, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\1,2,5,6-Dibenzanthracene, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("2,4,5-T") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\2,4,5-T.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("2,4,5-TP")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\2,4,5-TP.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("2,4-D") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\2,4-
D.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("2,4-DB,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\2,4-
DB, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("2,4-
Dimethylphenol, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\2,4-
Dimethylphenol, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("2,4-DP,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\2,4-
DP, Total.pdf")
            End If
```

```
            If frmAllCont.lstselected.Items.Contains("2-Nitrophenol,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\2-
Nitrophenol, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("4-Chloro-3-
Methyl-Phenol, Sediment") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\4-
Chloro-3-Methyl-Phenol, Sediment.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("4-Nitrophenol,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\4-
Nitrophenol, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Acenaphthene,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Acenaphthene, Dissolved.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Acenaphthene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Acenaphthene, Total.pdf")
            End If
            If
frmAllCont.lstselected.Items.Contains("Acenaphthylene, Suspended")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Acenaphthylene, Suspended.pdf")
            End If
            If
frmAllCont.lstselected.Items.Contains("Acenaphthylene, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Acenaphthylene, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Aldrin") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Aldrin.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Alkalinity,
Bicarbonate") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Alkalinity, Bicarbonate.pdf")
            End If
```

```
            If frmAllCont.lstselected.Items.Contains("Alkalinity,
Carbonate") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Alkalinity, Carbonate.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Alkalinity,
Fixed Endpoint") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Alkalinity, Fixed Endpoint.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Alkalinity,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Alkalinity, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Alpha Benzene
Hexachloride") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Alpha
Benzene Hexachloride.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Alpha
Endosulfan, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Alpha
Endosulfan, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Aluminum,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Aluminum, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Aluminum,
Total Recoverable in Water") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Aluminum, Total Recoverable in Water.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Ammonia - N")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Ammonia - N.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Ammonia
Dissolved Nitrogen") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Ammonia Dissolved Nitrogen.pdf")
            End If
```

```
            If frmAllCont.lstselected.Items.Contains("Ammonia
Nitrogen, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Ammonia Nitrogen, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Ammonia,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Ammonia, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Ammonium - N")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Ammonium - N.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Ammonium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Ammonium, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Anthracene,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Anthracene, Suspended.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Anthracene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Anthracene, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Antimony,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Antimony, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Arsenic,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Arsenic, Dissolved.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Arsenic,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Arsenic, Total.pdf")
            End If
```

```
            If frmAllCont.lstselected.Items.Contains("Banvel
(Dicamba)") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Banvel (Dicamba).pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Barium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Barium, Total.pdf")
            End If
            If
frmAllCont.lstselected.Items.Contains("Benzo(A)Anthracene1,2-
Benzanthracene, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo(A)Anthracene1,2-Benzanthracene,
Total.pdf")
            End If
            If
frmAllCont.lstselected.Items.Contains("Benzo(B)Fluoranthene, Total")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo(B)Fluoranthene, Total.pdf")
            End If
            If
frmAllCont.lstselected.Items.Contains("Benzo(B)Fluoranthene,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo(B)Fluoranthene, Suspended.pdf")
            End If
            If
frmAllCont.lstselected.Items.Contains("Benzo(Ghi)Perylene1,12-
Benzoperylene, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo(Ghi)Perylene1,12-Benzoperylene,
Total.pdf")
            End If
            If
frmAllCont.lstselected.Items.Contains("Benzo(K)Fluoranthene,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo(K)Fluoranthene, Suspended.pdf")
            End If
            If
frmAllCont.lstselected.Items.Contains("Benzo(K)Fluoranthene, Total")
Then
```

```
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo(K)Fluoranthene, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Benzo-A-
Pyrene, Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo-A-Pyrene, Suspended.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Benzo-A-
Pyrene, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo-A-Pyrene, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Beta
Endosulfan, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Beta
Endosulfan, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Bicarbonate")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Bicarbonate.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Biochemical
Oxygen Demand - 5") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Biochemical Oxygen Demand - 5.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Bis(2-
Ethylhexyl) Phthalate") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Bis(2-Ethylhexyl) Phthalate.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Bromide,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Bromide, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Cadmium,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Cadmium, Dissolved.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Cadmium,
Total") Then
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                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Cadmium, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Cadmium, Total
Recoverable in Water") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Cadmium, Total Recoverable in Water.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Calcium,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Calcium, Dissolved.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Calcium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Calcium, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Calcium, Total
Recoverable in Water") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Calcium, Total Recoverable in Water.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Carbon,
Dissolved Organic") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Carbon, Dissolved Organic.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Carbon, Total
Organic") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Carbon, Total Organic.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Chemical
Oxygen Demand, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chemical Oxygen Demand, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Chlordane,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chlordane, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Chloride,
Dissolved") Then
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                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chloride, Dissolved.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Chloride,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chloride, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Chlorpyrifos,
Total Recoverable") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chlorpyrifos, Total Recoverable.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Chromium,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chromium, Dissolved.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Chromium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chromium, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Chromium,
Total Recoverable in Water") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chromium, Total Recoverable in Water.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Chrysene,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chrysene, Suspended.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Chrysene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chrysene, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Cobalt,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Cobalt, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Copper,
Dissolved") Then
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                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Copper, Dissolved.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Copper,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Copper, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Dalapon,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Dalapon, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Delta Benzene
Hexachloride, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Delta
Benzene Hexachloride, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Demeton-O,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Demeton-O, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Demeton-S,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Demeton-S, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Diazinon")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Diazinon.pdf")
            End If
            If
frmAllCont.lstselected.Items.Contains("Dibenzo(A,H)Anthracene,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Dibenzo(A,H)Anthracene, Dissolved.pdf")
            End If
            If
frmAllCont.lstselected.Items.Contains("Dibenzo(A,H)Anthracene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Dibenzo(A,H)Anthracene, Total.pdf")
            End If
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            If frmAllCont.lstselected.Items.Contains("Dimethyl
Napthalene") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Dimethyl Napthalene.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Di-N-Butyl
Phthalate, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Di-N-
Butyl Phthalate, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Di-N-Octyl
Phthalate, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Di-N-
Octyl Phthalate, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Dinoseb") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Dinoseb.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Dissolved
Solids, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Dissolved Solids, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Disulfoton")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Disulfoton.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("E. Coli") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\E.
Coli.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Endosulfan
Sulfate, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Endosulfan Sulfate, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Endrin") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Endrin.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Endrin
Aldehyde, Total") Then
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                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Endrin Aldehyde, Total.pdf")
            End If
            If
frmAllCont.lstselected.Items.Contains("Epn(C14H14NO4PS)") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Epn(C14H14NO4PS).pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Ethion") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Ethion.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Fecal
Coliforms") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Fecal
Coliforms.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Fecal Strep")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Fecal
Strep.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Fluoranthene,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Fluoranthene, Suspended.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Fluoranthene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Fluoranthene, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Fluorene,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Fluorene, Suspended.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Fluorene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Fluorene, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Fluoride,
Dissolved") Then
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                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Fluoride, Dissolved.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Gamma-Bhc
(Lindane)") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Gamma-Bhc (Lindane).pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Guthion") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Guthion.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Hardness (Ca-
Mg)") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Hardness (Ca-Mg).pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Hardness,
Noncarbonate") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Hardness, Noncarbonate.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Hardness,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Hardness, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Heptachlor")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Heptachlor.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Heptachlor
Epoxide") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Heptachlor Epoxide.pdf")
            End If
            If
frmAllCont.lstselected.Items.Contains("Hexachlorobutadiene, Total")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Hexachlorobutadiene, Total.pdf")
            End If
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            If
frmAllCont.lstselected.Items.Contains("Hexachloroethane, Total")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Hexachloroethane, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Hydrocarbons,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Hydrocarbons, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Hydrocarbons,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Hydrocarbons, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Indeno (1,2,3-
Cd) Pyrene, Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Indeno (1,2,3-Cd) Pyrene, Suspended.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Indeno (1,2,3-
Cd) Pyrene, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Indeno (1,2,3-Cd) Pyrene, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Iron,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Iron,
Dissolved.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Iron, Total")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Iron,
Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Lead,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Lead,
Dissolved.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Lead, Total")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Lead,
Total.pdf")
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            End If
            If frmAllCont.lstselected.Items.Contains("Lithium,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Lithium, Dissolved.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Magnesium,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Magnesium, Dissolved.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Magnesium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Magnesium, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Malathion")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Malathion.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Manganese,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Manganese, Dissolved.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Manganese,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Manganese, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("MCPA") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\MCPA.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("MCPP, Total")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\MCPP,
Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Methoxychlor")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Methoxychlor.pdf")
            End If
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            If frmAllCont.lstselected.Items.Contains("Methyl
Parathion") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Methyl Parathion.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Molybdenum,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Molybdenum, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Motor Oil")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Motor
Oil.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Naphthalene,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Naphthalene, Dissolved.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Naphthalene,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Naphthalene, Suspended.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Naphthalene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Naphthalene, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Nickel,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nickel, Dissolved.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Nickel,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nickel, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Nitrate - N")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate - N.pdf")
            End If
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            If frmAllCont.lstselected.Items.Contains("Nitrate -
Nitrite") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate - Nitrite.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Nitrate -
Nitrogen") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate - Nitrogen.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Nitrate --
Nitrite") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate -- Nitrite.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Nitrate --
Nitrite - N") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate -- Nitrite - N.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Nitrate and
Nitrite - N") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate and  Nitrite - N.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Nitrate and
Nitrite, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate and Nitrite, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Nitrate
Nitrogen, Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate Nitrogen, Dissolved.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Nitrate
Nitrogen, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate Nitrogen, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Nitrate,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate, Total.pdf")
            End If
```

```
            If frmAllCont.lstselected.Items.Contains("Nitrite
Nitrogen, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrite Nitrogen, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Nitrite,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrite, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Nitrobenzene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrobenzene, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Nitrogen
Ammonia, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen Ammonia, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Nitrogen,
Ammonia") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Ammonia.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Nitrogen,
Dissolved Organic") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Dissolved Organic.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Nitrogen,
Nitrate Nitrite") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Nitrate Nitrite.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Nitrogen,
Organic") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Organic.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Nitrogen,
Particulate Organic") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Particulate Organic.pdf")
            End If
```

```
            If frmAllCont.lstselected.Items.Contains("Nitrogen,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Nitrogen,
Total Kjeldahl") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Total Kjeldahl.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Nitrogen,
Total Organic") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Total Organic.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Nitrogen,
Total Organic Kjeldahl") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Total Organic Kjeldahl.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("N-Nitrosodi-N-
Propylamine, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\N-
Nitrosodi-N-Propylamine, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Oil and
Grease") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Oil
and Grease.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Oxygen Demand,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Oxygen Demand, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Oxygen,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Oxygen, Dissolved.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Oxygen,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Oxygen, Total.pdf")
            End If
```

```
            If frmAllCont.lstselected.Items.Contains("P,P' DDD")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\P,P'
DDD.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("P,P' DDE")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\P,P'
DDE.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("P,P' DDT")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\P,P'
DDT.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Parathion")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Parathion.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("PCB - 1016,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\PCB -
1016, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("PCB - 1221")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\PCB -
1221.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("PCB - 1232")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\PCB -
1232.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("PCB - 1242")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\PCB -
1242.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("PCB - 1248")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\PCB -
1248.pdf")
            End If
```

```
            If frmAllCont.lstselected.Items.Contains("PCB - 1254")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\PCB -
1254.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("PCB - 1260")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\PCB -
1260.pdf")
            End If
            If
frmAllCont.lstselected.Items.Contains("Pentachlorophenol") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Pentachlorophenol.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Petroleum
Hydrocarbons, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Petroleum Hydrocarbons, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Petroleum
Hydrocarbons, Total Recoverable") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Petroleum Hydrocarbons, Total Recoverable.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("pH") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\pH.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Phenanthrene,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phenanthrene, Dissolved.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Phenanthrene,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phenanthrene, Suspended.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Phenanthrene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phenanthrene, Total.pdf")
            End If
```

```
            If
frmAllCont.lstselected.Items.Contains("Phenol(C6H5OH), Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phenol(C6H5OH), Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Phosphate,
Ortho") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphate, Ortho.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Phosphate,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphate, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Phosphorus,
Biological Available") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Biological Available.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Phosphorus,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Dissolved.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Phosphorus,
Dissolved Organic") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Dissolved Organic.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Phosphorus,
Dissolved Ortho-Phosphate") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Dissolved Ortho-Phosphate.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Phosphorus,
Filterable Reactive") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Filterable Reactive.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Phosphorus,
Ortho") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Ortho.pdf")
            End If
```

```
            If frmAllCont.lstselected.Items.Contains("Phosphorus,
Particle Bound") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Particle Bound.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Phosphorus,
Soluble Reactive") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Soluble Reactive.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Phosphorus,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Suspended.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Phosphorus,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Phosphorus,
Total Kjeldahl") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Total Kjeldahl.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Polycyclic
Aromatic Hydrocarbon, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Polycyclic Aromatic Hydrocarbon, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Polycyclic
Aromatic Hydrocarbons, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Polycyclic Aromatic Hydrocarbons, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Potassium,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Potassium, Dissolved.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Potassium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Potassium, Total.pdf")
            End If
```

```
            If frmAllCont.lstselected.Items.Contains("Pyrene,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Pyrene, Suspended.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Pyrene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Pyrene, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Residue,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Residue, Suspended.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Residue,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Residue, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Runoff") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Runoff.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Selenium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Selenium, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Silica") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Silica.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Silicon") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Silicon.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Silver,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Silver, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Sodium Salt")
Then
```

```
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Sodium Salt.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Sodium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Sodium, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Suspended
Solids, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Suspended Solids, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Specific
Conductance") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Specific Conductance.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Stibium") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Stibium.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Sulfate,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Sulfate, Dissolved.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Sulfate,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Sulfate, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Suspended
Solids, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Suspended Solids, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Toxaphene")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Toxaphene.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Turbidity")
Then
```

```
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Turbidity.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Vanadium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Vanadium, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Volatile
Solids, Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Volatile Solids, Dissolved.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Volatile
Solids, Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Volatile Solids, Suspended.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Volatile
Solids, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Volatile Solids, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Zinc,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Zinc,
Dissolved.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Zinc, Total")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Zinc,
Total.pdf")
            End If

            frmAllCont.Close()
            Me.Close()

        ElseIf frmOrgCont.lstselected.Items.Count > 0 Then

            If frmOrgCont.lstselected.Items.Contains("1- Methyl
Naphthalene, Sediment") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\1-
Methyl Naphthalene, Sediment.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("1,2,5,6-
Dibenzanthracene, Total") Then
```

```
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\1,2,5,6-Dibenzanthracene, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("2,4,5-T") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\2,4,5-T.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("2,4,5-TP")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\2,4,5-TP.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("2,4-D") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\2,4-
D.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("2,4-DB,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\2,4-
DB, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("2,4-
Dimethylphenol, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\2,4-
Dimethylphenol, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("2,4-DP,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\2,4-
DP, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("2-Nitrophenol,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\2-
Nitrophenol, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("4-Chloro-3-
Methyl-Phenol, Sediment") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\4-
Chloro-3-Methyl-Phenol, Sediment.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("4-Nitrophenol,
Total") Then
```

```
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\4-
Nitrophenol, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Acenaphthene,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Acenaphthene, Dissolved.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Acenaphthene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Acenaphthene, Total.pdf")
            End If
            If
frmOrgCont.lstselected.Items.Contains("Acenaphthylene, Suspended")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Acenaphthylene, Suspended.pdf")
            End If
            If
frmOrgCont.lstselected.Items.Contains("Acenaphthylene, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Acenaphthylene, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Aldrin") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Aldrin.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Alkalinity,
Bicarbonate") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Alkalinity, Bicarbonate.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Alkalinity,
Carbonate") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Alkalinity, Carbonate.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Alkalinity,
Fixed Endpoint") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Alkalinity, Fixed Endpoint.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Alkalinity,
Total") Then
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                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Alkalinity, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Alpha Benzene
Hexachloride") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Alpha
Benzene Hexachloride.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Alpha
Endosulfan, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Alpha
Endosulfan, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Aluminum,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Aluminum, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Aluminum,
Total Recoverable in Water") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Aluminum, Total Recoverable in Water.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Ammonia - N")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Ammonia - N.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Ammonia
Dissolved Nitrogen") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Ammonia Dissolved Nitrogen.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Ammonia
Nitrogen, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Ammonia Nitrogen, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Ammonia,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Ammonia, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Ammonium - N")
Then
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                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Ammonium - N.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Ammonium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Ammonium, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Anthracene,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Anthracene, Suspended.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Anthracene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Anthracene, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Antimony,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Antimony, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Arsenic,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Arsenic, Dissolved.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Arsenic,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Arsenic, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Banvel
(Dicamba)") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Banvel (Dicamba).pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Barium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Barium, Total.pdf")
            End If
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            If
frmOrgCont.lstselected.Items.Contains("Benzo(A)Anthracene1,2-
Benzanthracene, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo(A)Anthracene1,2-Benzanthracene,
Total.pdf")
            End If
            If
frmOrgCont.lstselected.Items.Contains("Benzo(B)Fluoranthene, Total")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo(B)Fluoranthene, Total.pdf")
            End If
            If
frmOrgCont.lstselected.Items.Contains("Benzo(B)Fluoranthene,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo(B)Fluoranthene, Suspended.pdf")
            End If
            If
frmOrgCont.lstselected.Items.Contains("Benzo(Ghi)Perylene1,12-
Benzoperylene, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo(Ghi)Perylene1,12-Benzoperylene,
Total.pdf")
            End If
            If
frmOrgCont.lstselected.Items.Contains("Benzo(K)Fluoranthene,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo(K)Fluoranthene, Suspended.pdf")
            End If
            If
frmOrgCont.lstselected.Items.Contains("Benzo(K)Fluoranthene, Total")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo(K)Fluoranthene, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Benzo-A-
Pyrene, Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo-A-Pyrene, Suspended.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Benzo-A-
Pyrene, Total") Then
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                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo-A-Pyrene, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Beta
Endosulfan, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Beta
Endosulfan, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Bicarbonate")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Bicarbonate.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Biochemical
Oxygen Demand - 5") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Biochemical Oxygen Demand - 5.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Bis(2-
Ethylhexyl) Phthalate") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Bis(2-Ethylhexyl) Phthalate.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Bromide,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Bromide, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Cadmium,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Cadmium, Dissolved.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Cadmium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Cadmium, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Cadmium, Total
Recoverable in Water") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Cadmium, Total Recoverable in Water.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Calcium,
Dissolved") Then
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                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Calcium, Dissolved.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Calcium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Calcium, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Calcium, Total
Recoverable in Water") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Calcium, Total Recoverable in Water.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Carbon,
Dissolved Organic") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Carbon, Dissolved Organic.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Carbon, Total
Organic") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Carbon, Total Organic.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Chemical
Oxygen Demand, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chemical Oxygen Demand, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Chlordane,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chlordane, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Chloride,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chloride, Dissolved.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Chloride,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chloride, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Chlorpyrifos,
Total Recoverable") Then
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                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chlorpyrifos, Total Recoverable.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Chromium,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chromium, Dissolved.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Chromium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chromium, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Chromium,
Total Recoverable in Water") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chromium, Total Recoverable in Water.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Chrysene,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chrysene, Suspended.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Chrysene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chrysene, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Cobalt,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Cobalt, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Copper,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Copper, Dissolved.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Copper,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Copper, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Dalapon,
Total") Then
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                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Dalapon, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Delta Benzene
Hexachloride,Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Delta
Benzene Hexachloride,Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Demeton-O,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Demeton-O, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Demeton-S,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Demeton-S, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Diazinon")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Diazinon.pdf")
            End If
            If
frmOrgCont.lstselected.Items.Contains("Dibenzo(A,H)Anthracene,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Dibenzo(A,H)Anthracene, Dissolved.pdf")
            End If
            If
frmOrgCont.lstselected.Items.Contains("Dibenzo(A,H)Anthracene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Dibenzo(A,H)Anthracene, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Dimethyl
Napthalene") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Dimethyl Napthalene.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Di-N-Butyl
Phthalate, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Di-N-
Butyl Phthalate, Total.pdf")
            End If
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            If frmOrgCont.lstselected.Items.Contains("Di-N-Octyl
Phthalate, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Di-N-
Octyl Phthalate, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Dinoseb") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Dinoseb.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Dissolved
Solids, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Dissolved Solids, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Disulfoton")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Disulfoton.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("E. Coli") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\E.
Coli.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Endosulfan
Sulfate, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Endosulfan Sulfate, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Endrin") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Endrin.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Endrin
Aldehyde, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Endrin Aldehyde, Total.pdf")
            End If
            If
frmOrgCont.lstselected.Items.Contains("Epn(C14H14NO4PS)") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Epn(C14H14NO4PS).pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Ethion") Then
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                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Ethion.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Fecal
Coliforms") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Fecal
Coliforms.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Fecal Strep")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Fecal
Strep.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Fluoranthene,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Fluoranthene, Suspended.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Fluoranthene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Fluoranthene, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Fluorene,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Fluorene, Suspended.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Fluorene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Fluorene, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Fluoride,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Fluoride, Dissolved.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Gamma-Bhc
(Lindane)") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Gamma-Bhc (Lindane).pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Guthion") Then
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                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Guthion.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Hardness (Ca-
Mg)") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Hardness (Ca-Mg).pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Hardness,
Noncarbonate") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Hardness, Noncarbonate.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Hardness,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Hardness, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Heptachlor")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Heptachlor.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Heptachlor
Epoxide") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Heptachlor Epoxide.pdf")
            End If
            If
frmOrgCont.lstselected.Items.Contains("Hexachlorobutadiene, Total")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Hexachlorobutadiene, Total.pdf")
            End If
            If
frmOrgCont.lstselected.Items.Contains("Hexachloroethane, Total")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Hexachloroethane, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Hydrocarbons")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Hydrocarbons.pdf")
            End If
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            If frmOrgCont.lstselected.Items.Contains("Hydrocarbons,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Hydrocarbons, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Indeno (1,2,3-
Cd) Pyrene, Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Indeno (1,2,3-Cd) Pyrene, Suspended.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Indeno (1,2,3-
Cd) Pyrene, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Indeno (1,2,3-Cd) Pyrene, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Iron,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Iron,
Dissolved.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Iron, Total")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Iron,
Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Lead,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Lead,
Dissolved.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Lead, Total")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Lead,
Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Lithium,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Lithium, Dissolved.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Magnesium,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Magnesium, Dissolved.pdf")
            End If
```

```
            If frmOrgCont.lstselected.Items.Contains("Magnesium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Magnesium, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Malathion")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Malathion.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Manganese,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Manganese, Dissolved.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Manganese,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Manganese, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("MCPA") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\MCPA.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("MCPP, Total")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\MCPP,
Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Methoxychlor")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Methoxychlor.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Methyl
Parathion") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Methyl Parathion.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Molybdenum,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Molybdenum, Total.pdf")
            End If
```

```
            If frmOrgCont.lstselected.Items.Contains("Motor Oil")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Motor
Oil.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Naphthalene,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Naphthalene, Dissolved.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Naphthalene,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Naphthalene, Suspended.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Naphthalene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Naphthalene, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Nickel,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nickel, Dissolved.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Nickel,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nickel, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Nitrate - N")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate - N.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Nitrate -
Nitrite") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate - Nitrite.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Nitrate -
Nitrogen") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate - Nitrogen.pdf")
            End If
```

```
            If frmOrgCont.lstselected.Items.Contains("Nitrate /
Nitrite") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate / Nitrite.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Nitrate /
Nitrite - N") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate / Nitrite - N.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Nitrate and
Nitrite - N") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate and  Nitrite - N.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Nitrate and
Nitrite, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate and Nitrite, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Nitrate
Nitrogen, Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate Nitrogen, Dissolved.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Nitrate
Nitrogen, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate Nitrogen, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Nitrate,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Nitrite
Nitrogen, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrite Nitrogen, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Nitrite,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrite, Total.pdf")
            End If
```

```
            If frmOrgCont.lstselected.Items.Contains("Nitrobenzene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrobenzene, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Nitrogen
Ammonia, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen Ammonia, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Nitrogen,
Ammonia") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Ammonia.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Nitrogen,
Dissolved Organic") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Dissolved Organic.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Nitrogen,
Nitrate Nitrite") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Nitrate Nitrite.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Nitrogen,
Organic") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Organic.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Nitrogen,
Particulate Organic") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Particulate Organic.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Nitrogen,
TKN") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, TKN.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Nitrogen,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Total.pdf")
            End If
```

```
            If frmOrgCont.lstselected.Items.Contains("Nitrogen,
Total Kjeldahl") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Total Kjeldahl.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Nitrogen,
Total Organic") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Total Organic.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Nitrogen,
Total Organic Kjeldahl") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Total Organic Kjeldahl.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("N-Nitrosodi-N-
Propylamine, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\N-
Nitrosodi-N-Propylamine, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Oil and
Grease") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Oil
and Grease.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Oxygen Demand,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Oxygen Demand, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Oxygen,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Oxygen, Dissolved.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Oxygen,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Oxygen, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("P,P' DDD")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\P,P'
DDD.pdf")
            End If
```

```
            If frmOrgCont.lstselected.Items.Contains("P,P' DDE")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\P,P'
DDE.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("P,P' DDT")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\P,P'
DDT.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Parathion")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Parathion.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("PCB - 1016,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\PCB -
1016, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("PCB - 1221")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\PCB -
1221.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("PCB - 1232")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\PCB -
1232.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("PCB - 1242")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\PCB -
1242.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("PCB - 1248")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\PCB -
1248.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("PCB - 1254")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\PCB -
1254.pdf")
            End If
```

```
            If frmOrgCont.lstselected.Items.Contains("PCB - 1260")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\PCB -
1260.pdf")
            End If
            If
frmOrgCont.lstselected.Items.Contains("Pentachlorophenol") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Pentachlorophenol.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Petroleum
Hydrocarbons, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Petroleum Hydrocarbons, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Petroleum
Hydrocarbons, Total Recoverable") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Petroleum Hydrocarbons, Total Recoverable.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("pH") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\pH.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Phenanthrene,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phenanthrene, Dissolved.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Phenanthrene,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phenanthrene, Suspended.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Phenanthrene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phenanthrene, Total.pdf")
            End If
            If
frmOrgCont.lstselected.Items.Contains("Phenol(C6H5OH), Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phenol(C6H5OH), Total.pdf")
            End If
```

```
            If frmOrgCont.lstselected.Items.Contains("Phosphate,
Ortho") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphate, Ortho.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Phosphate,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphate, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Phosphorus,
Biological Available") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Biological Available.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Phosphorus,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Dissolved.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Phosphorus,
Dissolved Organic") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Dissolved Organic.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Phosphorus,
Dissolved Ortho-Phosphate") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Dissolved Ortho-Phosphate.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Phosphorus,
Filterable Reactive") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Filterable Reactive.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Phosphorus,
Ortho") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Ortho.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Phosphorus,
Particle Bound") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Particle Bound.pdf")
            End If
```

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            If frmOrgCont.lstselected.Items.Contains("Phosphorus,
Soluble Reactive") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Soluble Reactive.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Phosphorus,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Suspended.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Phosphorus,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Phosphorus,
Total Kjeldahl") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Total Kjeldahl.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Polycyclic
Aromatic Hydrocarbon, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Polycyclic Aromatic Hydrocarbon, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Polycyclic
Aromatic Hydrocarbons, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Polycyclic Aromatic Hydrocarbons, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Potassium,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Potassium, Dissolved.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Potassium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Potassium, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Pyrene,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Pyrene, Suspended.pdf")
            End If
```

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            If frmOrgCont.lstselected.Items.Contains("Pyrene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Pyrene, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Residue,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Residue, Suspended.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Residue,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Residue, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Runoff") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Runoff.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Selenium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Selenium, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Silica") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Silica.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Silicon") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Silicon.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Silver,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Silver, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Sodium Salt")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Sodium Salt.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Sodium,
Total") Then
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                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Sodium, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Suspended
Solids, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Suspended Solids, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Specific
Conductance") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Specific Conductance.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Stibium") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Stibium.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Sulfate,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Sulfate, Dissolved.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Sulfate,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Sulfate, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Suspended
Solids, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Suspended Solids, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Toxaphene")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Toxaphene.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Turbidity")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Turbidity.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Vanadium,
Total") Then
```

```
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Vanadium, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Volatile
Solids, Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Volatile Solids, Dissolved.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Volatile
Solids, Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Volatile Solids, Suspended.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Volatile
Solids, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Volatile Solids, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Zinc,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Zinc,
Dissolved.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Zinc, Total")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Zinc,
Total.pdf")
            End If

            frmOrgCont.Close()
            Me.Close()

            'this list is for frmNonOrgCont
        ElseIf frmInOrgCont.lstselected.Items.Count > 0 Then

            If frmInOrgCont.lstselected.Items.Contains("1- Methyl
Naphthalene, Sediment") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\1-
Methyl Naphthalene, Sediment.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("1,2,5,6-
Dibenzanthracene, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\1,2,5,6-Dibenzanthracene, Total.pdf")
            End If
```

```
            If frmInOrgCont.lstselected.Items.Contains("2,4,5-T")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\2,4,5-T.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("2,4,5-TP")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\2,4,5-TP.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("2,4-D") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\2,4-
D.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("2,4-DB,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\2,4-
DB, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("2,4-
Dimethylphenol, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\2,4-
Dimethylphenol, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("2,4-DP,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\2,4-
DP, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("2-
Nitrophenol, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\2-
Nitrophenol, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("4-Chloro-3-
Methyl-Phenol, Sediment") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\4-
Chloro-3-Methyl-Phenol, Sediment.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("4-
Nitrophenol, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\4-
Nitrophenol, Total.pdf")
            End If
```

```
            If
frmInOrgCont.lstselected.Items.Contains("Acenaphthene, Dissolved")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Acenaphthene, Dissolved.pdf")
            End If
            If
frmInOrgCont.lstselected.Items.Contains("Acenaphthene, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Acenaphthene, Total.pdf")
            End If
            If
frmInOrgCont.lstselected.Items.Contains("Acenaphthylene, Suspended")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Acenaphthylene, Suspended.pdf")
            End If
            If
frmInOrgCont.lstselected.Items.Contains("Acenaphthylene, Total")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Acenaphthylene, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Aldrin")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Aldrin.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Alkalinity,
Bicarbonate") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Alkalinity, Bicarbonate.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Alkalinity,
Carbonate") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Alkalinity, Carbonate.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Alkalinity,
Fixed Endpoint") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Alkalinity, Fixed Endpoint.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Alkalinity,
Total") Then
```

```
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Alkalinity, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Alpha
Benzene Hexachloride") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Alpha
Benzene Hexachloride.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Alpha
Endosulfan, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Alpha
Endosulfan, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Aluminum,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Aluminum, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Aluminum,
Total Recoverable in Water") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Aluminum, Total Recoverable in Water.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Ammonia -
N") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Ammonia - N.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Ammonia
Dissolved Nitrogen") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Ammonia Dissolved Nitrogen.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Ammonia
Nitrogen, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Ammonia Nitrogen, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Ammonia,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Ammonia, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Ammonium -
N") Then
```

```
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Ammonium - N.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Ammonium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Ammonium, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Anthracene,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Anthracene, Suspended.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Anthracene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Anthracene, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Antimony,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Antimony, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Arsenic,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Arsenic, Dissolved.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Arsenic,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Arsenic, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Banvel
(Dicamba)") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Banvel (Dicamba).pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Barium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Barium, Total.pdf")
            End If
```

```
            If
frmInOrgCont.lstselected.Items.Contains("Benzo(A)Anthracene1,2-
Benzanthracene, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo(A)Anthracene1,2-Benzanthracene,
Total.pdf")
            End If
            If
frmInOrgCont.lstselected.Items.Contains("Benzo(B)Fluoranthene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo(B)Fluoranthene, Total.pdf")
            End If
            If
frmInOrgCont.lstselected.Items.Contains("Benzo(B)Fluoranthene,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo(B)Fluoranthene, Suspended.pdf")
            End If
            If
frmInOrgCont.lstselected.Items.Contains("Benzo(Ghi)Perylene1,12-
Benzoperylene, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo(Ghi)Perylene1,12-Benzoperylene,
Total.pdf")
            End If
            If
frmInOrgCont.lstselected.Items.Contains("Benzo(K)Fluoranthene,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo(K)Fluoranthene, Suspended.pdf")
            End If
            If
frmInOrgCont.lstselected.Items.Contains("Benzo(K)Fluoranthene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo(K)Fluoranthene, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Benzo-A-
Pyrene, Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo-A-Pyrene, Suspended.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Benzo-A-
Pyrene, Total") Then
```

```
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo-A-Pyrene, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Beta
Endosulfan, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Beta
Endosulfan, Total.pdf")
            End If
            If
frmInOrgCont.lstselected.Items.Contains("Bicarbonate") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Bicarbonate.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Biochemical
Oxygen Demand - 5") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Biochemical Oxygen Demand - 5.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Bis(2-
Ethylhexyl) Phthalate") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Bis(2-Ethylhexyl) Phthalate.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Bromide,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Bromide, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Cadmium,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Cadmium, Dissolved.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Cadmium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Cadmium, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Cadmium,
Total Recoverable in Water") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Cadmium, Total Recoverable in Water.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Calcium,
Dissolved") Then
```

```
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Calcium, Dissolved.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Calcium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Calcium, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Calcium,
Total Recoverable in Water") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Calcium, Total Recoverable in Water.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Carbon,
Dissolved Organic") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Carbon, Dissolved Organic.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Carbon,
Total Organic") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Carbon, Total Organic.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Chemical
Oxygen Demand, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chemical Oxygen Demand, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Chlordane,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chlordane, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Chloride,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chloride, Dissolved.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Chloride,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chloride, Total.pdf")
            End If
```

```
            If
frmInOrgCont.lstselected.Items.Contains("Chlorpyrifos, Total
Recoverable") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chlorpyrifos, Total Recoverable.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Chromium,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chromium, Dissolved.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Chromium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chromium, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Chromium,
Total Recoverable in Water") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chromium, Total Recoverable in Water.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Chrysene,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chrysene, Suspended.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Chrysene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chrysene, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Cobalt,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Cobalt, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Copper,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Copper, Dissolved.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Copper,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Copper, Total.pdf")
```

```
            End If
            If frmInOrgCont.lstselected.Items.Contains("Dalapon,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Dalapon, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Delta
Benzene Hexachloride,Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Delta
Benzene Hexachloride,Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Demeton-O,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Demeton-O, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Demeton-S,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Demeton-S, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Diazinon")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Diazinon.pdf")
            End If
            If
frmInOrgCont.lstselected.Items.Contains("Dibenzo(A,H)Anthracene,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Dibenzo(A,H)Anthracene, Dissolved.pdf")
            End If
            If
frmInOrgCont.lstselected.Items.Contains("Dibenzo(A,H)Anthracene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Dibenzo(A,H)Anthracene, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Dieldrin")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Dieldrin.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Dimethyl
Napthalene") Then
```

```
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Dimethyl Napthalene.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Di-N-Butyl
Phthalate, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Di-N-
Butyl Phthalate, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Di-N-Octyl
Phthalate, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Di-N-
Octyl Phthalate, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Dinoseb")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Dinoseb.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Dissolved
Solids, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Dissolved Solids, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Disulfoton")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Disulfoton.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("E. Coli")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\E.
Coli.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Endosulfan
Sulfate, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Endosulfan Sulfate, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Endrin")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Endrin.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Endrin
Aldehyde, Total") Then
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                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Endrin Aldehyde, Total.pdf")
            End If
            If
frmInOrgCont.lstselected.Items.Contains("Epn(C14H14NO4PS)") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Epn(C14H14NO4PS).pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Ethion")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Ethion.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Fecal
Coliforms") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Fecal
Coliforms.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Fecal
Strep") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Fecal
Strep.pdf")
            End If
            If
frmInOrgCont.lstselected.Items.Contains("Fluoranthene, Suspended")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Fluoranthene, Suspended.pdf")
            End If
            If
frmInOrgCont.lstselected.Items.Contains("Fluoranthene, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Fluoranthene, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Fluorene,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Fluorene, Suspended.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Fluorene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Fluorene, Total.pdf")
            End If
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            If frmInOrgCont.lstselected.Items.Contains("Fluoride,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Fluoride, Dissolved.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Gamma-Bhc
(Lindane)") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Gamma-Bhc (Lindane).pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Guthion")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Guthion.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Hardness
(Ca-Mg)") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Hardness (Ca-Mg).pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Hardness,
Noncarbonate") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Hardness, Noncarbonate.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Hardness,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Hardness, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Heptachlor")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Heptachlor.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Heptachlor
Epoxide") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Heptachlor Epoxide.pdf")
            End If
            If
frmInOrgCont.lstselected.Items.Contains("Hexachlorobutadiene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Hexachlorobutadiene, Total.pdf")
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            End If
            If
frmInOrgCont.lstselected.Items.Contains("Hexachloroethane, Total")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Hexachloroethane, Total.pdf")
            End If
            If
frmInOrgCont.lstselected.Items.Contains("Hydrocarbons") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Hydrocarbons.pdf")
            End If
            If
frmInOrgCont.lstselected.Items.Contains("Hydrocarbons, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Hydrocarbons, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Indeno
(1,2,3-Cd) Pyrene, Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Indeno (1,2,3-Cd) Pyrene, Suspended.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Indeno
(1,2,3-Cd) Pyrene, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Indeno (1,2,3-Cd) Pyrene, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Iron,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Iron,
Dissolved.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Iron,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Iron,
Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Lead,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Lead,
Dissolved.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Lead,
Total") Then
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                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Lead,
Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Lithium,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Lithium, Dissolved.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Magnesium,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Magnesium, Dissolved.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Magnesium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Magnesium, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Malathion")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Malathion.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Manganese,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Manganese, Dissolved.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Manganese,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Manganese, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("MCPA") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\MCPA.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("MCPP,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\MCPP,
Total.pdf")
            End If
            If
frmInOrgCont.lstselected.Items.Contains("Methoxychlor") Then
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                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Methoxychlor.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Methyl
Parathion") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Methyl Parathion.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Molybdenum,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Molybdenum, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Motor Oil")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Motor
Oil.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Naphthalene,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Naphthalene, Dissolved.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Naphthalene,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Naphthalene, Suspended.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Naphthalene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Naphthalene, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Nickel,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nickel, Dissolved.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Nickel,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nickel, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Nitrate -
N") Then
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                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate - N.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Nitrate -
Nitrite") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate - Nitrite.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Nitrate -
Nitrogen") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate - Nitrogen.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Nitrate /
Nitrite") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate / Nitrite.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Nitrate /
Nitrite - N") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate / Nitrite - N.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Nitrate and
Nitrite - N") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate and  Nitrite - N.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Nitrate and
Nitrite, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate and Nitrite, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Nitrate
Nitrogen, Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate Nitrogen, Dissolved.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Nitrate
Nitrogen, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate Nitrogen, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Nitrate,
Total") Then
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                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Nitrite
Nitrogen, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrite Nitrogen, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Nitrite,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrite, Total.pdf")
            End If
            If
frmInOrgCont.lstselected.Items.Contains("Nitrobenzene, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrobenzene, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Nitrogen
Ammonia, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen Ammonia, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Nitrogen,
Ammonia") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Ammonia.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Nitrogen,
Dissolved Organic") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Dissolved Organic.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Nitrogen,
Nitrate Nitrite") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Nitrate Nitrite.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Nitrogen,
Organic") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Organic.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Nitrogen,
Particulate Organic") Then
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                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Particulate Organic.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Nitrogen,
TKN") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, TKN.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Nitrogen,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Nitrogen,
Total Kjeldahl") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Total Kjeldahl.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Nitrogen,
Total Organic") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Total Organic.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Nitrogen,
Total Organic Kjeldahl") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Total Organic Kjeldahl.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("N-Nitrosodi-
N-Propylamine, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\N-
Nitrosodi-N-Propylamine, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Oil and
Grease") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Oil
and Grease.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Oxygen
Demand, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Oxygen Demand, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Oxygen,
Dissolved") Then
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                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Oxygen, Dissolved.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Oxygen,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Oxygen, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("P,P' DDD")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\P,P'
DDD.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("P,P' DDE")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\P,P'
DDE.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("P,P' DDT")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\P,P'
DDT.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Parathion")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Parathion.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("PCB - 1016,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\PCB -
1016, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("PCB - 1221")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\PCB -
1221.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("PCB - 1232")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\PCB -
1232.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("PCB - 1242")
Then
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                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\PCB -
1242.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("PCB - 1248")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\PCB -
1248.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("PCB - 1254")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\PCB -
1254.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("PCB - 1260")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\PCB -
1260.pdf")
            End If
            If
frmInOrgCont.lstselected.Items.Contains("Pentachlorophenol") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Pentachlorophenol.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Petroleum
Hydrocarbons, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Petroleum Hydrocarbons, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Petroleum
Hydrocarbons, Total Recoverable") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Petroleum Hydrocarbons, Total Recoverable.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("pH") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\pH.pdf")
            End If
            If
frmInOrgCont.lstselected.Items.Contains("Phenanthrene, Dissolved")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phenanthrene, Dissolved.pdf")
            End If
```

```
            If
frmInOrgCont.lstselected.Items.Contains("Phenanthrene, Suspended")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phenanthrene, Suspended.pdf")
            End If
            If
frmInOrgCont.lstselected.Items.Contains("Phenanthrene, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phenanthrene, Total.pdf")
            End If
            If
frmInOrgCont.lstselected.Items.Contains("Phenol(C6H5OH), Total")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phenol(C6H5OH), Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Phosphate,
Ortho") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphate, Ortho.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Phosphate,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphate, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Phosphorus,
Biological Available") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Biological Available.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Phosphorus,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Dissolved.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Phosphorus,
Dissolved Organic") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Dissolved Organic.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Phosphorus,
Dissolved Ortho-Phosphate") Then
```

```
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Dissolved Ortho-Phosphate.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Phosphorus,
Filterable Reactive") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Filterable Reactive.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Phosphorus,
Ortho") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Ortho.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Phosphorus,
Particle Bound") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Particle Bound.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Phosphorus,
Soluble Reactive") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Soluble Reactive.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Phosphorus,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Suspended.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Phosphorus,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Phosphorus,
Total Kjeldahl") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Total Kjeldahl.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Polycyclic
Aromatic Hydrocarbon, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Polycyclic Aromatic Hydrocarbon, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Polycyclic
Aromatic Hydrocarbons, Total") Then
```

```
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Polycyclic Aromatic Hydrocarbons, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Potassium,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Potassium, Dissolved.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Potassium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Potassium, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Pyrene,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Pyrene, Suspended.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Pyrene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Pyrene, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Residue,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Residue, Suspended.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Residue,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Residue, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Runoff")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Runoff.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Selenium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Selenium, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Silica")
Then
```

```
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Silica.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Silicon")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Silicon.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Silver,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Silver, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Sodium
Salt") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Sodium Salt.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Sodium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Sodium, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Suspended
Solids, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Suspended Solids, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Specific
Conductance") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Specific Conductance.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Stibium")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Stibium.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Sulfate,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Sulfate, Dissolved.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Sulfate,
Total") Then
```

```
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Sulfate, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Suspended
Solids, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Suspended Solids, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Toxaphene")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Toxaphene.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Turbidity")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Turbidity.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Vanadium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Vanadium, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Volatile
Solids, Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Volatile Solids, Dissolved.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Volatile
Solids, Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Volatile Solids, Suspended.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Volatile
Solids, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Volatile Solids, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Zinc,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Zinc,
Dissolved.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Zinc,
Total") Then
```

```
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Zinc,
Total.pdf")
            End If

            frmInOrgCont.Close()
            Me.Close()

            'this is for frmMetCont
        ElseIf frmMetCont.lstselected.Items.Count > 0 Then


            If frmMetCont.lstselected.Items.Contains("1- Methyl
Naphthalene, Sediment") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\1-
Methyl Naphthalene, Sediment.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("1,2,5,6-
Dibenzanthracene, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\1,2,5,6-Dibenzanthracene, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("2,4,5-T") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\2,4,5-T.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("2,4,5-TP")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\2,4,5-TP.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("2,4-D") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\2,4-
D.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("2,4-DB,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\2,4-
DB, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("2,4-
Dimethylphenol, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\2,4-
Dimethylphenol, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("2,4-DP,
Total") Then
```

```
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\2,4-
DP, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("2-Nitrophenol,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\2-
Nitrophenol, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("4-Chloro-3-
Methyl-Phenol, Sediment") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\4-
Chloro-3-Methyl-Phenol, Sediment.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("4-Nitrophenol,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\4-
Nitrophenol, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Acenaphthene,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Acenaphthene, Dissolved.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Acenaphthene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Acenaphthene, Total.pdf")
            End If
            If
frmMetCont.lstselected.Items.Contains("Acenaphthylene, Suspended")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Acenaphthylene, Suspended.pdf")
            End If
            If
frmMetCont.lstselected.Items.Contains("Acenaphthylene, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Acenaphthylene, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Aldrin") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Aldrin.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Alkalinity,
Bicarbonate") Then
```

```
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Alkalinity, Bicarbonate.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Alkalinity,
Carbonate") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Alkalinity, Carbonate.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Alkalinity,
Fixed Endpoint") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Alkalinity, Fixed Endpoint.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Alkalinity,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Alkalinity, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Alpha Benzene
Hexachloride") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Alpha
Benzene Hexachloride.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Alpha
Endosulfan, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Alpha
Endosulfan, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Aluminum,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Aluminum, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Aluminum,
Total Recoverable in Water") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Aluminum, Total Recoverable in Water.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Ammonia - N")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Ammonia - N.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Ammonia
Dissolved Nitrogen") Then
```

```
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Ammonia Dissolved Nitrogen.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Ammonia
Nitrogen, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Ammonia Nitrogen, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Ammonia,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Ammonia, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Ammonium - N")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Ammonium - N.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Ammonium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Ammonium, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Anthracene,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Anthracene, Suspended.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Anthracene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Anthracene, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Antimony,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Antimony, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Arsenic,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Arsenic, Dissolved.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Arsenic,
Total") Then
```

```
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Arsenic, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Banvel
(Dicamba)") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Banvel (Dicamba).pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Barium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Barium, Total.pdf")
            End If
            If
frmMetCont.lstselected.Items.Contains("Benzo(A)Anthracene1,2-
Benzanthracene, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo(A)Anthracene1,2-Benzanthracene,
Total.pdf")
            End If
            If
frmMetCont.lstselected.Items.Contains("Benzo(B)Fluoranthene, Total")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo(B)Fluoranthene, Total.pdf")
            End If
            If
frmMetCont.lstselected.Items.Contains("Benzo(B)Fluoranthene,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo(B)Fluoranthene, Suspended.pdf")
            End If
            If
frmMetCont.lstselected.Items.Contains("Benzo(Ghi)Perylene1,12-
Benzoperylene, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo(Ghi)Perylene1,12-Benzoperylene,
Total.pdf")
            End If
            If
frmMetCont.lstselected.Items.Contains("Benzo(K)Fluoranthene,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo(K)Fluoranthene, Suspended.pdf")
            End If
```

```
            If
frmMetCont.lstselected.Items.Contains("Benzo(K)Fluoranthene, Total")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo(K)Fluoranthene, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Benzo-A-
Pyrene, Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo-A-Pyrene, Suspended.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Benzo-A-
Pyrene, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo-A-Pyrene, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Beta
Endosulfan, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Beta
Endosulfan, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Bicarbonate")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Bicarbonate.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Biochemical
Oxygen Demand - 5") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Biochemical Oxygen Demand - 5.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Bis(2-
Ethylhexyl) Phthalate") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Bis(2-Ethylhexyl) Phthalate.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Bromide,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Bromide, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Cadmium,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Cadmium, Dissolved.pdf")
```

```
            End If
            If frmMetCont.lstselected.Items.Contains("Cadmium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Cadmium, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Cadmium, Total
Recoverable in Water") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Cadmium, Total Recoverable in Water.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Calcium,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Calcium, Dissolved.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Calcium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Calcium, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Calcium, Total
Recoverable in Water") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Calcium, Total Recoverable in Water.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Carbon,
Dissolved Organic") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Carbon, Dissolved Organic.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Carbon, Total
Organic") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Carbon, Total Organic.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Chemical
Oxygen Demand, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chemical Oxygen Demand, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Chlordane,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chlordane, Total.pdf")
```

```
            End If
            If frmMetCont.lstselected.Items.Contains("Chloride,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chloride, Dissolved.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Chloride,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chloride, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Chlorpyrifos,
Total Recoverable") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chlorpyrifos, Total Recoverable.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Chromium,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chromium, Dissolved.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Chromium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chromium, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Chromium,
Total Recoverable in Water") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chromium, Total Recoverable in Water.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Chrysene,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chrysene, Suspended.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Chrysene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chrysene, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Cobalt,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Cobalt, Total.pdf")
```

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            End If
            If frmMetCont.lstselected.Items.Contains("Copper,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Copper, Dissolved.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Copper,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Copper, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Dalapon,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Dalapon, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Delta Benzene
Hexachloride,Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Delta
Benzene Hexachloride,Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Demeton-O,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Demeton-O, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Demeton-S,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Demeton-S, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Diazinon")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Diazinon.pdf")
            End If
            If
frmMetCont.lstselected.Items.Contains("Dibenzo(A,H)Anthracene,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Dibenzo(A,H)Anthracene, Dissolved.pdf")
            End If
            If
frmMetCont.lstselected.Items.Contains("Dibenzo(A,H)Anthracene,
Total") Then
```

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                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Dibenzo(A,H)Anthracene, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Dieldrin")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Dieldrin.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Dimethyl
Napthalene") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Dimethyl Napthalene.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Di-N-Butyl
Phthalate, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Di-N-
Butyl Phthalate, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Di-N-Octyl
Phthalate, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Di-N-
Octyl Phthalate, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Dinoseb") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Dinoseb.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Dissolved
Solids, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Dissolved Solids, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Disulfoton")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Disulfoton.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("E. Coli") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\E.
Coli.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Endosulfan
Sulfate, Total") Then
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                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Endosulfan Sulfate, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Endrin") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Endrin.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Endrin
Aldehyde, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Endrin Aldehyde, Total.pdf")
            End If
            If
frmMetCont.lstselected.Items.Contains("Epn(C14H14NO4PS)") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Epn(C14H14NO4PS).pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Ethion") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Ethion.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Fecal
Coliforms") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Fecal
Coliforms.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Fecal Strep")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Fecal
Strep.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Fluoranthene,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Fluoranthene, Suspended.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Fluoranthene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Fluoranthene, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Fluorene,
Suspended") Then
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                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Fluorene, Suspended.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Fluorene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Fluorene, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Fluoride,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Fluoride, Dissolved.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Gamma-Bhc
(Lindane)") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Gamma-Bhc (Lindane).pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Guthion") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Guthion.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Hardness (Ca-
Mg)") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Hardness (Ca-Mg).pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Hardness,
Noncarbonate") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Hardness, Noncarbonate.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Hardness,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Hardness, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Heptachlor")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Heptachlor.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Heptachlor
Epoxide") Then
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                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Heptachlor Epoxide.pdf")
            End If
            If
frmMetCont.lstselected.Items.Contains("Hexachlorobutadiene, Total")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Hexachlorobutadiene, Total.pdf")
            End If
            If
frmMetCont.lstselected.Items.Contains("Hexachloroethane, Total")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Hexachloroethane, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Hydrocarbons")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Hydrocarbons.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Hydrocarbons,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Hydrocarbons, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Indeno (1,2,3-
Cd) Pyrene, Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Indeno (1,2,3-Cd) Pyrene, Suspended.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Indeno (1,2,3-
Cd) Pyrene, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Indeno (1,2,3-Cd) Pyrene, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Iron,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Iron,
Dissolved.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Iron, Total")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Iron,
Total.pdf")
            End If
```

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            If frmMetCont.lstselected.Items.Contains("Lead,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Lead,
Dissolved.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Lead, Total")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Lead,
Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Lithium,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Lithium, Dissolved.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Magnesium,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Magnesium, Dissolved.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Magnesium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Magnesium, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Malathion")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Malathion.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Manganese,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Manganese, Dissolved.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Manganese,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Manganese, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("MCPA") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\MCPA.pdf")
            End If
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            If frmMetCont.lstselected.Items.Contains("MCPP, Total")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\MCPP,
Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Methoxychlor")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Methoxychlor.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Methyl
Parathion") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Methyl Parathion.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Molybdenum,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Molybdenum, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Motor Oil")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Motor
Oil.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Naphthalene,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Naphthalene, Dissolved.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Naphthalene,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Naphthalene, Suspended.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Naphthalene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Naphthalene, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Nickel,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nickel, Dissolved.pdf")
            End If
```

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            If frmMetCont.lstselected.Items.Contains("Nickel,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nickel, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Nitrate - N")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate - N.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Nitrate -
Nitrite") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate - Nitrite.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Nitrate -
Nitrogen") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate - Nitrogen.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Nitrate /
Nitrite") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate / Nitrite.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Nitrate /
Nitrite - N") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate / Nitrite - N.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Nitrate and
Nitrite - N") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate and  Nitrite - N.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Nitrate and
Nitrite, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate and Nitrite, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Nitrate
Nitrogen, Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate Nitrogen, Dissolved.pdf")
            End If
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            If frmMetCont.lstselected.Items.Contains("Nitrate
Nitrogen, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate Nitrogen, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Nitrate,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Nitrite
Nitrogen, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrite Nitrogen, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Nitrite,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrite, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Nitrobenzene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrobenzene, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Nitrogen
Ammonia, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen Ammonia, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Nitrogen,
Ammonia") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Ammonia.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Nitrogen,
Dissolved Organic") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Dissolved Organic.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Nitrogen,
Nitrate Nitrite") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Nitrate Nitrite.pdf")
            End If
```

```
            If frmMetCont.lstselected.Items.Contains("Nitrogen,
Organic") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Organic.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Nitrogen,
Particulate Organic") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Particulate Organic.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Nitrogen,
TKN") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, TKN.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Nitrogen,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Nitrogen,
Total Kjeldahl") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Total Kjeldahl.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Nitrogen,
Total Organic") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Total Organic.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Nitrogen,
Total Organic Kjeldahl") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Total Organic Kjeldahl.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("N-Nitrosodi-N-
Propylamine, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\N-
Nitrosodi-N-Propylamine, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Oil and
Grease") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Oil
and Grease.pdf")
            End If
```

```
            If frmMetCont.lstselected.Items.Contains("Oxygen Demand,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Oxygen Demand, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Oxygen,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Oxygen, Dissolved.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Oxygen,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Oxygen, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("P,P' DDD")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\P,P'
DDD.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("P,P' DDE")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\P,P'
DDE.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("P,P' DDT")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\P,P'
DDT.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Parathion")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Parathion.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("PCB - 1016,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\PCB -
1016, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("PCB - 1221")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\PCB -
1221.pdf")
            End If
```

```
            If frmMetCont.lstselected.Items.Contains("PCB - 1232")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\PCB -
1232.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("PCB - 1242")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\PCB -
1242.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("PCB - 1248")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\PCB -
1248.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("PCB - 1254")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\PCB -
1254.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("PCB - 1260")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\PCB -
1260.pdf")
            End If
            If
frmMetCont.lstselected.Items.Contains("Pentachlorophenol") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Pentachlorophenol.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Petroleum
Hydrocarbons, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Petroleum Hydrocarbons, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Petroleum
Hydrocarbons, Total Recoverable") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Petroleum Hydrocarbons, Total Recoverable.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("pH") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\pH.pdf")
            End If
```

```
            If frmMetCont.lstselected.Items.Contains("Phenanthrene,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phenanthrene, Dissolved.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Phenanthrene,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phenanthrene, Suspended.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Phenanthrene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phenanthrene, Total.pdf")
            End If
            If
frmMetCont.lstselected.Items.Contains("Phenol(C6H5OH), Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phenol(C6H5OH), Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Phosphate,
Ortho") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphate, Ortho.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Phosphate,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphate, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Phosphorus,
Biological Available") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Biological Available.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Phosphorus,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Dissolved.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Phosphorus,
Dissolved Organic") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Dissolved Organic.pdf")
            End If
```

```
            If frmMetCont.lstselected.Items.Contains("Phosphorus,
Dissolved Ortho-Phosphate") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Dissolved Ortho-Phosphate.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Phosphorus,
Filterable Reactive") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Filterable Reactive.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Phosphorus,
Ortho") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Ortho.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Phosphorus,
Particle Bound") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Particle Bound.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Phosphorus,
Soluble Reactive") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Soluble Reactive.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Phosphorus,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Suspended.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Phosphorus,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Phosphorus,
Total Kjeldahl") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Total Kjeldahl.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Polycyclic
Aromatic Hydrocarbon, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Polycyclic Aromatic Hydrocarbon, Total.pdf")
            End If
```

```
            If frmMetCont.lstselected.Items.Contains("Polycyclic
Aromatic Hydrocarbons, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Polycyclic Aromatic Hydrocarbons, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Potassium,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Potassium, Dissolved.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Potassium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Potassium, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Pyrene,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Pyrene, Suspended.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Pyrene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Pyrene, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Residue,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Residue, Suspended.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Residue,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Residue, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Runoff") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Runoff.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Selenium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Selenium, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Silica") Then
```

```
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Silica.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Silicon") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Silicon.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Silver,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Silver, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Sodium Salt")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Sodium Salt.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Sodium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Sodium, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Suspended
Solids, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Suspended Solids, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Specific
Conductance") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Specific Conductance.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Stibium") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Stibium.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Sulfate,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Sulfate, Dissolved.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Sulfate,
Total") Then
```

```
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Sulfate, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Suspended
Solids, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Suspended Solids, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Toxaphene")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Toxaphene.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Turbidity")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Turbidity.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Vanadium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Vanadium, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Volatile
Solids, Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Volatile Solids, Dissolved.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Volatile
Solids, Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Volatile Solids, Suspended.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Volatile
Solids, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Volatile Solids, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Zinc,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Zinc,
Dissolved.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Zinc, Total")
Then
```

```
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Zinc,
Total.pdf")
            End If

            frmMetCont.Close()
            Me.Close()
        End If



    End Sub

    Private Sub btnboth_Click(ByVal sender As System.Object, ByVal e
As System.EventArgs) Handles btnboth.Click
        System.Diagnostics.Process.Start("C:\Program Files\MSU -
EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Exceldatabase.xls")
        'this runs a list for frmAllCont first
        If frmAllCont.lstselected.Items.Count > 0 Then
            If frmAllCont.lstselected.Items.Contains("1- Methyl
Naphthalene, Sediment") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\1-
Methyl Naphthalene, Sediment.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("1,2,5,6-
Dibenzanthracene, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\1,2,5,6-Dibenzanthracene, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("2,4,5-T") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\2,4,5-T.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("2,4,5-TP")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\2,4,5-TP.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("2,4-D") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\2,4-
D.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("2,4-DB,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\2,4-
DB, Total.pdf")
            End If
```

```
            If frmAllCont.lstselected.Items.Contains("2,4-
Dimethylphenol, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\2,4-
Dimethylphenol, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("2,4-DP,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\2,4-
DP, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("2-Nitrophenol,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\2-
Nitrophenol, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("4-Chloro-3-
Methyl-Phenol, Sediment") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\4-
Chloro-3-Methyl-Phenol, Sediment.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("4-Nitrophenol,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\4-
Nitrophenol, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Acenaphthene,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Acenaphthene, Dissolved.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Acenaphthene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Acenaphthene, Total.pdf")
            End If
            If
frmAllCont.lstselected.Items.Contains("Acenaphthylene, Suspended")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Acenaphthylene, Suspended.pdf")
            End If
            If
frmAllCont.lstselected.Items.Contains("Acenaphthylene, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Acenaphthylene, Total.pdf")
```

```
            End If
            If frmAllCont.lstselected.Items.Contains("Aldrin") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Aldrin.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Alkalinity,
Bicarbonate") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Alkalinity, Bicarbonate.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Alkalinity,
Carbonate") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Alkalinity, Carbonate.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Alkalinity,
Fixed Endpoint") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Alkalinity, Fixed Endpoint.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Alkalinity,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Alkalinity, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Alpha Benzene
Hexachloride") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Alpha
Benzene Hexachloride.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Alpha
Endosulfan, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Alpha
Endosulfan, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Aluminum,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Aluminum, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Aluminum,
Total Recoverable in Water") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Aluminum, Total Recoverable in Water.pdf")
            End If
```

```
            If frmAllCont.lstselected.Items.Contains("Ammonia - N")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Ammonia - N.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Ammonia
Dissolved Nitrogen") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Ammonia Dissolved Nitrogen.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Ammonia
Nitrogen, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Ammonia Nitrogen, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Ammonia,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Ammonia, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Ammonium - N")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Ammonium - N.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Ammonium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Ammonium, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Anthracene,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Anthracene, Suspended.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Anthracene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Anthracene, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Antimony,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Antimony, Total.pdf")
            End If
```

```
            If frmAllCont.lstselected.Items.Contains("Arsenic,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Arsenic, Dissolved.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Arsenic,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Arsenic, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Banvel
(Dicamba)") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Banvel (Dicamba).pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Barium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Barium, Total.pdf")
            End If
            If
frmAllCont.lstselected.Items.Contains("Benzo(A)Anthracene1,2-
Benzanthracene, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo(A)Anthracene1,2-Benzanthracene,
Total.pdf")
            End If
            If
frmAllCont.lstselected.Items.Contains("Benzo(B)Fluoranthene, Total")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo(B)Fluoranthene, Total.pdf")
            End If
            If
frmAllCont.lstselected.Items.Contains("Benzo(B)Fluoranthene,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo(B)Fluoranthene, Suspended.pdf")
            End If
            If
frmAllCont.lstselected.Items.Contains("Benzo(Ghi)Perylene1,12-
Benzoperylene, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo(Ghi)Perylene1,12-Benzoperylene,
Total.pdf")
            End If
```

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            If
frmAllCont.lstselected.Items.Contains("Benzo(K)Fluoranthene,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo(K)Fluoranthene, Suspended.pdf")
            End If
            If
frmAllCont.lstselected.Items.Contains("Benzo(K)Fluoranthene, Total")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo(K)Fluoranthene, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Benzo-A-
Pyrene, Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo-A-Pyrene, Suspended.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Benzo-A-
Pyrene, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo-A-Pyrene, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Beta
Endosulfan, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Beta
Endosulfan, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Bicarbonate")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Bicarbonate.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Biochemical
Oxygen Demand - 5") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Biochemical Oxygen Demand - 5.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Bis(2-
Ethylhexyl) Phthalate") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Bis(2-Ethylhexyl) Phthalate.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Bromide,
Total") Then
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                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Bromide, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Cadmium,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Cadmium, Dissolved.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Cadmium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Cadmium, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Cadmium, Total
Recoverable in Water") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Cadmium, Total Recoverable in Water.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Calcium,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Calcium, Dissolved.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Calcium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Calcium, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Calcium, Total
Recoverable in Water") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Calcium, Total Recoverable in Water.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Carbon,
Dissolved Organic") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Carbon, Dissolved Organic.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Carbon, Total
Organic") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Carbon, Total Organic.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Chemical
Oxygen Demand, Total") Then
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                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chemical Oxygen Demand, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Chlordane,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chlordane, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Chloride,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chloride, Dissolved.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Chloride,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chloride, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Chlorpyrifos,
Total Recoverable") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chlorpyrifos, Total Recoverable.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Chromium,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chromium, Dissolved.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Chromium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chromium, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Chromium,
Total Recoverable in Water") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chromium, Total Recoverable in Water.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Chrysene,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chrysene, Suspended.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Chrysene,
Total") Then
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                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chrysene, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Cobalt,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Cobalt, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Copper,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Copper, Dissolved.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Copper,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Copper, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Dalapon,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Dalapon, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Delta Benzene
Hexachloride,Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Delta
Benzene Hexachloride,Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Demeton-O,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Demeton-O, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Demeton-S,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Demeton-S, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Diazinon")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Diazinon.pdf")
            End If
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            If
frmAllCont.lstselected.Items.Contains("Dibenzo(A,H)Anthracene,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Dibenzo(A,H)Anthracene, Dissolved.pdf")
            End If
            If
frmAllCont.lstselected.Items.Contains("Dibenzo(A,H)Anthracene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Dibenzo(A,H)Anthracene, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Dieldrin")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Dieldrin.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Dimethyl
Napthalene") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Dimethyl Napthalene.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Di-N-Butyl
Phthalate, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Di-N-
Butyl Phthalate, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Di-N-Octyl
Phthalate, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Di-N-
Octyl Phthalate, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Dinoseb") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Dinoseb.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Dissolved
Solids, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Dissolved Solids, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Disulfoton")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Disulfoton.pdf")
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            End If
            If frmAllCont.lstselected.Items.Contains("E. Coli") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\E.
Coli.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Endosulfan
Sulfate, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Endosulfan Sulfate, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Endrin") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Endrin.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Endrin
Aldehyde, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Endrin Aldehyde, Total.pdf")
            End If
            If
frmAllCont.lstselected.Items.Contains("Epn(C14H14NO4PS)") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Epn(C14H14NO4PS).pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Ethion") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Ethion.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Fecal
Coliforms") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Fecal
Coliforms.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Fecal Strep")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Fecal
Strep.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Fluoranthene,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Fluoranthene, Suspended.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Fluoranthene,
Total") Then
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                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Fluoranthene, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Fluorene,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Fluorene, Suspended.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Fluorene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Fluorene, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Fluoride,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Fluoride, Dissolved.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Gamma-Bhc
(Lindane)") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Gamma-Bhc (Lindane).pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Guthion") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Guthion.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Hardness (Ca-
Mg)") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Hardness (Ca-Mg).pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Hardness,
Noncarbonate") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Hardness, Noncarbonate.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Hardness,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Hardness, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Heptachlor")
Then
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                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Heptachlor.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Heptachlor
Epoxide") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Heptachlor Epoxide.pdf")
            End If
            If
frmAllCont.lstselected.Items.Contains("Hexachlorobutadiene, Total")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Hexachlorobutadiene, Total.pdf")
            End If
            If
frmAllCont.lstselected.Items.Contains("Hexachloroethane, Total")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Hexachloroethane, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Hydrocarbons")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Hydrocarbons.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Hydrocarbons,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Hydrocarbons, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Indeno (1,2,3-
Cd) Pyrene, Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Indeno (1,2,3-Cd) Pyrene, Suspended.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Indeno (1,2,3-
Cd) Pyrene, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Indeno (1,2,3-Cd) Pyrene, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Iron,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Iron,
Dissolved.pdf")
            End If
```

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            If frmAllCont.lstselected.Items.Contains("Iron, Total")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Iron,
Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Lead,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Lead,
Dissolved.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Lead, Total")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Lead,
Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Lithium,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Lithium, Dissolved.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Magnesium,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Magnesium, Dissolved.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Magnesium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Magnesium, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Malathion")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Malathion.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Manganese,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Manganese, Dissolved.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Manganese,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Manganese, Total.pdf")
            End If
```

```
            If frmAllCont.lstselected.Items.Contains("MCPA") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\MCPA.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("MCPP, Total")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\MCPP,
Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Methoxychlor")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Methoxychlor.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Methyl
Parathion") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Methyl Parathion.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Molybdenum,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Molybdenum, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Motor Oil")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Motor
Oil.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Naphthalene,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Naphthalene, Dissolved.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Naphthalene,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Naphthalene, Suspended.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Naphthalene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Naphthalene, Total.pdf")
            End If
```

```
            If frmAllCont.lstselected.Items.Contains("Nickel,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nickel, Dissolved.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Nickel,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nickel, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Nitrate - N")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate - N.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Nitrate -
Nitrite") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate - Nitrite.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Nitrate -
Nitrogen") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate - Nitrogen.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Nitrate /
Nitrite") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate / Nitrite.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Nitrate /
Nitrite - N") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate / Nitrite - N.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Nitrate and
Nitrite - N") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate and  Nitrite - N.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Nitrate and
Nitrite, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate and Nitrite, Total.pdf")
            End If
```

```
            If frmAllCont.lstselected.Items.Contains("Nitrate
Nitrogen, Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate Nitrogen, Dissolved.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Nitrate
Nitrogen, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate Nitrogen, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Nitrate,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Nitrite
Nitrogen, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrite Nitrogen, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Nitrite,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrite, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Nitrobenzene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrobenzene, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Nitrogen
Ammonia, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen Ammonia, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Nitrogen,
Ammonia") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Ammonia.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Nitrogen,
Dissolved Organic") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Dissolved Organic.pdf")
            End If
```

```
            If frmAllCont.lstselected.Items.Contains("Nitrogen,
Nitrate Nitrite") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Nitrate Nitrite.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Nitrogen,
Organic") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Organic.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Nitrogen,
Particulate Organic") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Particulate Organic.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Nitrogen,
TKN") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, TKN.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Nitrogen,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Nitrogen,
Total Kjeldahl") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Total Kjeldahl.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Nitrogen,
Total Organic") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Total Organic.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Nitrogen,
Total Organic Kjeldahl") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Total Organic Kjeldahl.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("N-Nitrosodi-N-
Propylamine, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\N-
Nitrosodi-N-Propylamine, Total.pdf")
            End If
```

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            If frmAllCont.lstselected.Items.Contains("Oil and
Grease") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Oil
and Grease.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Oxygen Demand,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Oxygen Demand, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Oxygen,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Oxygen, Dissolved.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Oxygen,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Oxygen, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("P,P' DDD")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\P,P'
DDD.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("P,P' DDE")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\P,P'
DDE.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("P,P' DDT")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\P,P'
DDT.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Parathion")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Parathion.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("PCB - 1016,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\PCB -
1016, Total.pdf")
            End If
```

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            If frmAllCont.lstselected.Items.Contains("PCB - 1221")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\PCB -
1221.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("PCB - 1232")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\PCB -
1232.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("PCB - 1242")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\PCB -
1242.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("PCB - 1248")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\PCB -
1248.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("PCB - 1254")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\PCB -
1254.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("PCB - 1260")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\PCB -
1260.pdf")
            End If
            If
frmAllCont.lstselected.Items.Contains("Pentachlorophenol") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Pentachlorophenol.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Petroleum
Hydrocarbons, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Petroleum Hydrocarbons, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Petroleum
Hydrocarbons, Total Recoverable") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Petroleum Hydrocarbons, Total Recoverable.pdf")
            End If
```

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            If frmAllCont.lstselected.Items.Contains("pH") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\pH.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Phenanthrene,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phenanthrene, Dissolved.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Phenanthrene,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phenanthrene, Suspended.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Phenanthrene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phenanthrene, Total.pdf")
            End If
            If
frmAllCont.lstselected.Items.Contains("Phenol(C6H5OH), Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phenol(C6H5OH), Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Phosphate,
Ortho") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphate, Ortho.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Phosphate,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphate, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Phosphorus,
Biological Available") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Biological Available.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Phosphorus,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Dissolved.pdf")
            End If
```

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            If frmAllCont.lstselected.Items.Contains("Phosphorus,
Dissolved Organic") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Dissolved Organic.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Phosphorus,
Dissolved Ortho-Phosphate") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Dissolved Ortho-Phosphate.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Phosphorus,
Filterable Reactive") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Filterable Reactive.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Phosphorus,
Ortho") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Ortho.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Phosphorus,
Particle Bound") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Particle Bound.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Phosphorus,
Soluble Reactive") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Soluble Reactive.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Phosphorus,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Suspended.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Phosphorus,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Phosphorus,
Total Kjeldahl") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Total Kjeldahl.pdf")
            End If
```

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            If frmAllCont.lstselected.Items.Contains("Polycyclic
Aromatic Hydrocarbons, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Polycyclic Aromatic Hydrocarbons, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Potassium,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Potassium, Dissolved.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Potassium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Potassium, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Pyrene,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Pyrene, Suspended.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Pyrene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Pyrene, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Residue,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Residue, Suspended.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Residue,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Residue, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Runoff") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Runoff.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Selenium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Selenium, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Silica") Then
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                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Silica.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Silicon") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Silicon.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Silver,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Silver, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Sodium Salt")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Sodium Salt.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Sodium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Sodium, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Solids,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Solids, Suspended.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Specific
Conductance") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Specific Conductance.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Stibium") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Stibium.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Sulfate,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Sulfate, Dissolved.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Sulfate,
Total") Then
```

```
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Sulfate, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Suspended
Solids, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Suspended Solids, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Toxaphene")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Toxaphene.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Turbidity")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Turbidity.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Vanadium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Vanadium, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Volatile
Solids, Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Volatile Solids, Dissolved.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Volatile
Solids, Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Volatile Solids, Suspended.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Volatile
Solids, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Volatile Solids, Total.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Zinc,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Zinc,
Dissolved.pdf")
            End If
            If frmAllCont.lstselected.Items.Contains("Zinc, Total")
Then
```

```
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Zinc,
Total.pdf")
            End If

            frmAllCont.Close()
            Me.Close()

        ElseIf frmOrgCont.lstselected.Items.Count > 0 Then

            If frmOrgCont.lstselected.Items.Contains("1- Methyl
Naphthalene, Sediment") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\1-
Methyl Naphthalene, Sediment.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("1,2,5,6-
Dibenzanthracene, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\1,2,5,6-Dibenzanthracene, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("2,4,5-T") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\2,4,5-T.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("2,4,5-TP")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\2,4,5-TP.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("2,4-D") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\2,4-
D.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("2,4-DB,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\2,4-
DB, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("2,4-
Dimethylphenol, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\2,4-
Dimethylphenol, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("2,4-DP,
Total") Then
```

```
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\2,4-
DP, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("2-Nitrophenol,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\2-
Nitrophenol, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("4-Chloro-3-
Methyl-Phenol, Sediment") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\4-
Chloro-3-Methyl-Phenol, Sediment.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("4-Nitrophenol,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\4-
Nitrophenol, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Acenaphthene,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Acenaphthene, Dissolved.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Acenaphthene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Acenaphthene, Total.pdf")
            End If
            If
frmOrgCont.lstselected.Items.Contains("Acenaphthylene, Suspended")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Acenaphthylene, Suspended.pdf")
            End If
            If
frmOrgCont.lstselected.Items.Contains("Acenaphthylene, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Acenaphthylene, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Aldrin") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Aldrin.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Alkalinity,
Bicarbonate") Then
```

```
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Alkalinity, Bicarbonate.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Alkalinity,
Carbonate") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Alkalinity, Carbonate.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Alkalinity,
Fixed Endpoint") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Alkalinity, Fixed Endpoint.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Alkalinity,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Alkalinity, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Alpha Benzene
Hexachloride") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Alpha
Benzene Hexachloride.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Alpha
Endosulfan, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Alpha
Endosulfan, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Aluminum,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Aluminum, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Aluminum,
Total Recoverable in Water") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Aluminum, Total Recoverable in Water.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Ammonia - N")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Ammonia - N.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Ammonia
Dissolved Nitrogen") Then
```

```
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Ammonia Dissolved Nitrogen.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Ammonia
Nitrogen, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Ammonia Nitrogen, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Ammonia,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Ammonia, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Ammonium - N")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Ammonium - N.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Ammonium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Ammonium, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Anthracene,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Anthracene, Suspended.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Anthracene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Anthracene, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Antimony,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Antimony, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Arsenic,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Arsenic, Dissolved.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Arsenic,
Total") Then
```

```
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Arsenic, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Banvel
(Dicamba)") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Banvel (Dicamba).pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Barium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Barium, Total.pdf")
            End If
            If
frmOrgCont.lstselected.Items.Contains("Benzo(A)Anthracene1,2-
Benzanthracene, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo(A)Anthracene1,2-Benzanthracene,
Total.pdf")
            End If
            If
frmOrgCont.lstselected.Items.Contains("Benzo(B)Fluoranthene, Total")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo(B)Fluoranthene, Total.pdf")
            End If
            If
frmOrgCont.lstselected.Items.Contains("Benzo(B)Fluoranthene,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo(B)Fluoranthene, Suspended.pdf")
            End If
            If
frmOrgCont.lstselected.Items.Contains("Benzo(Ghi)Perylene1,12-
Benzoperylene, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo(Ghi)Perylene1,12-Benzoperylene,
Total.pdf")
            End If
            If
frmOrgCont.lstselected.Items.Contains("Benzo(K)Fluoranthene,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo(K)Fluoranthene, Suspended.pdf")
            End If
```

```
            If
frmOrgCont.lstselected.Items.Contains("Benzo(K)Fluoranthene, Total")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo(K)Fluoranthene, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Benzo-A-
Pyrene, Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo-A-Pyrene, Suspended.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Benzo-A-
Pyrene, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo-A-Pyrene, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Beta
Endosulfan, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Beta
Endosulfan, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Bicarbonate")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Bicarbonate.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Biochemical
Oxygen Demand - 5") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Biochemical Oxygen Demand - 5.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Bis(2-
Ethylhexyl) Phthalate") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Bis(2-Ethylhexyl) Phthalate.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Bromide,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Bromide, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Cadmium,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Cadmium, Dissolved.pdf")
```

```
            End If
            If frmOrgCont.lstselected.Items.Contains("Cadmium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Cadmium, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Cadmium, Total
Recoverable in Water") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Cadmium, Total Recoverable in Water.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Calcium,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Calcium, Dissolved.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Calcium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Calcium, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Calcium, Total
Recoverable in Water") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Calcium, Total Recoverable in Water.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Carbon,
Dissolved Organic") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Carbon, Dissolved Organic.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Carbon, Total
Organic") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Carbon, Total Organic.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Chemical
Oxygen Demand, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chemical Oxygen Demand, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Chlordane,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chlordane, Total.pdf")
```

```
            End If
            If frmOrgCont.lstselected.Items.Contains("Chloride,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chloride, Dissolved.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Chloride,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chloride, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Chlorpyrifos,
Total Recoverable") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chlorpyrifos, Total Recoverable.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Chromium,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chromium, Dissolved.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Chromium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chromium, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Chromium,
Total Recoverable in Water") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chromium, Total Recoverable in Water.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Chrysene,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chrysene, Suspended.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Chrysene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chrysene, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Cobalt,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Cobalt, Total.pdf")
```

```
            End If
            If frmOrgCont.lstselected.Items.Contains("Copper,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Copper, Dissolved.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Copper,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Copper, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Dalapon,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Dalapon, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Delta Benzene
Hexachloride,Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Delta
Benzene Hexachloride,Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Demeton-O,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Demeton-O, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Demeton-S,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Demeton-S, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Diazinon")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Diazinon.pdf")
            End If
            If
frmOrgCont.lstselected.Items.Contains("Dibenzo(A,H)Anthracene,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Dibenzo(A,H)Anthracene, Dissolved.pdf")
            End If
            If
frmOrgCont.lstselected.Items.Contains("Dibenzo(A,H)Anthracene,
Total") Then
```

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                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Dibenzo(A,H)Anthracene, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Dieldrin")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Dieldrin.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Dimethyl
Napthalene") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Dimethyl Napthalene.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Di-N-Butyl
Phthalate, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Di-N-
Butyl Phthalate, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Di-N-Octyl
Phthalate, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Di-N-
Octyl Phthalate, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Dinoseb") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Dinoseb.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Dissolved
Solids, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Dissolved Solids, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Disulfoton")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Disulfoton.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("E. Coli") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\E.
Coli.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Endosulfan
Sulfate, Total") Then
```

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                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Endosulfan Sulfate, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Endrin") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Endrin.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Endrin
Aldehyde, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Endrin Aldehyde, Total.pdf")
            End If
            If
frmOrgCont.lstselected.Items.Contains("Epn(C14H14NO4PS)") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Epn(C14H14NO4PS).pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Ethion") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Ethion.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Fecal
Coliforms") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Fecal
Coliforms.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Fecal Strep")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Fecal
Strep.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Fluoranthene,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Fluoranthene, Suspended.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Fluoranthene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Fluoranthene, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Fluorene,
Suspended") Then
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                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Fluorene, Suspended.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Fluorene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Fluorene, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Fluoride,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Fluoride, Dissolved.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Gamma-Bhc
(Lindane)") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Gamma-Bhc (Lindane).pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Guthion") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Guthion.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Hardness (Ca-
Mg)") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Hardness (Ca-Mg).pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Hardness,
Noncarbonate") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Hardness, Noncarbonate.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Hardness,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Hardness, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Heptachlor")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Heptachlor.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Heptachlor
Epoxide") Then
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                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Heptachlor Epoxide.pdf")
            End If
            If
frmOrgCont.lstselected.Items.Contains("Hexachlorobutadiene, Total")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Hexachlorobutadiene, Total.pdf")
            End If
            If
frmOrgCont.lstselected.Items.Contains("Hexachloroethane, Total")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Hexachloroethane, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Hydrocarbons")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Hydrocarbons.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Hydrocarbons,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Hydrocarbons, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Indeno (1,2,3-
Cd) Pyrene, Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Indeno (1,2,3-Cd) Pyrene, Suspended.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Indeno (1,2,3-
Cd) Pyrene, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Indeno (1,2,3-Cd) Pyrene, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Iron,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Iron,
Dissolved.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Iron, Total")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Iron,
Total.pdf")
            End If
```

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            If frmOrgCont.lstselected.Items.Contains("Lead,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Lead,
Dissolved.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Lead, Total")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Lead,
Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Lithium,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Lithium, Dissolved.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Magnesium,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Magnesium, Dissolved.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Magnesium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Magnesium, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Malathion")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Malathion.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Manganese,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Manganese, Dissolved.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Manganese,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Manganese, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("MCPA") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\MCPA.pdf")
            End If
```

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            If frmOrgCont.lstselected.Items.Contains("MCPP, Total")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\MCPP,
Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Methoxychlor")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Methoxychlor.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Methyl
Parathion") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Methyl Parathion.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Molybdenum,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Molybdenum, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Motor Oil")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Motor
Oil.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Naphthalene,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Naphthalene, Dissolved.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Naphthalene,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Naphthalene, Suspended.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Naphthalene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Naphthalene, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Nickel,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nickel, Dissolved.pdf")
            End If
```

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            If frmOrgCont.lstselected.Items.Contains("Nickel,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nickel, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Nitrate - N")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate - N.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Nitrate -
Nitrite") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate - Nitrite.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Nitrate -
Nitrogen") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate - Nitrogen.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Nitrate /
Nitrite") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate / Nitrite.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Nitrate /
Nitrite - N") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate / Nitrite - N.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Nitrate and
Nitrite - N") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate and  Nitrite - N.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Nitrate and
Nitrite, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate and Nitrite, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Nitrate
Nitrogen, Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate Nitrogen, Dissolved.pdf")
            End If
```

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            If frmOrgCont.lstselected.Items.Contains("Nitrate
Nitrogen, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate Nitrogen, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Nitrate,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Nitrite
Nitrogen, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrite Nitrogen, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Nitrite,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrite, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Nitrobenzene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrobenzene, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Nitrogen
Ammonia, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen Ammonia, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Nitrogen,
Ammonia") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Ammonia.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Nitrogen,
Dissolved Organic") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Dissolved Organic.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Nitrogen,
Nitrate Nitrite") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Nitrate Nitrite.pdf")
            End If
```

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            If frmOrgCont.lstselected.Items.Contains("Nitrogen,
Organic") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Organic.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Nitrogen,
Particulate Organic") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Particulate Organic.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Nitrogen,
TKN") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, TKN.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Nitrogen,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Nitrogen,
Total Kjeldahl") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Total Kjeldahl.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Nitrogen,
Total Organic") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Total Organic.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Nitrogen,
Total Organic Kjeldahl") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Total Organic Kjeldahl.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("N-Nitrosodi-N-
Propylamine, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\N-
Nitrosodi-N-Propylamine, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Oil and
Grease") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Oil
and Grease.pdf")
            End If
```

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            If frmOrgCont.lstselected.Items.Contains("Oxygen Demand,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Oxygen Demand, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Oxygen,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Oxygen, Dissolved.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Oxygen,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Oxygen, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("P,P' DDD")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\P,P'
DDD.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("P,P' DDE")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\P,P'
DDE.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("P,P' DDT")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\P,P'
DDT.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Parathion")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Parathion.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("PCB - 1016,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\PCB -
1016, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("PCB - 1221")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\PCB -
1221.pdf")
            End If
```

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            If frmOrgCont.lstselected.Items.Contains("PCB - 1232")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\PCB -
1232.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("PCB - 1242")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\PCB -
1242.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("PCB - 1248")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\PCB -
1248.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("PCB - 1254")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\PCB -
1254.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("PCB - 1260")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\PCB -
1260.pdf")
            End If
            If
frmOrgCont.lstselected.Items.Contains("Pentachlorophenol") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Pentachlorophenol.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Petroleum
Hydrocarbons, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Petroleum Hydrocarbons, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Petroleum
Hydrocarbons, Total Recoverable") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Petroleum Hydrocarbons, Total Recoverable.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("pH") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\pH.pdf")
            End If
```

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            If frmOrgCont.lstselected.Items.Contains("Phenanthrene,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phenanthrene, Dissolved.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Phenanthrene,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phenanthrene, Suspended.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Phenanthrene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phenanthrene, Total.pdf")
            End If
            If
frmOrgCont.lstselected.Items.Contains("Phenol(C6H5OH), Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phenol(C6H5OH), Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Phosphate,
Ortho") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphate, Ortho.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Phosphate,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphate, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Phosphorus,
Biological Available") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Biological Available.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Phosphorus,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Dissolved.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Phosphorus,
Dissolved Organic") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Dissolved Organic.pdf")
            End If
```

```
            If frmOrgCont.lstselected.Items.Contains("Phosphorus,
Dissolved Ortho-Phosphate") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Dissolved Ortho-Phosphate.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Phosphorus,
Filterable Reactive") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Filterable Reactive.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Phosphorus,
Ortho") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Ortho.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Phosphorus,
Particle Bound") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Particle Bound.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Phosphorus,
Soluble Reactive") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Soluble Reactive.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Phosphorus,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Suspended.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Phosphorus,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Phosphorus,
Total Kjeldahl") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Total Kjeldahl.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Polycyclic
Aromatic Hydrocarbon, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Polycyclic Aromatic Hydrocarbon, Total.pdf")
            End If
```

```
            If frmOrgCont.lstselected.Items.Contains("Polycyclic
Aromatic Hydrocarbons, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Polycyclic Aromatic Hydrocarbons, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Potassium,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Potassium, Dissolved.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Potassium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Potassium, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Pyrene,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Pyrene, Suspended.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Pyrene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Pyrene, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Residue,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Residue, Suspended.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Residue,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Residue, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Runoff") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Runoff.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Selenium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Selenium, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Silica") Then
```

```
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Silica.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Silicon") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Silicon.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Silver,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Silver, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Sodium Salt")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Sodium Salt.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Sodium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Sodium, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Solids,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Solids, Suspended.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Specific
Conductance") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Specific Conductance.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Stibium") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Stibium.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Sulfate,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Sulfate, Dissolved.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Sulfate,
Total") Then
```

```
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Sulfate, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Suspended
Solids, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Suspended Solids, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Toxaphene")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Toxaphene.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Turbidity")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Turbidity.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Vanadium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Vanadium, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Volatile
Solids, Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Volatile Solids, Dissolved.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Volatile
Solids, Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Volatile Solids, Suspended.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Volatile
Solids, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Volatile Solids, Total.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Zinc,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Zinc,
Dissolved.pdf")
            End If
            If frmOrgCont.lstselected.Items.Contains("Zinc, Total")
Then
```

```
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Zinc,
Total.pdf")
            End If

            frmOrgCont.Close()
            Me.Close()

            'this list is for frmNonOrgCont
        ElseIf frmInOrgCont.lstselected.Items.Count > 0 Then

            If frmInOrgCont.lstselected.Items.Contains("1- Methyl
Naphthalene, Sediment") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\1-
Methyl Naphthalene, Sediment.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("1,2,5,6-
Dibenzanthracene, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\1,2,5,6-Dibenzanthracene, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("2,4,5-T")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\2,4,5-T.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("2,4,5-TP")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\2,4,5-TP.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("2,4-D") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\2,4-
D.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("2,4-DB,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\2,4-
DB, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("2,4-
Dimethylphenol, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\2,4-
Dimethylphenol, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("2,4-DP,
Total") Then
```

```
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\2,4-
DP, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("2-
Nitrophenol, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\2-
Nitrophenol, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("4-Chloro-3-
Methyl-Phenol, Sediment") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\4-
Chloro-3-Methyl-Phenol, Sediment.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("4-
Nitrophenol, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\4-
Nitrophenol, Total.pdf")
            End If
            If
frmInOrgCont.lstselected.Items.Contains("Acenaphthene, Dissolved")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Acenaphthene, Dissolved.pdf")
            End If
            If
frmInOrgCont.lstselected.Items.Contains("Acenaphthene, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Acenaphthene, Total.pdf")
            End If
            If
frmInOrgCont.lstselected.Items.Contains("Acenaphthylene, Suspended")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Acenaphthylene, Suspended.pdf")
            End If
            If
frmInOrgCont.lstselected.Items.Contains("Acenaphthylene, Total")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Acenaphthylene, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Aldrin")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Aldrin.pdf")
```

```
            End If
            If frmInOrgCont.lstselected.Items.Contains("Alkalinity,
Bicarbonate") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Alkalinity, Bicarbonate.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Alkalinity,
Carbonate") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Alkalinity, Carbonate.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Alkalinity,
Fixed Endpoint") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Alkalinity, Fixed Endpoint.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Alkalinity,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Alkalinity, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Alpha
Benzene Hexachloride") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Alpha
Benzene Hexachloride.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Alpha
Endosulfan, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Alpha
Endosulfan, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Aluminum,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Aluminum, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Aluminum,
Total Recoverable in Water") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Aluminum, Total Recoverable in Water.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Ammonia -
N") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Ammonia - N.pdf")
```

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            End If
            If frmInOrgCont.lstselected.Items.Contains("Ammonia
Dissolved Nitrogen") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Ammonia Dissolved Nitrogen.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Ammonia
Nitrogen, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Ammonia Nitrogen, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Ammonia,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Ammonia, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Ammonium -
N") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Ammonium - N.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Ammonium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Ammonium, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Anthracene,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Anthracene, Suspended.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Anthracene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Anthracene, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Antimony,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Antimony, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Arsenic,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Arsenic, Dissolved.pdf")
```

```
            End If
            If frmInOrgCont.lstselected.Items.Contains("Arsenic,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Arsenic, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Banvel
(Dicamba)") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Banvel (Dicamba).pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Barium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Barium, Total.pdf")
            End If
            If
frmInOrgCont.lstselected.Items.Contains("Benzo(A)Anthracene1,2-
Benzanthracene, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo(A)Anthracene1,2-Benzanthracene,
Total.pdf")
            End If
            If
frmInOrgCont.lstselected.Items.Contains("Benzo(B)Fluoranthene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo(B)Fluoranthene, Total.pdf")
            End If
            If
frmInOrgCont.lstselected.Items.Contains("Benzo(B)Fluoranthene,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo(B)Fluoranthene, Suspended.pdf")
            End If
            If
frmInOrgCont.lstselected.Items.Contains("Benzo(Ghi)Perylene1,12-
Benzoperylene, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo(Ghi)Perylene1,12-Benzoperylene,
Total.pdf")
            End If
            If
frmInOrgCont.lstselected.Items.Contains("Benzo(K)Fluoranthene,
Suspended") Then
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```
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo(K)Fluoranthene, Suspended.pdf")
            End If
            If
frmInOrgCont.lstselected.Items.Contains("Benzo(K)Fluoranthene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo(K)Fluoranthene, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Benzo-A-
Pyrene, Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo-A-Pyrene, Suspended.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Benzo-A-
Pyrene, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo-A-Pyrene, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Beta
Endosulfan, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Beta
Endosulfan, Total.pdf")
            End If
            If
frmInOrgCont.lstselected.Items.Contains("Bicarbonate") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Bicarbonate.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Biochemical
Oxygen Demand - 5") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Biochemical Oxygen Demand - 5.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Bis(2-
Ethylhexyl) Phthalate") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Bis(2-Ethylhexyl) Phthalate.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Bromide,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Bromide, Total.pdf")
            End If
```

```
            If frmInOrgCont.lstselected.Items.Contains("Cadmium,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Cadmium, Dissolved.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Cadmium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Cadmium, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Cadmium,
Total Recoverable in Water") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Cadmium, Total Recoverable in Water.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Calcium,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Calcium, Dissolved.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Calcium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Calcium, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Calcium,
Total Recoverable in Water") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Calcium, Total Recoverable in Water.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Carbon,
Dissolved Organic") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Carbon, Dissolved Organic.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Carbon,
Total Organic") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Carbon, Total Organic.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Chemical
Oxygen Demand, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chemical Oxygen Demand, Total.pdf")
            End If
```

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            If frmInOrgCont.lstselected.Items.Contains("Chlordane,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chlordane, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Chloride,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chloride, Dissolved.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Chloride,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chloride, Total.pdf")
            End If
            If
frmInOrgCont.lstselected.Items.Contains("Chlorpyrifos, Total
Recoverable") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chlorpyrifos, Total Recoverable.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Chromium,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chromium, Dissolved.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Chromium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chromium, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Chromium,
Total Recoverable in Water") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chromium, Total Recoverable in Water.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Chrysene,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chrysene, Suspended.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Chrysene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chrysene, Total.pdf")
```

```
            End If
            If frmInOrgCont.lstselected.Items.Contains("Cobalt,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Cobalt, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Copper,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Copper, Dissolved.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Copper,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Copper, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Dalapon,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Dalapon, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Delta
Benzene Hexachloride,Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Delta
Benzene Hexachloride,Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Demeton-O,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Demeton-O, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Demeton-S,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Demeton-S, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Diazinon")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Diazinon.pdf")
            End If
            If
frmInOrgCont.lstselected.Items.Contains("Dibenzo(A,H)Anthracene,
Dissolved") Then
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                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Dibenzo(A,H)Anthracene, Dissolved.pdf")
            End If
            If
frmInOrgCont.lstselected.Items.Contains("Dibenzo(A,H)Anthracene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Dibenzo(A,H)Anthracene, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Dieldrin")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Dieldrin.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Dimethyl
Napthalene") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Dimethyl Napthalene.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Di-N-Butyl
Phthalate, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Di-N-
Butyl Phthalate, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Di-N-Octyl
Phthalate, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Di-N-
Octyl Phthalate, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Dinoseb")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Dinoseb.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Dissolved
Solids, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Dissolved Solids, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Disulfoton")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Disulfoton.pdf")
            End If
```

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            If frmInOrgCont.lstselected.Items.Contains("E. Coli")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\E.
Coli.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Endosulfan
Sulfate, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Endosulfan Sulfate, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Endrin")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Endrin.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Endrin
Aldehyde, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Endrin Aldehyde, Total.pdf")
            End If
            If
frmInOrgCont.lstselected.Items.Contains("Epn(C14H14NO4PS)") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Epn(C14H14NO4PS).pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Ethion")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Ethion.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Fecal
Coliforms") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Fecal
Coliforms.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Fecal
Strep") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Fecal
Strep.pdf")
            End If
            If
frmInOrgCont.lstselected.Items.Contains("Fluoranthene, Suspended")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Fluoranthene, Suspended.pdf")
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            End If
            If
frmInOrgCont.lstselected.Items.Contains("Fluoranthene, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Fluoranthene, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Fluorene,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Fluorene, Suspended.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Fluorene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Fluorene, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Fluoride,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Fluoride, Dissolved.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Gamma-Bhc
(Lindane)") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Gamma-Bhc (Lindane).pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Guthion")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Guthion.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Hardness
(Ca-Mg)") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Hardness (Ca-Mg).pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Hardness,
Noncarbonate") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Hardness, Noncarbonate.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Hardness,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Hardness, Total.pdf")
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            End If
            If frmInOrgCont.lstselected.Items.Contains("Heptachlor")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Heptachlor.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Heptachlor
Epoxide") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Heptachlor Epoxide.pdf")
            End If
            If
frmInOrgCont.lstselected.Items.Contains("Hexachlorobutadiene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Hexachlorobutadiene, Total.pdf")
            End If
            If
frmInOrgCont.lstselected.Items.Contains("Hexachloroethane, Total")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Hexachloroethane, Total.pdf")
            End If
            If
frmInOrgCont.lstselected.Items.Contains("Hydrocarbons") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Hydrocarbons.pdf")
            End If
            If
frmInOrgCont.lstselected.Items.Contains("Hydrocarbons, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Hydrocarbons, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Indeno
(1,2,3-Cd) Pyrene, Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Indeno (1,2,3-Cd) Pyrene, Suspended.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Indeno
(1,2,3-Cd) Pyrene, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Indeno (1,2,3-Cd) Pyrene, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Iron,
Dissolved") Then
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                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Iron,
Dissolved.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Iron,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Iron,
Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Lead,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Lead,
Dissolved.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Lead,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Lead,
Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Lithium,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Lithium, Dissolved.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Magnesium,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Magnesium, Dissolved.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Magnesium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Magnesium, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Malathion")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Malathion.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Manganese,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Manganese, Dissolved.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Manganese,
Total") Then
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                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Manganese, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("MCPA") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\MCPA.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("MCPP,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\MCPP,
Total.pdf")
            End If
            If
frmInOrgCont.lstselected.Items.Contains("Methoxychlor") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Methoxychlor.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Methyl
Parathion") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Methyl Parathion.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Molybdenum,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Molybdenum, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Motor Oil")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Motor
Oil.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Naphthalene,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Naphthalene, Dissolved.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Naphthalene,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Naphthalene, Suspended.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Naphthalene,
Total") Then
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                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Naphthalene, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Nickel,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nickel, Dissolved.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Nickel,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nickel, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Nitrate -
N") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate - N.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Nitrate -
Nitrite") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate - Nitrite.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Nitrate -
Nitrogen") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate - Nitrogen.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Nitrate /
Nitrite") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate / Nitrite.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Nitrate /
Nitrite - N") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate / Nitrite - N.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Nitrate and
Nitrite - N") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate and  Nitrite - N.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Nitrate and
Nitrite, Total") Then
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                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate and Nitrite, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Nitrate
Nitrogen, Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate Nitrogen, Dissolved.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Nitrate
Nitrogen, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate Nitrogen, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Nitrate,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Nitrite
Nitrogen, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrite Nitrogen, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Nitrite,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrite, Total.pdf")
            End If
            If
frmInOrgCont.lstselected.Items.Contains("Nitrobenzene, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrobenzene, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Nitrogen
Ammonia, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen Ammonia, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Nitrogen,
Ammonia") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Ammonia.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Nitrogen,
Dissolved Organic") Then
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                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Dissolved Organic.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Nitrogen,
Nitrate Nitrite") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Nitrate Nitrite.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Nitrogen,
Organic") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Organic.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Nitrogen,
Particulate Organic") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Particulate Organic.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Nitrogen,
TKN") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, TKN.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Nitrogen,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Nitrogen,
Total Kjeldahl") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Total Kjeldahl.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Nitrogen,
Total Organic") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Total Organic.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Nitrogen,
Total Organic Kjeldahl") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Total Organic Kjeldahl.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("N-Nitrosodi-
N-Propylamine, Total") Then
```

```
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\N-
Nitrosodi-N-Propylamine, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Oil and
Grease") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Oil
and Grease.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Oxygen
Demand, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Oxygen Demand, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Oxygen,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Oxygen, Dissolved.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Oxygen,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Oxygen, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("P,P' DDD")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\P,P'
DDD.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("P,P' DDE")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\P,P'
DDE.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("P,P' DDT")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\P,P'
DDT.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Parathion")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Parathion.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("PCB - 1016,
Total") Then
```

```
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\PCB -
1016, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("PCB - 1221")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\PCB -
1221.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("PCB - 1232")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\PCB -
1232.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("PCB - 1242")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\PCB -
1242.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("PCB - 1248")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\PCB -
1248.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("PCB - 1254")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\PCB -
1254.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("PCB - 1260")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\PCB -
1260.pdf")
            End If
            If
frmInOrgCont.lstselected.Items.Contains("Pentachlorophenol") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Pentachlorophenol.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Petroleum
Hydrocarbons, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Petroleum Hydrocarbons, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Petroleum
Hydrocarbons, Total Recoverable") Then
```

```
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Petroleum Hydrocarbons, Total Recoverable.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("pH") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\pH.pdf")
            End If
            If
frmInOrgCont.lstselected.Items.Contains("Phenanthrene, Dissolved")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phenanthrene, Dissolved.pdf")
            End If
            If
frmInOrgCont.lstselected.Items.Contains("Phenanthrene, Suspended")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phenanthrene, Suspended.pdf")
            End If
            If
frmInOrgCont.lstselected.Items.Contains("Phenanthrene, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phenanthrene, Total.pdf")
            End If
            If
frmInOrgCont.lstselected.Items.Contains("Phenol(C6H5OH), Total")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phenol(C6H5OH), Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Phosphate,
Ortho") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphate, Ortho.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Phosphate,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphate, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Phosphorus,
Biological Available") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Biological Available.pdf")
            End If
```

```
            If frmInOrgCont.lstselected.Items.Contains("Phosphorus,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Dissolved.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Phosphorus,
Dissolved Organic") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Dissolved Organic.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Phosphorus,
Dissolved Ortho-Phosphate") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Dissolved Ortho-Phosphate.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Phosphorus,
Filterable Reactive") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Filterable Reactive.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Phosphorus,
Ortho") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Ortho.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Phosphorus,
Particle Bound") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Particle Bound.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Phosphorus,
Soluble Reactive") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Soluble Reactive.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Phosphorus,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Suspended.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Phosphorus,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Total.pdf")
            End If
```

```
            If frmInOrgCont.lstselected.Items.Contains("Phosphorus,
Total Kjeldahl") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Total Kjeldahl.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Polycyclic
Aromatic Hydrocarbon, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Polycyclic Aromatic Hydrocarbon, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Polycyclic
Aromatic Hydrocarbons, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Polycyclic Aromatic Hydrocarbons, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Potassium,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Potassium, Dissolved.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Potassium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Potassium, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Pyrene,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Pyrene, Suspended.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Pyrene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Pyrene, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Residue,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Residue, Suspended.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Residue,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Residue, Total.pdf")
            End If
```

```
            If frmInOrgCont.lstselected.Items.Contains("Runoff")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Runoff.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Selenium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Selenium, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Silica")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Silica.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Silicon")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Silicon.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Silver,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Silver, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Sodium
Salt") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Sodium Salt.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Sodium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Sodium, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Solids,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Solids, Suspended.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Specific
Conductance") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Specific Conductance.pdf")
            End If
```

```
            If frmInOrgCont.lstselected.Items.Contains("Stibium")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Stibium.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Sulfate,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Sulfate, Dissolved.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Sulfate,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Sulfate, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Suspended
Solids, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Suspended Solids, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Toxaphene")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Toxaphene.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Turbidity")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Turbidity.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Vanadium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Vanadium, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Volatile
Solids, Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Volatile Solids, Dissolved.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Volatile
Solids, Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Volatile Solids, Suspended.pdf")
            End If
```

```
            If frmInOrgCont.lstselected.Items.Contains("Volatile
Solids, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Volatile Solids, Total.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Zinc,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Zinc,
Dissolved.pdf")
            End If
            If frmInOrgCont.lstselected.Items.Contains("Zinc,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Zinc,
Total.pdf")
            End If

            frmInOrgCont.Close()
            Me.Close()

            'this is for frmMetCont
        ElseIf frmMetCont.lstselected.Items.Count > 0 Then


            If frmMetCont.lstselected.Items.Contains("1- Methyl
Naphthalene, Sediment") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\1-
Methyl Naphthalene, Sediment.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("1,2,5,6-
Dibenzanthracene, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\1,2,5,6-Dibenzanthracene, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("2,4,5-T") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\2,4,5-T.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("2,4,5-TP")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\2,4,5-TP.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("2,4-D") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\2,4-
D.pdf")
            End If
```

```
            If frmMetCont.lstselected.Items.Contains("2,4-DB,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\2,4-
DB, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("2,4-
Dimethylphenol, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\2,4-
Dimethylphenol, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("2,4-DP,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\2,4-
DP, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("2-Nitrophenol,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\2-
Nitrophenol, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("4-Chloro-3-
Methyl-Phenol, Sediment") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\4-
Chloro-3-Methyl-Phenol, Sediment.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("4-Nitrophenol,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\4-
Nitrophenol, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Acenaphthene,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Acenaphthene, Dissolved.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Acenaphthene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Acenaphthene, Total.pdf")
            End If
            If
frmMetCont.lstselected.Items.Contains("Acenaphthylene, Suspended")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Acenaphthylene, Suspended.pdf")
```

```
            End If
            If
frmMetCont.lstselected.Items.Contains("Acenaphthylene, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Acenaphthylene, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Aldrin") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Aldrin.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Alkalinity,
Bicarbonate") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Alkalinity, Bicarbonate.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Alkalinity,
Carbonate") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Alkalinity, Carbonate.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Alkalinity,
Fixed Endpoint") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Alkalinity, Fixed Endpoint.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Alkalinity,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Alkalinity, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Alpha Benzene
Hexachloride") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Alpha
Benzene Hexachloride.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Alpha
Endosulfan, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Alpha
Endosulfan, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Aluminum,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Aluminum, Total.pdf")
            End If
```

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            If frmMetCont.lstselected.Items.Contains("Aluminum,
Total Recoverable in Water") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Aluminum, Total Recoverable in Water.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Ammonia - N")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Ammonia - N.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Ammonia
Dissolved Nitrogen") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Ammonia Dissolved Nitrogen.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Ammonia
Nitrogen, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Ammonia Nitrogen, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Ammonia,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Ammonia, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Ammonium - N")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Ammonium - N.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Ammonium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Ammonium, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Anthracene,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Anthracene, Suspended.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Anthracene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Anthracene, Total.pdf")
            End If
```

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            If frmMetCont.lstselected.Items.Contains("Antimony,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Antimony, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Arsenic,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Arsenic, Dissolved.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Arsenic,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Arsenic, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Banvel
(Dicamba)") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Banvel (Dicamba).pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Barium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Barium, Total.pdf")
            End If
            If
frmMetCont.lstselected.Items.Contains("Benzo(A)Anthracene1,2-
Benzanthracene, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo(A)Anthracene1,2-Benzanthracene,
Total.pdf")
            End If
            If
frmMetCont.lstselected.Items.Contains("Benzo(B)Fluoranthene, Total")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo(B)Fluoranthene, Total.pdf")
            End If
            If
frmMetCont.lstselected.Items.Contains("Benzo(B)Fluoranthene,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo(B)Fluoranthene, Suspended.pdf")
            End If
```

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            If
frmMetCont.lstselected.Items.Contains("Benzo(Ghi)Perylene1,12-
Benzoperylene, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo(Ghi)Perylene1,12-Benzoperylene,
Total.pdf")
            End If
            If
frmMetCont.lstselected.Items.Contains("Benzo(K)Fluoranthene,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo(K)Fluoranthene, Suspended.pdf")
            End If
            If
frmMetCont.lstselected.Items.Contains("Benzo(K)Fluoranthene, Total")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo(K)Fluoranthene, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Benzo-A-
Pyrene, Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo-A-Pyrene, Suspended.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Benzo-A-
Pyrene, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Benzo-A-Pyrene, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Beta
Endosulfan, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Beta
Endosulfan, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Bicarbonate")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Bicarbonate.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Biochemical
Oxygen Demand - 5") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Biochemical Oxygen Demand - 5.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Bis(2-
Ethylhexyl) Phthalate") Then
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                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Bis(2-Ethylhexyl) Phthalate.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Bromide,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Bromide, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Cadmium,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Cadmium, Dissolved.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Cadmium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Cadmium, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Cadmium, Total
Recoverable in Water") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Cadmium, Total Recoverable in Water.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Calcium,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Calcium, Dissolved.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Calcium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Calcium, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Calcium, Total
Recoverable in Water") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Calcium, Total Recoverable in Water.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Carbon,
Dissolved Organic") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Carbon, Dissolved Organic.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Carbon, Total
Organic") Then
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                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Carbon, Total Organic.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Chemical
Oxygen Demand, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chemical Oxygen Demand, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Chlordane,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chlordane, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Chloride,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chloride, Dissolved.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Chloride,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chloride, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Chlorpyrifos,
Total Recoverable") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chlorpyrifos, Total Recoverable.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Chromium,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chromium, Dissolved.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Chromium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chromium, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Chromium,
Total Recoverable in Water") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chromium, Total Recoverable in Water.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Chrysene,
Suspended") Then
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                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chrysene, Suspended.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Chrysene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Chrysene, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Cobalt,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Cobalt, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Copper,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Copper, Dissolved.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Copper,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Copper, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Dalapon,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Dalapon, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Delta Benzene
Hexachloride,Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Delta
Benzene Hexachloride,Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Demeton-O,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Demeton-O, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Demeton-S,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Demeton-S, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Diazinon")
Then
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                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Diazinon.pdf")
            End If
            If
frmMetCont.lstselected.Items.Contains("Dibenzo(A,H)Anthracene,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Dibenzo(A,H)Anthracene, Dissolved.pdf")
            End If
            If
frmMetCont.lstselected.Items.Contains("Dibenzo(A,H)Anthracene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Dibenzo(A,H)Anthracene, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Dieldrin")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Dieldrin.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Dimethyl
Napthalene") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Dimethyl Napthalene.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Di-N-Butyl
Phthalate, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Di-N-
Butyl Phthalate, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Di-N-Octyl
Phthalate, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Di-N-
Octyl Phthalate, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Dinoseb") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Dinoseb.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Dissolved
Solids, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Dissolved Solids, Total.pdf")
            End If
```

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            If frmMetCont.lstselected.Items.Contains("Disulfoton")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Disulfoton.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("E. Coli") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\E.
Coli.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Endosulfan
Sulfate, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Endosulfan Sulfate, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Endrin") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Endrin.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Endrin
Aldehyde, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Endrin Aldehyde, Total.pdf")
            End If
            If
frmMetCont.lstselected.Items.Contains("Epn(C14H14NO4PS)") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Epn(C14H14NO4PS).pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Ethion") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Ethion.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Fecal
Coliforms") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Fecal
Coliforms.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Fecal Strep")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Fecal
Strep.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Fluoranthene,
Suspended") Then
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                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Fluoranthene, Suspended.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Fluoranthene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Fluoranthene, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Fluorene,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Fluorene, Suspended.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Fluorene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Fluorene, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Fluoride,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Fluoride, Dissolved.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Gamma-Bhc
(Lindane)") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Gamma-Bhc (Lindane).pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Guthion") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Guthion.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Hardness (Ca-
Mg)") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Hardness (Ca-Mg).pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Hardness,
Noncarbonate") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Hardness, Noncarbonate.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Hardness,
Total") Then
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                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Hardness, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Heptachlor")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Heptachlor.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Heptachlor
Epoxide") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Heptachlor Epoxide.pdf")
            End If
            If
frmMetCont.lstselected.Items.Contains("Hexachlorobutadiene, Total")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Hexachlorobutadiene, Total.pdf")
            End If
            If
frmMetCont.lstselected.Items.Contains("Hexachloroethane, Total")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Hexachloroethane, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Hydrocarbons")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Hydrocarbons.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Hydrocarbons,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Hydrocarbons, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Indeno (1,2,3-
Cd) Pyrene, Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Indeno (1,2,3-Cd) Pyrene, Suspended.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Indeno (1,2,3-
Cd) Pyrene, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Indeno (1,2,3-Cd) Pyrene, Total.pdf")
            End If
```

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            If frmMetCont.lstselected.Items.Contains("Iron,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Iron,
Dissolved.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Iron, Total")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Iron,
Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Lead,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Lead,
Dissolved.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Lead, Total")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Lead,
Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Lithium,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Lithium, Dissolved.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Magnesium,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Magnesium, Dissolved.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Magnesium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Magnesium, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Malathion")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Malathion.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Manganese,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Manganese, Dissolved.pdf")
            End If
```

```
            If frmMetCont.lstselected.Items.Contains("Manganese,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Manganese, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("MCPA") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\MCPA.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("MCPP, Total")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\MCPP,
Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Methoxychlor")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Methoxychlor.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Methyl
Parathion") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Methyl Parathion.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Molybdenum,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Molybdenum, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Motor Oil")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Motor
Oil.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Naphthalene,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Naphthalene, Dissolved.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Naphthalene,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Naphthalene, Suspended.pdf")
            End If
```

```
            If frmMetCont.lstselected.Items.Contains("Naphthalene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Naphthalene, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Nickel,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nickel, Dissolved.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Nickel,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nickel, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Nitrate - N")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate - N.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Nitrate -
Nitrite") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate - Nitrite.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Nitrate -
Nitrogen") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate - Nitrogen.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Nitrate /
Nitrite") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate / Nitrite.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Nitrate /
Nitrite - N") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate / Nitrite - N.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Nitrate and
Nitrite - N") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate and  Nitrite - N.pdf")
            End If
```

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            If frmMetCont.lstselected.Items.Contains("Nitrate and
Nitrite, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate and Nitrite, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Nitrate
Nitrogen, Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate Nitrogen, Dissolved.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Nitrate
Nitrogen, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate Nitrogen, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Nitrate,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrate, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Nitrite
Nitrogen, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrite Nitrogen, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Nitrite,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrite, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Nitrobenzene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrobenzene, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Nitrogen
Ammonia, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen Ammonia, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Nitrogen,
Ammonia") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Ammonia.pdf")
            End If
```

```
            If frmMetCont.lstselected.Items.Contains("Nitrogen,
Dissolved Organic") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Dissolved Organic.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Nitrogen,
Nitrate Nitrite") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Nitrate Nitrite.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Nitrogen,
Organic") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Organic.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Nitrogen,
Particulate Organic") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Particulate Organic.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Nitrogen,
TKN") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, TKN.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Nitrogen,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Nitrogen,
Total Kjeldahl") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Total Kjeldahl.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Nitrogen,
Total Organic") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Total Organic.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Nitrogen,
Total Organic Kjeldahl") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Nitrogen, Total Organic Kjeldahl.pdf")
            End If
```

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            If frmMetCont.lstselected.Items.Contains("N-Nitrosodi-N-
Propylamine, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\N-
Nitrosodi-N-Propylamine, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Oil and
Grease") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Oil
and Grease.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Oxygen Demand,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Oxygen Demand, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Oxygen,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Oxygen, Dissolved.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Oxygen,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Oxygen, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("P,P' DDD")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\P,P'
DDD.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("P,P' DDE")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\P,P'
DDE.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("P,P' DDT")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\P,P'
DDT.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Parathion")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Parathion.pdf")
            End If
```

```
            If frmMetCont.lstselected.Items.Contains("PCB - 1016,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\PCB -
1016, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("PCB - 1221")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\PCB -
1221.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("PCB - 1232")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\PCB -
1232.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("PCB - 1242")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\PCB -
1242.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("PCB - 1248")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\PCB -
1248.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("PCB - 1254")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\PCB -
1254.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("PCB - 1260")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\PCB -
1260.pdf")
            End If
            If
frmMetCont.lstselected.Items.Contains("Pentachlorophenol") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Pentachlorophenol.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Petroleum
Hydrocarbons, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Petroleum Hydrocarbons, Total.pdf")
            End If
```

```
            If frmMetCont.lstselected.Items.Contains("Petroleum
Hydrocarbons, Total Recoverable") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Petroleum Hydrocarbons, Total Recoverable.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("pH") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\pH.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Phenanthrene,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phenanthrene, Dissolved.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Phenanthrene,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phenanthrene, Suspended.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Phenanthrene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phenanthrene, Total.pdf")
            End If
            If
frmMetCont.lstselected.Items.Contains("Phenol(C6H5OH), Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phenol(C6H5OH), Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Phosphate,
Ortho") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphate, Ortho.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Phosphate,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphate, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Phosphorus,
Biological Available") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Biological Available.pdf")
            End If
```

```
            If frmMetCont.lstselected.Items.Contains("Phosphorus,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Dissolved.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Phosphorus,
Dissolved Organic") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Dissolved Organic.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Phosphorus,
Dissolved Ortho-Phosphate") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Dissolved Ortho-Phosphate.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Phosphorus,
Filterable Reactive") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Filterable Reactive.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Phosphorus,
Ortho") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Ortho.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Phosphorus,
Particle Bound") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Particle Bound.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Phosphorus,
Soluble Reactive") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Soluble Reactive.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Phosphorus,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Suspended.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Phosphorus,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Total.pdf")
            End If
```

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            If frmMetCont.lstselected.Items.Contains("Phosphorus,
Total Kjeldahl") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Phosphorus, Total Kjeldahl.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Polycyclic
Aromatic Hydrocarbon, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Polycyclic Aromatic Hydrocarbon, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Polycyclic
Aromatic Hydrocarbons, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Polycyclic Aromatic Hydrocarbons, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Potassium,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Potassium, Dissolved.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Potassium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Potassium, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Pyrene,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Pyrene, Suspended.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Pyrene,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Pyrene, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Residue,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Residue, Suspended.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Residue,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Residue, Total.pdf")
            End If
```

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            If frmMetCont.lstselected.Items.Contains("Runoff") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Runoff.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Selenium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Selenium, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Silica") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Silica.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Silicon") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Silicon.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Silver,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Silver, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Sodium Salt")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Sodium Salt.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Sodium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Sodium, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Solids,
Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Suspended Solids, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Specific
Conductance") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Specific Conductance.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Stibium") Then
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                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Stibium.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Sulfate,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Sulfate, Dissolved.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Sulfate,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Sulfate, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Suspended
Solids, Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Suspended Solids, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Toxaphene")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Toxaphene.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Turbidity")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Turbidity.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Vanadium,
Total") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Vanadium, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Volatile
Solids, Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Volatile Solids, Dissolved.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Volatile
Solids, Suspended") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Volatile Solids, Suspended.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Volatile
Solids, Total") Then
```

```
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Volatile Solids, Total.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Zinc,
Dissolved") Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Zinc,
Dissolved.pdf")
            End If
            If frmMetCont.lstselected.Items.Contains("Zinc, Total")
Then
                System.Diagnostics.Process.Start("C:\Program
Files\MSU - EML\BMP Toolbox\Resources\BMP Toolbox\Contaminants\Zinc,
Total.pdf")
            End If

            frmMetCont.Close()
            Me.Close()
        End If

    End Sub

    Private Sub btnexcel_Click(ByVal sender As System.Object, ByVal
e As System.EventArgs) Handles btnexcel.Click
        System.Diagnostics.Process.Start("C:\Program Files\MSU -
EML\BMP Toolbox\Resources\BMP
Toolbox\Contaminants\Exceldatabase.xls")

        frmAllCont.Close()
        frmInOrgCont.Close()
        frmOrgCont.Close()
        frmMetCont.Close()

        Me.Close()
    End Sub

    Private Sub Label1_Click(ByVal sender As System.Object, ByVal e
As System.EventArgs) Handles Label1.Click

    End Sub
End Class
```

An Estimation of Self-supplied Residential Water Use in Michigan

Basic Information

Title:	An Estimation of Self-supplied Residential Water Use in Michigan
Project Number:	2009MI136B
Start Date:	3/1/2009
End Date:	2/28/2010
Funding Source:	104B
Congressional District:	8th
Research Category:	Social Sciences
Focus Category:	Economics, Groundwater, Water Use
Descriptors:	Groundwater use, water demand, self-supplied water use
Principal Investigators:	Patricia Norris, Saichon Seedang, Mary Thompson

Publications

There are no publications.

Title: An Estimation of Self-supplied Residential Water Use in Michigan
Project Number: 2009MI136B
Start: 03/01/08(actual)
End: 02/28/10 (actual)
Funding Source: USGS ("104B")
Congressional District: eighth
Research Category: Social Sciences
Focus Categories: ECON, GW, WU
Descriptors: Groundwater use, water demand, self-supplied water use
Primary PI: Patricia Norris, Professor, CARRS, Michigan State, 206 Natural Resources Bldg., East Lansing, MI 48824, norrisp@msu.edu, 517-432-4129
Saichon Seedang, Vist Asst. Professor, Institute of Water Research and Guyer-Seevers Program in Natural Resource Conservation, Department of Community, Agriculture, Recreation and Resource Studies (CARRS), Michigan State University
Mary Thompson, Outreach-Specialist, Guyer-Seevers Program in Natural Resource Conservation, Department of Community, Agriculture, Recreation and Resource Studies (CARRS), Michigan State University
Project Class: Research

Introduction

Groundwater is considered the primary water supply source for residential use in Michigan. Nearly half of Michigan's population relies on groundwater sources for drinking water (Michigan Department of Environmental Quality-MDEQ, 2003). There is increasing local and statewide concern about the growing demand for groundwater withdrawal leading to supply shortages. In addition, the depleted groundwater limits availability of water to sustain stream base flows during summer droughts and adversely affects aquatic ecosystems dependent upon groundwater flows (e.g., wetlands, rivers). Currently Michigan does not have precise information on water withdrawal and use for the residential water use sector, especially those that rely upon private residential wells. The proposed research focuses on an estimation of per capita self-supplied residential water use at selected sites in Michigan. The research also seeks to understand trends and behaviors as well as factors that influence self-supplied water use. The results of this research can be useful for developing water conservation policies and better estimating self-supplied residential withdrawal and use to integrate into water management and planning at the local watershed scale. The objective of this technical report is to report the progress of survey planning and development efforts during 2009-2010 funding period.

General Statement

Problem/Demand

Improved information on water use is especially vital in the Great Lakes region, where a relative "wealth" in water has meant relatively less attention by states to groundwater withdrawals.

Inventories of water use are compiled and published periodically by states, USGS, and in the Great Lakes region, the Great Lakes Commission. In some cases methods used to estimate water use vary across states and agencies, and as a result, reported water use varies (NRC, 2002). The quantity of water withdrawn by entities that are required to report withdrawals (with some notable exceptions) is relatively well known, but estimates of groundwater withdrawn by self-supplied domestic (private well) users are more problematic. Generally, self-supplied domestic water use is approximated using estimates of self-supplied domestic population and per capita use coefficients adapted from water use reports for public water supplies.

This method raises questions about the accuracy of water use information and whether similar per capita use rates can be accurately applied to both groups. For example, do self-supplied domestic well users moderate their water use in response to factors like well capacity, aquifer characteristics or wastewater management system? Answers to this and similar questions will improve the estimation of self-supplied domestic water use. Without more careful attention to these kinds of questions, inaccurate estimates of self-supplied domestic water withdrawals may undermine the ability to account for these water withdrawals in larger state and regional water planning and management activities.

Research Objectives

To have a precise estimation of per-capita self-supplied water use and other water use information (i.e. pattern and behavior of use), it is necessary to conduct a survey gathering water use information at the household level. Specific objectives are: 1) To conduct a survey of residential self-supplied water users to collect information about their water use, water withdrawal, patterns and behavior of use, and factors influencing their use of groundwater; 2) To estimate per capita self-supplied residential water use and projected changes in use; and 3) To provide recommendations for groundwater conservation and management, specifically demand side management.

Methodology

This project proposed to collect primary data at three selected areas within Michigan through a residential household water use survey carried out using mail survey forms.

Principle Findings and Significance

Significant work during 2009-2010 focused on theoretical model development (e.g. identify relevant variables that explain water use) and questionnaire survey construction (e.g., drafting survey questions and survey format). We also have an undergraduate student working on GIS mapping of sewerage network pipes at one of our survey sites. Once the questionnaire has been reviewed by our professional technical advisory committee, we will incorporate their suggestions and begin pre-testing the survey instrument with a small sample of water users in target communities. Once the survey instrument is acceptable, it will be sent to a random sample of households, drawn from selected communities, that depend upon domestic wells.

We have extended our survey scope and data collection from a previous focus on only self-supplied domestic water use (well users) to cover publicly-supplied water users. We also will

include measurement of actual water use by a subsample of the self-supplied domestic water users who complete the survey. Per capita water use for self-supplied and publicly-supplied households will be calculated using survey data on household size and water use data collected through direct measurement or from water bills, and statistical analysis will be conducted to test several specific research hypotheses (e.g., rates of per capita water use by self-supplied users and publicly-supplied users do not differ). The research will be directed through the Guyer-Seevers Program for Natural Resource Conservation at Michigan State University (MSU), led by PI Norris.

Although our proposal, submitted in collaboration with USGS, state and local agencies to the USGS/NIWR FY2009[1], did not receive funding, we received useful comments and suggestions which helped improve our current survey proposal. We are continuing to seek further funding sources to support this survey effort, especially for survey implementation and water withdrawal measurement.

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[1] USGS/NIWR Water Resources Research National Competitive Grants Program FY2009 (Title*: Improving Self-supplied Domestic Water Use Estimation: Using Surveys and Water Use Monitoring to Compare Self-supplied and Publicly-supplied Water Use*).

Community Capacity and Use of Groundwater Information: Social Networks, Coalitions, Abilities, and Stratification in Use of the Water Withdrawal Assessment Tool

Basic Information

Title:	Community Capacity and Use of Groundwater Information: Social Networks, Coalitions, Abilities, and Stratification in Use of the Water Withdrawal Assessment Tool
Project Number:	2009MI137B
Start Date:	3/1/2009
End Date:	2/28/2010
Funding Source:	104B
Congressional District:	8th
Research Category:	Social Sciences
Focus Category:	Water Use, Education, Law, Institutions, and Policy
Descriptors:	Social Networks, Community Capacity, Water Withdrawal Assessment, GroundwaterFlow and Transport, Water Quality, Biological Sciences, Engineering, or Climate andHydrologic Processes
Principal Investigators:	Stephen Gasteyer

Publications

1. Gasteyer, S. and R. Butts Jarnagin. 2010. Fluid Interpretation: Compacts, Legislation, Water Conservation/Efficiency Standards, and Rural Communities, soon to be under review with Journal of Natural Resources Policy Resources.
2. Gasteyer, S. 2010. Imaginaries and Social Construction of Water Scarcity. To be submitted to Sociological Spectrum.
3. Butts, R, and S. Gasteyer. 2010. Left out to dry: Environmental justice & water rights To be submitted to Journal of Social Problems.

Title: Community Capacity and Use of Groundwater Information: Social Networks, Coalitions, Abilities, and Stratification in Use of the Water Withdrawal Assessment Tool
Project Number: 2009MI137B
Start: 03/01/08(actual)
End: 02/28/10 (actual)
Funding Source: USGS ("104B")
Congressional District: eighth
Research Category: Social Sciences
Focus Categories: EDU, LIP, WU
Descriptors: Social Networks, Community Capacity, Water Withdrawal Assessment, GroundwaterFlow and Transport, Water Quality, Biological Sciences, Engineering, or Climate andHydrologic Processes
Primary PI: Stephen Gasteyer, Assistant Professor, Department of Sociology, Michigan State University, 316 Berkey Hall, East Lansing, MI 48824, gasteyer@msu.edu, (517) 355-3505
Project Class: Education

Introduction

Economic constraints, coupled with natural resource depletion, spurred the development of new legislation and complex scientific tools that have been successfully integrated to form an improved, more sophisticated water withdrawal permitting process in Michigan. This case study traces the development of new legislation delegating common-pool resource governance to scientific tools and local water user committees. Then, the pool of local water users from which water user committees are likely to draw membership are scrutinized for their fit within the framework. Finally, further research investigating foreseeable problems and potential solutions is proposed. The findings aid in observing how the theoretical adaptive governance process unfolds in practice, paying particular attention to potential sources of counterproductive conflict in a globally competitive era. States increasingly implementing similar legislation can use findings to refine procedures ensuring progress toward equitable common-pool resource allocation and water sustainability.

General Statement

Problem/Demand

The Michigan Water Use Law develops a process for limiting excessive withdrawal of groundwater and ensuring in-stream flow to feed the Great Lakes. To address potential conflicts that may emerge from denying a well permit, the law calls for the establishment of "water use committees" to negotiate alternatives to denial of a permit to pump groundwater in Michigan. It is essential to understand the capacity of local organizations to arbitrate potential water conflicts.

This projects investigates several questions related to this context:

1) What are the major threats to overuse of water? Are there differences in sector plans for water use required by Michigan Water Use Law?
2) How do we know the capacity of water organizations (watershed organizations, conservancy districts, etc.) at the watershed level to address water conflicts and to facilitate resolution to those conflicts?
3) To what extent do those groups align with expected water quantity conflicts?
4) To what extent do those organizations have the capacity to mediate?

We nest this analysis in the context of water use conflict in Monroe County, MI

In this one year study, we successfully addressed points 1-3; and the survey has been developed to address point 4, but we ran out of money to implement that survey. Currently we are pursuing funding to implement the survey.

Methodology

We used content analysis, data analysis, participant observation and interviews in answering these questions. We gathered existing sector plans from submitted to the DEQ in compliance with the Water Use law and content analyzed these sector plans.

We used USGS, the MSU IWR and data from other sources to compile a list of the areas in Michigan most threatened with water conflict. We then used a list of watershed groups compiled by Professor Kathy Halvorsen in Forestry at Michigan Technology Institute. We updated this list using data from EPA, CTIC, Water Network, Public Citizen, Food And Water Watch to compile a complete list of 102 water groups in Michigan. We overlay the service areas of these organizations on the conflict areas. A survey has been developed and we plan on leveraging resources to deliver this survey later this year.

For our case study in Monroe County we used interviews, content analysis of video footage, and content analysis of media and public hearing transcripts to depict what had happened in the county.

Problem and Research Objectives

The research problem: how does the goal of decentralization of water use conflict, match with the capability of at the sub-basin level to address water use mediation? The research objectives were to identify the intrinsic possibilities of water conflict in the context of Michigan, the existing interesting in addressing those potentialities, and the capabilities of local groups to address risk of conflict.

Principle Findings and Significance

We find that even in the context of water rich Michigan, there is significant risk of water use conflict in particular areas given restrictions on use based on modeled assessments of ecological harm from water extraction. Analysis of sector reports indicates that only the public drinking and waste water sector seriously addressed mechanisms for significantly implementing conservation practices to mitigate potential water use conflicts. The agricultural sector did mention use water conservation practices in irrigation—specifically citing the need for government support to facilitate these activities. Sand and Aggregate Quarry sector report effectively skirted in acknowledgement of potential problem or possibility of their role in a solution to the potential conflict.

Over the course of this grant, the capacity of the Michigan government agency charged with implementing this proposal has shrunk due to financial crises. The capacity of the government to facilitate planning for possible water conflicts and mitigating of conflicts has diminished significantly. Significant hope is projected for the role of local actors in stepping in as mediators.

In terms of local groups, we find that in several of the areas where there are already concerns about water use, there are not existing water organizations identified. Water use is not an area of interest for the Soil and Water Conservation District in some areas. In other areas, water groups identified may not be appropriate mediators in the case of a potential conflict.

Further, in analysis of web sites and watershed organization information, we found a wide disparity in the extent to which these groups have experience in participatory, visioning or other processes that could flatten the learning curve for conflict resolution training. Clearly, if local water groups are to fill this void, a significant effort is needed to boost local capacity. Completing the survey will be very helpful in fleshing out these findings.

We find in the context of Monroe County, MI that the combination of these forces has ensured defacto that powerful groups are able to extract water to the point depletion with relatively little retribution or mitigation, which has resulted in deprivation of water rights for some in the county, and questionable water management behavior by others.

Notable Achievements

While the findings are preliminary, we have presented 3 papers at professional meetings. papers currently under review out of this effort.

Title: Community Capacity and Use of Groundwater Information: Social Networks, Coalitions, Abilities, and Stratification in Use of the Water Withdrawal Assessment Tool

Brief: Assesses the potentials and problematics of the Michigan Water Use Law.

Funding Agency: USGS 2009MI137B

1) Fluid Interpretation: Compacts, Legislation, Water Conservation/Efficiency Standards, and Rural Communities, Law and Society Annual Meeting, May 27-30, 2009, Denver, CO
2) Water Conservation and Perceived Water Scarcity? Water Conservation, Compact and Conservation Management in Michigan, American Water Works Association Annual Conference, June 12-18, 2009, San Diego, CA
3) Left Out to Dry: Environmental Justice and Water Rights, American Sociological Association, August 12-16, 2009, San Francisco, CA

These have been shaped into three manuscripts, all of which will soon be under review.

Publications

Gasteyer, S. and R. Butts Jarnagin. 2010. Fluid Interpretation: Compacts, Legislation, Water Conservation/Efficiency Standards, and Rural Communities, soon to be under review with *Journal of Natural Resources Policy Resources*.

Gasteyer, S. 2010. Imaginaries and Social Construction of Water Scarcity. To be submitted to *Sociological Spectrum*.

Butts, R, and S. Gasteyer. 2010. Left out to dry: Environmental justice & water rights To be submitted to *Journal of Social Problems*.

Natural Resources Integrated Information System

Basic Information

Title:	Natural Resources Integrated Information System
Project Number:	2009MI139B
Start Date:	3/1/2009
End Date:	2/28/2010
Funding Source:	104B
Congressional District:	8th
Research Category:	Water Quality
Focus Category:	Management and Planning, Water Quality, Water Use
Descriptors:	Data Analysis, Data Storage and Retrieval, Information Dissemination, System Analysis, Geographic Information Systems, Water Quality Management, Watershed Management
Principal Investigators:	Jon Bartholic

Publications

1. Seedang, S., Fernald, A., Adams, R., Landers, D. 2008. Economic Analysis of Water Temperature Reduction Practices in a Large River Floodplain: an Exploratory Study of the Willamette River, Oregon, Wiley InterScience on line at www.interscience.wiley.com, 19 pages.
2. Bartholic, J., ONeil, G., Shi, Y. 2009. A Web-Accessible Watershed-Based System Targets Land Areas at Highest Risk for Sediment Loss to Streams. On Line Proceedings 2009 at http://www.benthos.org/Other-Publications/NABStracts/2009/4406.aspx, North American Benthological Society, Grand Rapids, MI.
3. ONeil, G., Shi, Y., Bartholic, J., Fanelli, R., Engel, B., Hunter, J., 2008. Swan Creek Watershed Project Final Report submitted to U.S. Army Corps of Engineers in fulfillment of funding requirements. 17 Pages.
4. Shi, Y., 2009. Midwest Spatial Decision Support System Partnership, Exchange Network Grant Program Semi-Annual Progress Report for Grant OS-83320901-0, submitted to Wisconsin DNR to Environmental Protection Agency. 21 pages.
5. Bartholic, J., S. Seedang, P. Norris, and J. Asher. 2009. New Great Lakes Basin Policy and Integrated Water Management (Proceedings paper). Water Policy Conference, Czech University of Life Sciences, Prague, Czech Republic, June 22-26, 2009.
6. Bartholic, J. Asher, and S. Seedang. 2009. Michigans Water Withdrawal Assessment Tool (Proceedings paper). 2009 UCOWR/NIWR Annual Conference, Chicago, Il, July 7-9, 2009
7. Norris, P., S. Seedang, and M. Thompson. 2009. Water Use and Water Demand by Self-supplied Residential Water Users in Michigan. Technical Paper # 2008MI118B for USGS Natural Resources Integrated Information System; US Dept of Geological Services.
8. Norris, P. and S. Seedang. 2008. Institutional Context for Water Use Decisions and Policy Innovations in Michigan, Symposium Governance and Valuation of Great Lakes Water for the 21st Century sponsored by The Center for Water & Society and the Environmental Engineering Seminar Series, Michigan Technological Institute, MI.
9. Seedang, S., P. Norris, and J. Bartholic. 2009. The Role of Water Conservation Technology, Economics, and Institutions for Managing Groundwater Use Conflicts (Proceedings abstract). The

American Water Resources Association Annual Conference, Seattle, WA, November 9-12, 2009.

Title: Natural Resources Integrated Information System
Project Number: 2009MI116B
Start: 03/01/09(actual)
End: 02/28/10 (actual)
Funding Source: USGS ("104B")
Congressional District: eighth
Research Category: Water Quality
Focus Categories: M & P, WQL, MOD
Descriptors: Data Analysis, Data Storage and Retrieval, Information Dissemination, System Analysis, Geographic Information Systems, Water Quality Management, Watershed Management
Primary PI: Jon F. Bartholic, Institute of Water Research, Michigan State University
Project Class: Research

Problem and Research Objectives

To protect and restore the nation's waters, federal and state agencies are increasingly utilizing a watershed approach to examine and address water resources problems. The overall goal of this approach is the restoration, maintenance and protection of water resources across the country. The Institute of Water Research at Michigan State University is also looking at water resources on a watershed basis and is working to develop programs and partnerships within a watershed framework. Because of our Institute's long-term position relative to national and state water programs, we function as a coordinator to assist with linkages, support education, research, and outreach with and among agencies in the broad water arena. Accordingly, we are in a unique position to facilitate watershed policy, planning, and management using a multi-disciplinary perspective.

Methodology

Our proposed efforts include three major thrusts. The first is the enhancement of integrated watershed systems including both surface and groundwater that can be used for analysis of various management options. The second is extended education where the internet and advanced computer systems as well as traditional conferences and training workshops are used to extend new knowledge to agencies, organizations, and local level watershed and land use groups. The third involves developing a networking infrastructure to facilitate cooperation among partners such as the USDA, Natural Resource Conservation Service, USEPA, Army Corp of Engineers, the Great Lakes Commission, state Departments of Natural Resources, Environmental Quality, and Agriculture, township associations and county organizations.

Principle Findings and Significance

Extensive investigation and research is needed to achieve effective coupling of human management needs with geospatial databases and decision support systems to assist better decision-making. Multiple research funding opportunities exist to support linking understanding of various phases of the hydrologic cycle with impacts on water use, management, and conservation. As a result, outstanding opportunities to develop scientific water management skills and techniques for the 21st Century are clearly within reach.

Specific Projects Conducted

Research and Development: The *Water Resources Partnership* is a major effort with support and involvement from units across the University campus with the Michigan Department of Environmental Quality as the key external funding partner. At this time the project is a four year effort funded at 1.5 million dollars. [This project is inclusive in nature relative to Michigan's Department of Environmental Quality (MDEQ) partners and clients interested in the products.] Campus partners provide fundamental inputs relative to new frontiers such as computational thinking which is dependent on new computational capabilities, web technologies, and advanced GIS web-based delivery systems. Also, MSU's Extension and Outreach and Engagement units are involved. Fundamentally this project facilitates the discovery of new approaches for integrating advanced multi-scale modeling with intuitive visual and interactively enhanced outputs. Products from this activity are also used in other active projects, with those projects in turn providing general feedback into the Water Resources Partnership.

Our strong research base is enhanced by our involvement in regional/national USDA Hatch multi-state research projects. One such project, MICLO4064/W2190 entitled *Water Policy and Management Challenges in the West* (from W1190), addresses water policy and economic research and involves researchers across the U.S. Another research project, MICLO4052/S1042 *Modeling for TMDL Development and Watershed Based Planning and Management and Assessment*, involves hydrologic and non-point source (NPS) modelers with a specific focus on total maximum daily loading (TMDL's) and general NPS reduction strategies.

Web Data System Components: Significant new web-based information components have been generated by the two projects in this section. *ATtILA (Analytical Tools Interface for Landscape Assessments) and ReVA (Regional Vulnerability Assessment)* are analysis systems developed by EPA. Both of these tools are incorporated into Digital Watershed (a nationwide web accessible spatial GIS delivery tool). EPA has provided funds to also incorporate these tools or their outputs as an additional component of the information delivery capabilities in Digital Watershed. The *National Environmental Information Exchange Network* (NEIEN) is a project with the Wisconsin Department of Natural Resources and was funded by EPA as part of their technology discovery and implementation efforts. This system "on the fly" extracts and delivers in a localized format, water quality information from EPA's STORET (STOrage and RETrieval) web services. Both of these web data systems components are being incorporated into applications.

Applications: The utilization and fine-tuning of products for end-users is where IWRs efforts have their impact. Four of our active applications follow. They include, (1) the *HIT (High Impact Targeting)* system of land practices to maximize NPS reduction; (2) the *Swan Creek Urban and Rural Landscape Watershed Project* web-based tool provides guidance for both urban and agricultural decision-making that enhance environmental and economic sustainability; (3) the *WCAT (Watershed Comprehensive Assessment Tool)*; and (4) the remaining major application is *Water Neutral Footprint*, a project with The Nature Conservancy (TNC) and Coca-Cola to aid Coca-Cola with reducing its water footprint.

Social Dimensions: A key component in all IWR activities is integrating social and economic factors into the systems that we develop for end users. The *Social Indicators Data Management and Analysis (SIDMA) System* tool is a multistate project supported by EPA. This tool will be used by watershed groups throughout EPA's Region 5 initially but is expected to expand throughout the Midwest.

A. Research and Development

A.1 Water Resources Partnership
A.2 Michigan activities in support of Regional/National Research:

A.2.1 MICL04052/S-1042: Modeling for TMDL Development and Watershed Based Planning and Management and Assessment

A.2.2 MICLO4064/W-2190: Water Policy and Management Challenges in the West (from W1190)

B. Web Data System Components

B.1 ATtILA (Analytical Tools Interface for Landscape Assessments) and ReVA (Regional Vulnerability Assessment) Integration Project

B.2 Exchange Network
National Environmental Information Exchange Network - NEIEN Progress

C. Applications (with emphasis on Spatial Decision Support System)

C.1 High Impact Targeting – HIT

C.2 Swan Creek Urban and Rural Landscape Watershed Project

C.3 Watershed Comprehensive Assessment Tool – WCAT

C.4 Water Neutral Footprint: The Nature Conservancy/Coca-Cola

D. Social Dimensions

D.1 Social Indicators Data Management and Analysis System – SIDMA

A. Research and Development

A.1 Water Resources Partnership

A Jointly Funded Agreement between Michigan State University and the Michigan Department of Environmental Quality Focused on Source Water Protection and Holistic Water Resources Management

Introduction

Michigan State University's goal in the Joint Funding Agreement (JFA) between MSU and the Michigan Department of Environmental Quality (MDEQ) is to develop an intelligent water resources cyber-infrastructure - a first of its kind, for integrated hydrological research, education, outreach, and science-based water resources management. This effort has the potential to transform the way we conduct hydrological science and engineering, substantially reducing the costs of managing Michigan's water resources while yielding major research grant opportunities for the University, and significantly increasing MSU's research productivity.

Our initial year's efforts have been exciting and productive. A kickoff meeting held in November 2008 was successful in enhancing understanding among the University community, the MDEQ and various other government and agency personnel of this Holistic Water Resources Management project. We gained important feedback and involvement from a larger community of University and DEQ personnel plus external partners in this effort, and look forward to continued interaction with this diverse group of individuals.

Our efforts, in bringing in new dollars, advancing research, and sharing results and potential outcomes with our constituents during this first year were significant. Some of our initial activities are described below.

Section 1.01 DEQ-funded tasks

Progress was made on each of the DEQ's primary supported efforts. MIGWWP - the Michigan Interactive Ground Water for Wellhead Protection (MIGWWP) software continues to be enhanced and optimized. The project team has successfully used MIGWWP to delineate 877 source water recharge protection areas for community water supplies in three Michigan counties. Pilot outreach programs to distribute maps of the recharge areas and share information about protecting the land within those areas were held in those counties, with 149 people attending the workshops. Additional pilot projects are being planned. In combination with outreach programs directed to those water supply communities, this data and information can save millions of dollars by minimizing contamination risk to our public drinking water supplies. In addition, the upgrade of the Map Image Viewer software is in progress. Additional outreach, education and facilitation services to small communities is also underway, with an emphasis on delivering educational programs relating to land use planning and zoning for source water protection.

Section 1.02 MSU-funded activities

<u>Cyber-enabled Discovery and Innovation</u>

We have created a genuine synergy between MDEQ's groundwater management programs and massive statewide data integration, MSU's fundamental research in hydrological modeling, and

the National Science Foundation (NSF)'s cyber vision for the 21st century. We have designed our JFA activities to capitalize on this synergic interaction and the unprecedented opportunities made possible by the new vast data sources, exponentially growing computing power, and innovative computational thinking.

We have significantly accelerated our planned rollout of the first ever statewide, hierarchical groundwater modeling environment and the linked preprocessed database system to best position MSU for the new, NSF center-scale research competition on Cyber-enabled Discovery and Innovation (CDI). The integrated hierarchical system will enable, for the first time, realtime multiscale analysis, modeling, and visualization of groundwater systems in Michigan's drinking water aquifers. The system promises potential transformative changes and drastic cost reduction in managing Michigan's vast numbers of water wells, wellhead protection areas, groundwater-dependent resources, and contaminated sites on a statewide scale. We have also been investigating new methods to enable, realtime cyber-based discovery, with a focus on multiscale methods for compressing, storing, representing, analyzing, modeling, visualizing, and transmitting massive statewide datasets.

We are on schedule to submit our center-scale NSF CDI proposal in collaboration with MDEQ and USGS in the next funding cycle in 2010. The project will integrate science, data, technology, and new computational thinking and bring together hydrological modelers, hydrogeologists, computer scientists, information technology experts, statisticians, computational mathematicians, GIS scientists, as well as, state managers and decision makers. The integrated project will emphasize theoretical and methodological developments, software and technological innovations, science discoveries and complex problem solving, and education and outreach, and tackle fundamental bottlenecks in the practical applications of massive and exponentially growing datasets. Figure 1 depicts the vision for this project.

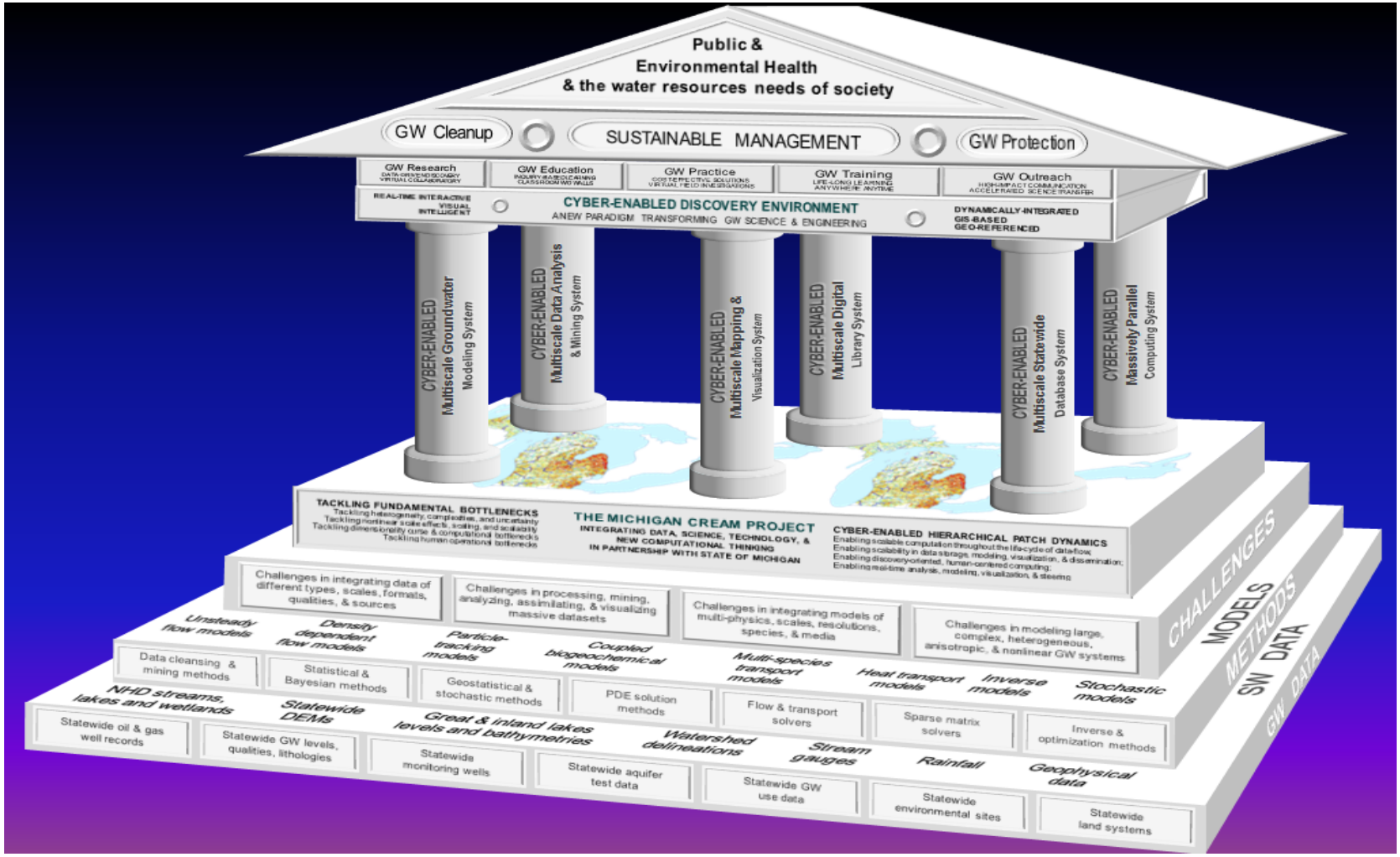

Figure 1. Vision for Cyber-enabled Discovery and Innovation

Water Withdrawal Assessment Tool

With support from the state legislature, guidance from MDEQ and the US Geological Survey, IWR played a significant role in the implementation of the new Water Withdrawal Assessment Tool (WWAT). Specifically, we designed, implemented, and now maintain the operational statewide web-based WWAT. Further, we were asked to guide and facilitate the rollout of this system by MDEQ, which includes obtaining extensive initial feedback from users.

The team was instrumental in the dissemination, education, and demonstration of the WWAT and new water withdrawal legislation, conducting twelve educational meetings throughout Michigan with hands-on opportunities for nearly 400 potential users of the system. From its inception on October 1 until December 31, 2008, about 1,100 unique visits were made to the Water Withdrawal Assessment Tool internet site. This is about 370 visits per month. About 30% of these were return visits. During this period 28 comments were entered on the site. The vast majority of these were insightful and constructive comments related to the actual workings of the site interface.

The attached fiscal year 08/09 Summary Budget shows the additional funds that have been obtained to continue modification and maintenance of the system.

Expanding Outreach and Engagement

This project continues a transformational process that enhances our understanding of the implications of human interactions with the natural systems. Thus, human activities can be better managed to assure a sustainable and ecologically viable ecosystem. Our outreach work pertaining to source water protection in our local communities combines data and information generated by MIGWWP and Map Image Viewer with hands-on learning opportunities related to protecting local water supplies. Feedback from the outreach programs has been positive, and additional work is being planned for subsequent years. In addition, a strong partnership between MDEQ staff and MSU collaborators has developed in support of this project, with regular team meetings and other ongoing feedback to ensure long-term success.

Evaluation of the use of the Water Withdrawal Assessment Tool and its usability will also continue. Feedback from the meeting series described above is being summarized, and a follow-up survey is planned to determine how the tool is being used, and the value of the training.

A portion of the JFA funding will be used for leveraging the current research efforts of the 2009 USGS 104 (B) grant program, titled " *Community Capacity and Use of Groundwater Information: Social Networks, Coalitions, Abilities, and Stratification in Use of the Water Withdrawal Assessment Tool (WWAT)"*) by an MSU faculty member and graduate student. Information gained from this research will help to better understand the characteristics, context, knowledge, and social network of those receiving information on the WWAT to improve water conservation and management and assist in better designing outreach and engagement programs and efforts under the JFA project.

Expanding Our Reach

With this partnership and the University's initial investment, we have been reinventing our processes of engagement and discovery, and are preparing a foundation for further exploration of new forms of information and dynamically delivered natural resource decision-making guidance for citizens at the basin, state, county, and local levels. By leveraging funds and obtaining new grants, our new activities draw upon our existing ones, and provide value-added data and information that will enhance our efforts. The following highlights some of these activities that have strong ties with the JFA. In addition, a list of collaborators and affiliates on the various projects is included in this report.

1. A project in coordination with the Great Lakes Regional Water Program (GLRWP), Social Indicators, is designed to assist watershed groups throughout the basin in obtaining a better understanding of the social makeup of the population within the watersheds where they work. This information facilitates their effective planning for communication, dissemination of information and implementation of watershed activities. Additional funding from the Environmental Protection Agency and the GLRWP has been obtained to continue and expand this effort.
2. A major new effort involving numerous faculty members from several colleges is now being funded by the Great Lakes Protection Fund for three years for a total of $471,000. This effort will facilitate the development of and enable the University to have important new capabilities for utilizing new communication technologies and social networking as a means of assisting and supporting communities and individual landowners as they implement low impact development and best management practices in the protection and restoration of vital ecosystem and terrestrial functionality.
3. A significant partnership is developing with The Nature Conservancy (TNC) Michigan Office that will address water use issues. One joint project has been funded and a joint cooperative agreement involving the US Department of Agriculture is being processed in the amount of $80,000. Also, a major Conservation Innovation Grant through USDA-NRCS has been submitted for $750,000 of which MSU's portion is $375,000. An additional proposal is being prepared for a USDA-EPA request for proposals totaling $500,000 (approximately half for MSU). Thus, this additional partnership is a very important added dimension to our JFA Holistic Water Resources Management initiative.
4. Our multi-year support from the US Army Corps of Engineers will be continuing at approximately $200,000/year.
5. Currently several JFA faculty members have been involved in the study of Michigan groundwater use, planning and policy. They developed a potential research proposal project titled, "*Improving Self-supplied Domestic Water Use Estimation: Using Surveys and Water Use Monitoring to Compare Self-supplied and Publicly-supplied Water Use*" and submitted to the Water Resources Research National Competitive Grants Program for the Fiscal Year 2009 in collaboration with the Michigan USGS Water Science Center (note: total federal and non-federal funding $485,881). We anticipate the outcomes of the project will complement other ongoing water resources management and research projects in Michigan, including the JFA water resources planning efforts.

Last Name	First Name		Department	College
Researchers				
Asher	Jeremiah	*	IWR	Agriculture and Natural Resources
Bao	Lei		IWR	Agriculture and Natural Resources
Bartholic	Jon		IWR, Crop & Soil Sciences, and Community, Ag, Recreation and Res Studies	Agriculture and Natural Resources
Beecher	Jan		Public Utilities Institute, Economics & Political Science	
Bissell	Edward	*	Geography	Social Science
Booth	Justin	*	Geography	Social Science
Last Name	**First Name**		**Department**	**College**
Cheruvelil	Kendra		Lyman Briggs Dean	Lyman Briggs
Fanelli	Rosemary		IWR	Agriculture and Natural Resources
Fang	Zhouzheng		MTH	
Gasteyer	Stephen		Sociology	Social Science
Grabill	Jeff		Writing, Rhetoric & American Culture	Arts & Letters
Guan	Zhengfei		Food and Resource Economics	Agriculture and Natural Resources
Kline Robach	Ruth	*	IWR & Community, Ag, Recreation and Res Studies	Agriculture and Natural Resources
Kramer	Daniel		James Madison College Dean	James Madison
Lenz	Joel	*	Geography	Social Science
Li	Shu Guang	*	Civil & Environmental Engineering	Engineering
Liao	Huasheng	*	Civil & Environmental Engineering	Engineering
Lin	He		IWR	Agriculture and Natural Resources
Lusch	David	*	IWR & Geography	Social Science
Mandle	Richard		Michigan Department of Environmental Quality	

Mantha	Phanikumar	Civil & Environmental Engineering	Engineering
McPherson	Brian	IWR	Agriculture and Natural Resources
McPherson	Jason	IWR	Agriculture and Natural Resources
Meerschaert	Mark	SIT	
Miller	Steve	Agricultural, Food And Resource Economics	Agriculture and Natural Resources
Mujeer	S	MDIT	
Nejadhash	Amirpouyan	Biosystems & Agricultural Engineering and Crop & Soil Science	Engineering
Norris	Pat	Community, Ag, Recreation and Res Studies and Agricultural, Food & Resource Economics	Agriculture and Natural Resources
Northcott	Bill	Biosystems & Agricultural Engineering	Engineering
O'Neil	Glenn	IWR	Agriculture and Natural Resources
Peterman	Tian	IWR	Agriculture and Natural Resources
Reeves	Howard	Civil & Environmental Engineering/USGS	Engineering
Last Name	**First Name**	**Department**	**College**
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Safferman	Steven	Biosystems & Agricultural Engineering	Engineering
Seedang	Saichon	IWR and Community, Ag, Recreation & Res Studies	Agriculture and Natural Resources
Shi	Yi *	IWR	Agriculture and Natural Resources
Snyder	JD	IWR	Agriculture and Natural Resources
Tan	Pang-Ning		
Thompson	Mary	Community, Ag, Recreation and Res Studies	Agriculture and Natural Resources
Wallace	Roger	Civil & Environmental Engineering	Engineering
Wei	Guowei	MTH	

Wolfson	Lois	*	IWR and Fisheries & Wildlife	Agriculture and Natural Resources
Xiao	Yimin		SIT	

Last Name	First Name		Department	College
Associates				
Campbell	Erin		IWR	Agriculture and Natural Resources
Coscarelli	Mark		IWR	Agriculture and Natural Resources
Ernst	Elizabeth		IWR	Agriculture and Natural Resources
Kettren Jr	LeRoy		IWR	Agriculture and Natural Resources
Otto	Christopher		IWR	Agriculture and Natural Resources
Grad Students				
An	John		Civil & Environmental Engineering	Engineering
Abbas	Hassan	*	Civil & Environmental Engineering	Engineering
Bass	Dean			
Chen	Changqing	*	IWR	Agriculture and Natural Resources
Dey	Dipa		Civil & Environmental Engineering	Engineering
Li	Yang		Civil & Environmental Engineering	
Miles	Casey		Digital Writing	Arts & Letters
Oztan	Mehmet		Civil & Environmental Engineering	Engineering
Sampath	Prasanna		Civil & Environmental Engineering	
Tong	Wei	*	IWR	Agriculture and Natural Resources
Xie	Shuangshuang		IWR	Agriculture and Natural Resources
Zhou	Adrian		Civil & Environmental Engineering	Engineering
Students				
Ashcroff	Heather			

Branch	Mariah		
Crombez	Kathleen	Geography	Social Science
Frost	Joseph		
McDonald	Mason	Urban Region	Social Science
Pattengill	Jacob		
Rose	Matthew	En Bio/Zol	
Sauter	Bradley		
Shelley	Jordan	En Bio/Zol	
Wood	Matt		
Wright	Sarah		
Xu	Minjie	Ur& Regnl	

A.2 Michigan activities in support of Regional/National Research

A.2.1 MICL04052/S-1042: Modeling for TMDL Development and Watershed Based Planning and Management and Assessment

WCAT: The EPA has taken a critical step to accelerate national progress in the development and implementation of effective watershed plans to protect water quality with the publication of its 2006 Handbook for Developing Watershed Plans to Restore and Protect Our Waters. This handbook describes science-based, watershed management methods and techniques to guide work to improve and protect water quality. Knowing how to acquire relevant data and how to use appropriate analytical tools can be a formidable and labor intensive task. The need then, for structure and guidance when tackling this task, quickly becomes clear. The Watershed CAT directly addresses this need. The Watershed Comprehensive Assessment Tool (or Watershed CAT) is an interactive DSS for developing effective watershed management plans. This system guides users through the data intensive steps of the watershed planning process and introduces you to online data sources, online analysis tools and additional watershed related information. Each step of the watershed planning process has several activities for which a specific tool or online data source is provided. The Digital Watershed Mapper, previously developed by the Institute of Water Research, serves as the platform for the Watershed CAT on web at: http://35.9.116.206/IWR/WCAT/index.asp. HIT: HIT is an interactive system where users can visualize GIS data on high-risk erosion areas that are of the greatest interest to them. The use of HIT supports important NRCS, MDA, and other state agency conservation goals such as the reduction of soil erosion and sedimentation, improvement of water quality, and enhancement of wildlife habitat. Conservation districts and farmers can use this targeted approach to realize the maximum impact of conservation programs. HIT has recently been enhanced and expanded to cover the entire U.S. side of the Great Lakes Basin. The tools mapping interface has been redesigned and integrated with Microsofts Bing maps, creating a rich data viewing experience that allows users to conduct in-depth watershed-scale and field-scale analyses on web at: http://www.iwr.msu.edu/hit. Swan Creek: The IWR at MSU and Purdue University have built the Swan Creek Watershed Management System (currently at http://www.iwr.msu.edu/swancreek), a decision support tool for the northwestern Ohio watershed. The system utilizes dynamic online modeling to allow users to evaluate the environmental impacts of different agricultural and urban BMP best management practices (BMPs) within the watershed. Examples of the systems functionality include cost-benefit analyses of conservation tillages ability to reduce sediment run-off from farmland, and the impacts of urbanization on run-off volume and pollutant loading. The systems development was a collaborative process with Purdue leading the development of urban analysis components, and MSU leading the development of the agricultural analysis components to facilitate a seamless system and the use of common data across models.

Outcomes/Impacts:

WCAT: The purpose of the Watershed CAT is to enhance and optimize the effectiveness and efficiency of watershed planners, EPA, NRCS, citizens, and state environmental and agricultural agencies engaged in the development/implementation of watershed plans. Convenient Web access to a broad range of geo-referenced data sets and data layers customized and connected to decision support tools harnesses the wealth of assembled data for application to specific watersheds. The overall goal of the Watershed CAT is to simplify the watershed planning process by making GIS based information, critical data layers and data sets, and decision support

tools available from one site on the Web. This dynamic and user friendly system helps energize watershed management strategies and improve and protect water quality. The Watershed CAT provides a powerful digital systems compliment to the EPA Watershed Handbook and a foundation for understanding the complexity of watershed functions and human behavioral impacts on water quality. By utilizing the WCAT system, watershed groups have access to a broad array of tools/models that simplifies the information gathering process. A webinar and presentation on the system have been provided to EPA Administrators and planners. The system is presently being incorporated into EPA watershed planning recommendations. HIT: HIT has been presented at numerous regional and national meetings and in webinars covering the Great Lakes Region. Most importantly the MI DEQ is supporting/encouraging the use of HIT in the 319 watershed grants for which they provide support. Swan Creek: The Swan Creek Ohio System is being utilized by urban planners and soil and water conservationists following a workshop in Toledo, OH with 30 key leading planners. The Army Corps of Engineers is providing funding to expand the system to four additional large watersheds across the Great Lakes Basin.

Publications:

Seedang, S., Fernald, A., Adams, R., Landers, D. 2008. Economic Analysis of Water Temperature Reduction Practices in a Large River Floodplain: an Exploratory Study of the Willamette River, Oregon, Wiley InterScience on line at www.interscience.wiley.com, 19 pages.

Bartholic, J., ONeil, G., Shi, Y. 2009. A Web-Accessible Watershed-Based System Targets Land Areas at Highest Risk for Sediment Loss to Streams. On Line Proceedings 2009 at http://www.benthos.org/Other-Publications/NABStracts/2009/4406.aspx, North American Benthological Society, Grand Rapids, MI.

ONeil, G., Shi, Y., Bartholic, J., Fanelli, R., Engel, B., Hunter, J., 2008. Swan Creek Watershed Project Final Report submitted to U.S. Army Corps of Engineers in fulfillment of funding requirements. 17 Pages.

Shi, Y., 2009. Midwest Spatial Decision Support System Partnership, Exchange Network Grant Program Semi-Annual Progress Report for Grant OS-83320901-0, submitted to Wisconsin DNR to Environmental Protection Agency. 21 pages.

A.2.2 MICLO4064/W-2190: Water Policy and Management Challenges in the West (from W1190)

Outputs:

Research efforts focused on water policy and allocation as part of collaborative multi-state research project, Interfacing Technological, Economic, and Institutional Principles for Managing Inter-Sector Mobilization of Water. Research activities over the past year included; 1) explored the application of a market-based policy to groundwater management, 2) reviewed potential management practices for groundwater conservation and ecosystem improvement, 3) reviewed practices for valuation of ecosystem services, 4) evaluated the effectiveness of management policies and their implementation in terms of hydrological and economical feasibility, 5) examined the implementation of Michigan water use policy and identified potential water use conflicts, 6) indentified information gaps and needs for improving new Michigan water use policy and tools, 7) reviewed factors related to the adoption of agricultural water conservation technology through various case studies, 8) explored the role of economic tools and institutions related to the adoption of water conservation policy, and 9) synthesized results and provided suggestions for implementing Michigans water conservation policy and applications to other states. Significant data, information, and knowledge were gained through these research activities and included the development of an innovative water conservation offset policy design, information about potential water management practices, data and information on ecosystem services values, information related to factors influencing water conservation adoption decisions (particularly within the agricultural water use sector), information about water use conflicts, information about research methods/techniques/practices for accessing and estimating water use. Research activities over the past year strengthened and expanded new collaborations and partners within the university, state agencies and local stakeholders (e.g., Michigan State University departments and extension, University of Michigan, University of Southern Illinois, US Geological Survey, Michigan Department of Environmental Quality, Michigan communities) along with other Great Lakes states agencies. In addition, outputs and research activities and results have been shared with the multi-state researcher team at the annual meeting and continue through network communications.

Outcomes/Impacts:

Results of research on the market-based policy design (water conservation offset credits) application for groundwater permitting provided an alternative policy for managing groundwater resources in a sensitive groundwater withdrawal watershed. The offset policy may help reduce conflicts related to water use, reduce agencies costs of regulations and dealing with conflicts, provide incentives to water use sectors for greater participation in water conservation, and overall help improve ecosystem conditions while allowing high economic water use activities to continue. A significant increase in understanding the interconnection between groundwater, surface water and ecosystems through using integrated biophysical models has contributed to a better policy design and an increase in awareness of using the best science-based technology to support policy decision making. Research results from reviewing water conservation adoption in other areas could help policy decision makers understand the factors and conditions for successful implementation of water conservation in Michigan and the Great Lakes region.

Perceptions regarding water availability, the burden of large investment of irrigation conservation technology, institutional needs to support implementation of policy, and the role of local water users are among the significant knowledge base for decision makers to be aware of when developing a conservation policy. Research output related to water conservation and policy alternatives could become an important policy tool for future establishment of a water user committee required by the new Michigan water use laws and has the potential to assist in managing water use conflicts in the case study. Research activities have identified information gaps in the design of new Michigan water use policy and tools in that they need to incorporate information about self-supplied water use to help improve accuracy when evaluating withdrawal impacts and water availability.

Publications:

Bartholic, J., S. Seedang, P. Norris, and J. Asher. 2009. New Great Lakes Basin Policy and Integrated Water Management (Proceedings paper). Water Policy Conference, Czech University of Life Sciences, Prague, Czech Republic, June 22-26, 2009.

Bartholic, J. Asher, and S. Seedang. 2009. Michigans Water Withdrawal Assessment Tool (Proceedings paper). 2009 UCOWR/NIWR Annual Conference, Chicago, Il, July 7-9, 2009

Norris, P., S. Seedang, and M. Thompson. 2009. Water Use and Water Demand by Self-supplied Residential Water Users in Michigan. Technical Paper # 2008MI118B for USGS Natural Resources Integrated Information System; US Dept of Geological Services.

Norris, P. and S. Seedang. 2008. Institutional Context for Water Use Decisions and Policy Innovations in Michigan, Symposium Governance and Valuation of Great Lakes Water for the 21st Century sponsored by The Center for Water & Society and the Environmental Engineering Seminar Series, Michigan Technological Institute, MI.

Seedang, S., P. Norris, and J. Bartholic. 2009. The Role of Water Conservation Technology, Economics, and Institutions for Managing Groundwater Use Conflicts (Proceedings abstract). The American Water Resources Association Annual Conference, Seattle, WA, November 9-12, 2009.

Seedang, S., S. Fernald, R.M. Adams, and D.H. Landers. 2008. Economic Analyses of Water Temperature Reduction Practices in a Large River Flood Plain. Journal of River Research and Applications. 24: 941-959.

B. Web Data System Components

B.1 ATtILA (Analytical Tools Interface for Landscape Assessments) and ReVA (Regional Vulnerability Assessment) Integration Project

Introduction

Ecological assessment is a very important activity to prevent further degradation of the environment. The US Environmental Protection Agency (EPA) has conducted regional ecological assessments over the past decades. On the regional level, EPA's Office of Research and Development (ORD) has a program called the Regional Vulnerability Assessment (ReVA) program. ReVA utilizes descriptive spatial data and models to assess drivers of ecological change and create alternative management scenarios. The results are put into ReVA's Environmental Decision Toolkit (EDT). ReVa was originally developed for Mid-Atlantic region. There exists a need to expand the program to other regions of the US such as the Mid-West.

The Landscape Ecology Branch of EPA ORD also developed a GIS-based tool called ATtILA (Analytical Tools Interface for Landscape Assessments). This tool allows environmental managers and others to assess ecological conditions by generating various landscape metrics. These metrics are quantitative measurements of the environmental condition or vulnerability of an area. The ATtILA is a stand-alone GIS extension that requires user download and installation before they can actually utilize it. The users also have to collect data needed for all calculations. In order to reach more end users and make the tool easier to use, EPA ORD scientists have expressed the intention to make at lease part of ATtILA functions web accessible so end users run the tool directly online without downloading the tool or collecting the data themselves.

To meet these needs, the Institute of Water Research of Michigan State University proposed to integrate part of the ATtILA and ReVA functions into the existing Digital Watershed (DW) system. Digital Watershed provides a user-friendly nation-wide spatial decision support system that utilizes the national 8-digit watershed database within the EPA BASINS program. The DW contains a comprehensive 8-digit watershed database including all regulated facilities, river networks, DEM, state soils, and other relevant data layers. Advanced spatial data visualization and selected modeling functions are also incorporated into the system. The DW system is extensible so new data layers and new models can be added over time. The integration of ATtILA and ReVA into the DW will not only enhance the usability of DW, but also help ATtILA and ReVa reach a broad audience.

ATtILA/ReVA Capabilities

ATtILA is an easy to use ArcView extension that calculates many commonly used landscape metrics. By providing an intuitive interface, the extension provides the ability to generate landscape metrics to a wide audience, regardless of their GIS knowledge level. ATtILA is a robust, flexible program. It accepts data from a broad range of sources and is equally suitable across all landscapes, from deserts to rain forests to urban areas.

Four families of metrics are included in the extension, and each group has a dialog to accept user input on which metrics to calculate and what input data to use:

- landscape characteristics: related to land cover proportions and patch metrics (e.g. percent forest cover or number and size of forest patches)
- riparian characteristics: describe land cover adjacent to and near streams (e.g. percent of crop land within 30 meters of streams)

- human stressors: concern population, roads, and land use practices (e.g. population change or road/stream crossings)
- physical characteristics: provide statistical summaries of such attributes as elevation and slope

The data required for ATtILA calculations are reporting units (polygons), land cover, elevation and slope, streams, roads, population, precipitation and water quality.

ReVa integrates descriptive spatial data and models into its Environmental Decision Toolkit (EDT). EDT provides multi-scale perspective on environmental condition; information visualization of environmental data in multiple dimensions; comparative inference of data and model results and insight into current status and potential future problems. EDT contains the following categories of ecological indicators:

- Agricultural metrics (derived from 2002 US census of Agriculture)
- Species toxicity/vulnerability metrics (derived from habitat and ASPEN model data)
- At-risk species metrics (derived from Natureserve data)
- Riparian characteristics metrics (derived from ATtILA)
- Demographic metrics (derived from census data)
- Landcover proportion metrics (derived from ATtILA)
- Water quality metrics (derived from L-THIA)
- Road and Stream Metrics
- Forest patch metrics
- Forest fragmentation/connectivity metrics
- Landcover diversity metrics
- Air pollution metrics (derived from Community Model of Air Quality model)
- Water use metrics (from USGS)
- Groundwater contamination risk metrics
- Soil erosion and conservation metrics

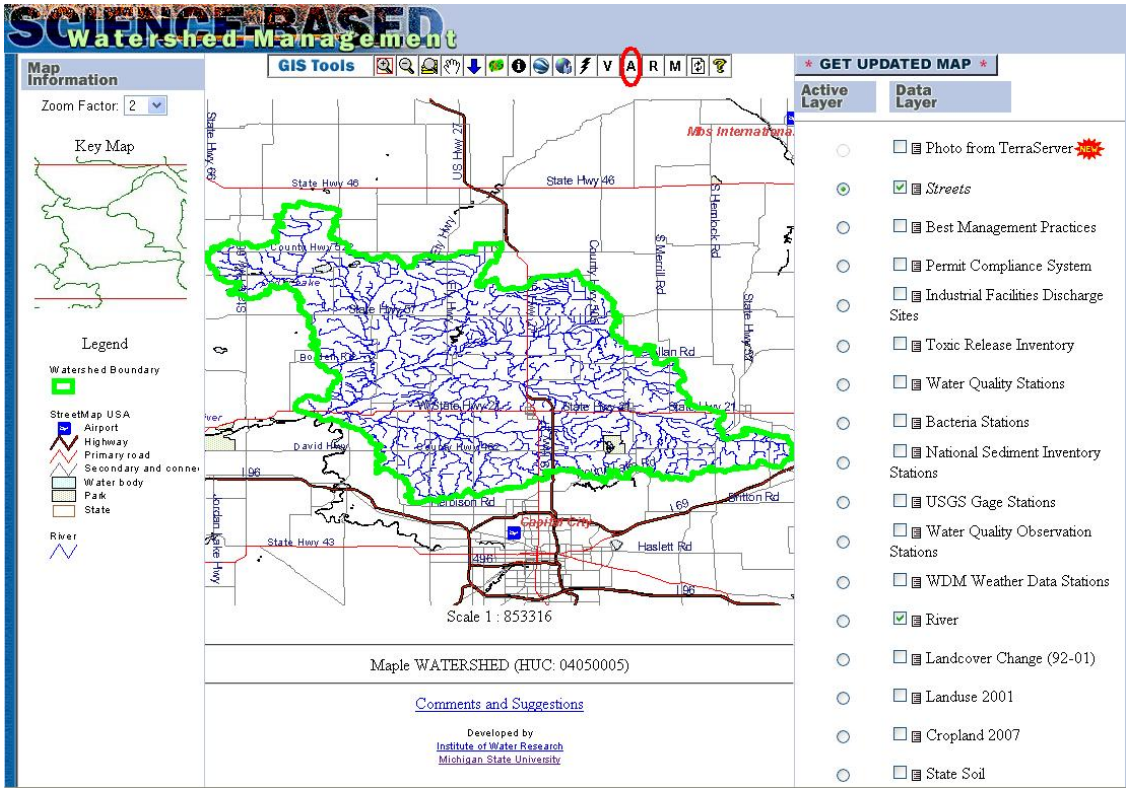

Figure 1. ATtILA Function

ATtILA/ReVA and DW Integration

The integration of selected ATtILA indicator functions into the DW for 8-digit watersheds has been completed. The function for an example watershed can be found at: http://35.8.121.101/scripts/esrimap.dll?name=watermap&cmd=WFPage&huc=04050005.

The ATtILA function is accessible via the "A" icon on the toolbar (Figure 1). Clicking the "A" icon will trigger the system to generate selected indicators in real time for the current 8-digit watershed (Figure 2). The data required for ATtILA calculations including landuse 2001 and DEM have been loaded to all 8-digit watersheds in EPA region 5. You can run ATtILA function online in real time to create selected indicators for any 8-digit watershed in EPA region 5. The river and stream data layer has also been updated with the newly available NHDPlus data.

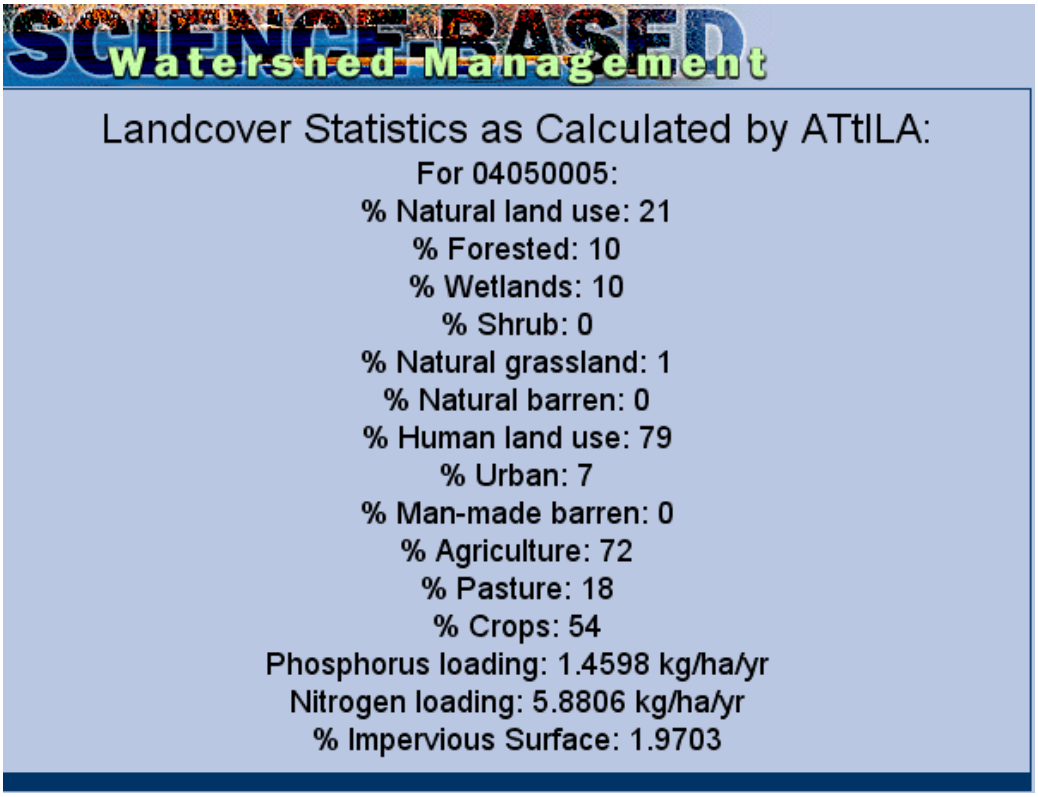

Figure 2. Selected Indicators Generated by Online ATtILA Function

The ReVA's Web-based EDT has been made interoperable with DW system so end users can seamlessly access EDT's ecological indicators for 8-digit watersheds via DW user interface. The ReVA EDT interoperability function is completed by consuming the web services constructed by EDT developers. . The function for the example watershed can be found at: http://35.8.121.101/scripts/esrimap.dll?name=watermap&cmd=WFPage&huc=04050005.

The ReVA interoperability function is accessible via the "R" icon on the toolbar (Figure 3). Clicking the "R" icon will trigger the system to access ReVA's EDT in real time for the current 8-digit watershed. The ecological indicators results returned by EDT for the current 8-digit watershed in xml format are then parsed and presented to end users in a table (Figure 4). A complete list of all available indicators can be found in the appendix. End users can also access the maps of individual ecological indicators for all 8 digit watersheds in EPA region 5 by clicking "View Map" link provided in the table for every indicator record (Figure 5).

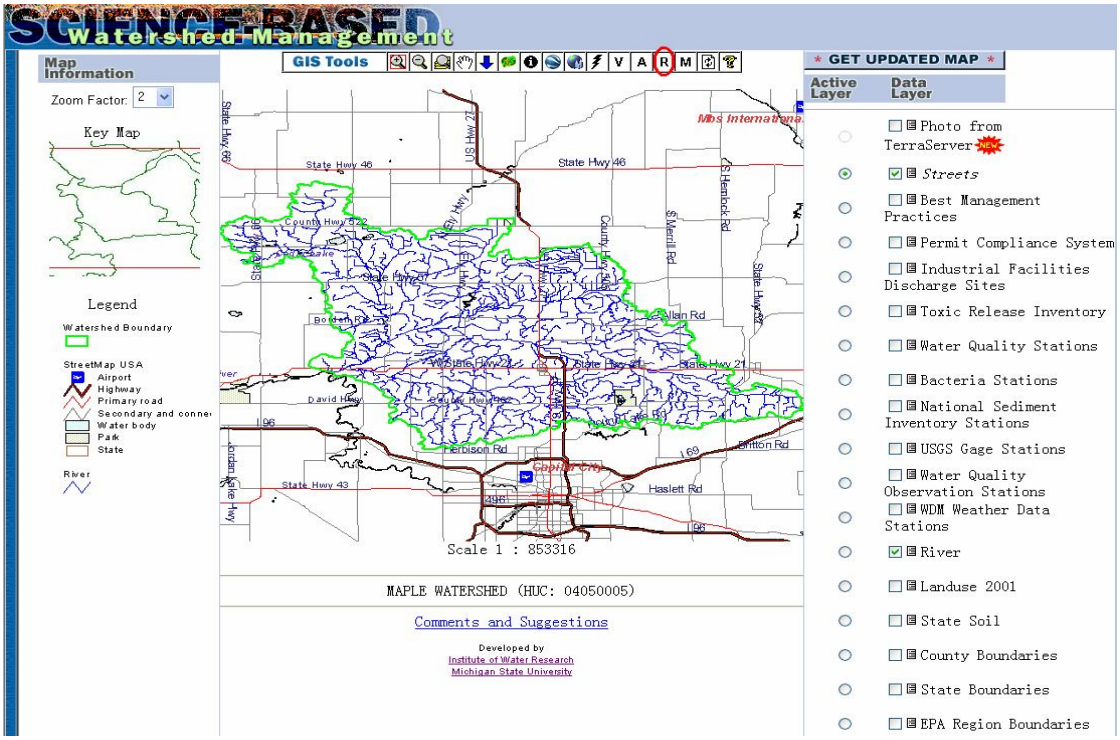

Figure 3. ReVA Function

EPA ReVa Indicators :

INDICATOR	DESCRIPTION	VALUE	UNIT	CATEGORY	Map
AGCROPPCT	Percentage of watershed that is cropland	54.5942	% of watershed	Landcover proportion metrics (derived from ATtILA)	View Map
AGPASTPCT	Percentage of watershed that is pasture	18.4772	% of watershed	Landcover proportion metrics (derived from ATtILA)	View Map
AGTOTPCT	Percentage of watershed that is any agricultural land use	73.0713	% of watershed	Landcover proportion metrics (derived from ATtILA)	View Map
AGTSL3	Percentage of watershed with all agriculture land on slopes that are greater than three percent	9.8153	% of watershed area	Soil erosion and conservation metrics	View Map
AMPHIB	Relative Vulnerability Amphibians to Toxics	0	Unitless	Species toxicity/vulnerability metrics (derived from habitat and ASPEN model data)	View Map
AQ.PLANT	Relative Vulnerability Aquatic Plants to Toxics	0	Unitless	Species toxicity/vulnerability metrics (derived from habitat and ASPEN model data)	View Map
AQ.SUM	Sum of all aquatic vulnerability to toxicity indices	0	Unitless	Species toxicity/vulnerability metrics (derived from habitat and ASPEN model data)	View Map
AQINV	Relative Vulnerability of Aquatic Invertebrates to Toxics	0	Unitless	Species toxicity/vulnerability metrics (derived from habitat and ASPEN model data)	View Map
AUPACRE	Animal units (1000 lbs of live animal weight) per acre of farmland	0.11707	1000 lbs animal wt/acre	Agricultural metrics (derived from 2002 US census of Agriculture)	View Map
AVERAGE.FA	Average farm size	232.33445	acres	Agricultural metrics (derived from 2002 US census of Agriculture)	View Map
AVGTRVTM	Average travel time to work. Long commute times suggest traffic congestion and/or long distances traveled.	13.55341	minutes	Demographic metrics (derived from census data)	View Map
BIRD.SUM	Relative Vulnerability Birds to Toxics	0	Unitless	Species toxicity/vulnerability metrics (derived from habitat and ASPEN model data)	View Map

Figure 4. Ecological Indicators Returned by Online ReVA EDT

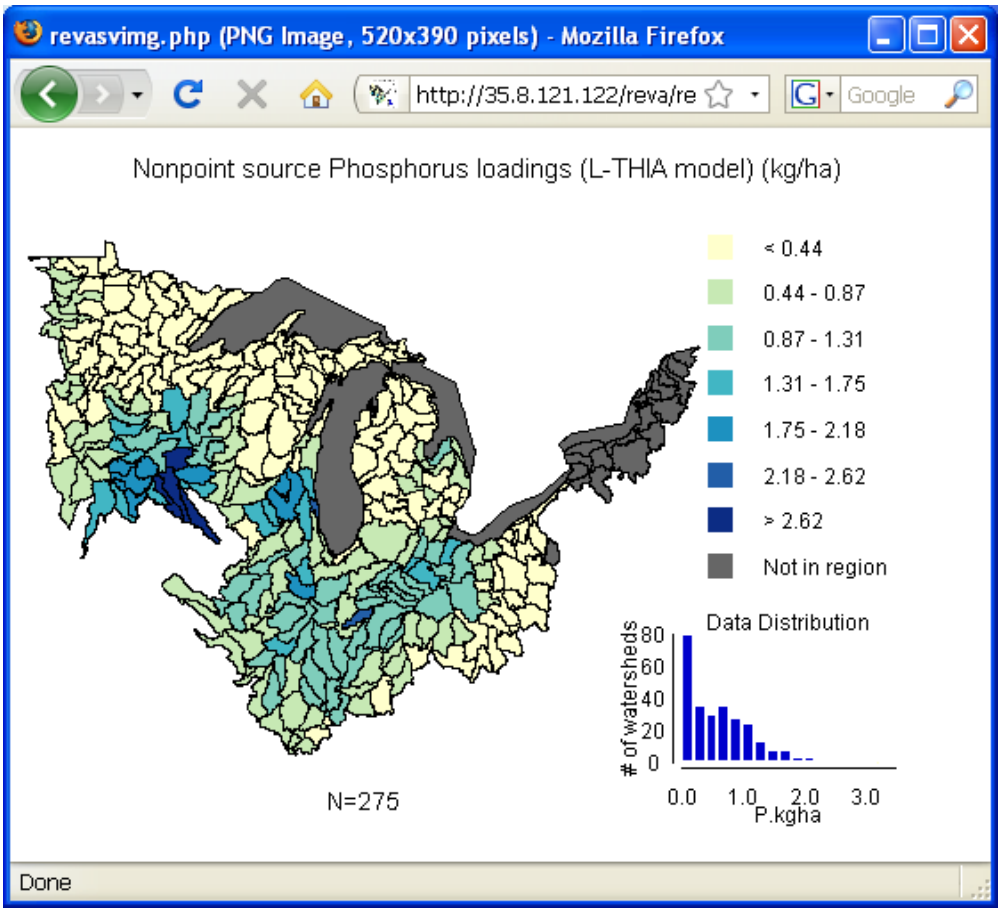

Figure 5. Map of Phosphorus Loadings for All 8 Digit Watershed in EPA Region 5

With these ATtILA and ReVA functions, end users can also compare any two watersheds by looking at metrics and indicators for the two watersheds calculated by ATtILA and ReVA.

Appendix

INDICATOR	DESCRIPTION	UNIT
	Agricultural metrics (derived from 2002 US census of Agriculture)	
AUPACRE	Animal units (1000 lbs of live animal weight) per acre of farmland	1000 lbs animal wt/acre
AVERAGE.FA	Average farm size	acres
CHEMICALUS	Per acre spending on agricultural chemicals. Spending is an indicator of intensity of chemical use but also reflects where more expensive chemicals are used.	dollars/acre
CORNFORGRA	Cropland productivity (measured as average yield of corn from National Agricultural Statistical Survey)	bushels/acre
FERTILIZER	Spending on fertilizer per acre	dollars/acre
FORESTDOLL	Farm sales of forest products	dollars/farm
FORESTPROD	Value of sales of forest products from farms, total within watershed	dollars
PERCENT.IR	Percent irrigated cropland acres (NASS)	% of watershed
PERCRNSOY	Percent cropland in corn and soy (developed from NASS county-level data)	% of watershed
PRCAPCLARE	Percent high productivity land (% in soil capability classes 1 and 2 in US Generalized Soil Map)	% of watershed with soil capability class 1 or 2
RECDOLLARS	Farm income from recreational services (per farm)	dollars/farm
RECREATION	Farm income from recreational services, total within watershed	dollars
SMALLFARMS	Percent of total farms defined as small family farms (sales < $250,000)	Percent
VALUELANDB	Value of land and buildings per farm	dollars/farm
CornForGrain	Cropland productivity, measured as average yield of corn (for grain) per acre (NASS)	bushels/ac
CornForSilage	Cropland productivity, measured as average yield of corn (for silage) per acre (NASS)	tons/ac
CRNYLDMAJ	Soil quality for crops, corn yield per acre (majority unit in HUC, from soil database - use only for relative values)	bu/ac
RNGPRDMAJ	Soil quality for range production (majority unit in HUC, from soil database - use only for relative values)	lbs/ac air-dry vegetation

INDICATOR	DESCRIPTION	UNIT
VEGORCHARD	Percent of cropland acres in Vegetables and Fruits. Indicates potential for availability of locally produced food	% of watershed
	species toxicity/vulnerability metrics (derived from habitat and ASPEN model data)	
PLANT.SUM	Relative Vulnerability of Terrestrial Plants to Toxics	Unitless
MAMM.SUM	Relative Vulnerability of Terrestrial Mammals to Toxics	Unitless
HERP.SUM	Relative Vulnerability Terrestrial Reptiles to Toxics	Unitless
AMPHIB	Relative Vulnerability Amphibians to Toxics	Unitless
AQ.PLANT	Relative Vulnerability Aquatic Plants to Toxics	Unitless
AQ.SUM	Sum of all aquatic vulnerability to toxicity indices	Unitless
AQINV	Relative Vulnerability of Aquatic Invertebrates to Toxics	Unitless
BIRD.SUM	Relative Vulnerability Birds to Toxics	Unitless
CFISH	Relative Vulnerability of Fish (cold water - streams) to Toxics	Unitless
WFISH	Relative Vulnerability Fish (warm water - lakes) to Toxics	Unitless
TERR.SUM	Sum of all terrestrial vulnerability to toxicity indices	Unitless
TOX.SUM	Sum of all vulnerability to toxicity indices	Unitless
	At-risk species metrics (derived from Natureserve data)	
SPECIESG1	Count of all T&E Species with Global Ranking 1	count (number)
SPECIESG2	Count of all T&E Species with Global Ranking 2	count (number)
SPECIESG3	Count of all T&E Species with Global Ranking 3	count (number)
SPECIESG4	Count of Species with Global Ranking 4	count (number)
SPECIESG5	Count of Species with Global Ranking 5	count (number)
TOTALSPECIES	Count of all T&E species within the area from Nature Serve data (G1-G3)	count (number)
	Riparian characteristics metrics (derived from ATtILA)	
RIPAGCROP0	Percentage of total stream length in watershed that is adjacent to cropland	% of total area

INDICATOR	DESCRIPTION	UNIT
RIPAGCROP30	Percentage of cropland in a 30 meter stream buffer area	% of total area
RIPAGCROP60	Percentage of cropland in a 60 meter stream buffer area	% of total area
RIPAGPAST0	Percentage of total stream length in watershed that is adjacent to pastureland	% of total area
RIPAGPAST30	Percentage of pastureland in a 30 meter stream buffer area	% of total area
RIPAGPAST60	Percentage of pastureland in a 60 meter stream buffer area	% of total area
RIPAGTOT0	Percentage of total stream length in watershed that is adjacent to all agriculture land	% of total area
RIPAGTOT30	Percentage of all agricultural land in a 30 meter stream buffer area	% of total area
RIPAGTOT60	Percentage of all agricultural land in a 60 meter stream buffer area	% of total area
RIPFOR0	Percentage of total stream length in watershed that is adjacent to forest	% of total area
RIPFOR30	Percentage of forest in a 30 meter stream buffer area	% of total area
RIPFOR60	Percentage of forest in a 60 meter stream buffer area	% of total area
RIPHUMAN0	Percentage of total stream length in watershed that is adjacent to human land use	% of total area
RIPHUMAN30	Percentage of human land use in a 30 meter stream buffer area	% of total area
RIPHUMAN60	Percentage of human land use in a 60 meter stream buffer area	% of total area
RIPNAT0	Percentage of total stream length in watershed that is adjacent to any natural land cover	% of total area
RIPNAT30	Percentage of natural land cover in a 30 meter stream buffer area	% of total area
RIPNAT60	Percentage of natural land cover in a 60 meter stream buffer area	% of total area
RIPNATBAR0	Percentage of total stream length in watershed that is adjacent to natural barren land	% of total area
RIPNATBAR30	Percentage of natural barren land in a 30 meter stream buffer area	% of total area
RIPNATBAR60	Percentage of natural barren land in a 60 meter stream buffer area	% of total area
RIPNATGRASS0	Percentage of total stream length in watershed	% of total area

INDICATOR	DESCRIPTION	UNIT
	that is adjacent to natural grassland	
RIPNATGRASS30	Percentage of natural grassland in a 30 meter stream buffer area	% of total area
RIPNATGRASS60	Percentage of natural grassland in a 60 meter stream buffer area	% of total area
RIPURBAN0	Percentage of total stream length in watershed that is adjacent to urban land	% of total area
RIPURBAN30	Percentage of urban land in a 30 meter stream buffer area	% of total area
RIPURBAN60	Percentage of urban land in a 60 meter stream buffer area	% of total area
	Demographic metrics (derived from census data)	
PERAGRIWOR	Percentage of civilian population that is over age 16 and identified as 1) Farmers and farm managers or 2) Agricultural workers, including supervisors in 2000.	% of watershed population
PERBELOWPO	Percentage of individuals below the 1999 Poverty Threshold in 2000	% of watershed population
PERCHILD05	Percentage of the population that is 5 years old or younger in 2000	% of watershed population
PERECONACT	Percentage of the population that is economically active (18-64 years old) in 2000	% of watershed population
PERNATAMER	Percentage of the population classified American Indian and Alaska Native in 2000	% of watershed population
PERNONWHIT	Percentage of the population that is non-white in 2000 (i.e. all minorities, other races, Hispanic Ethnicity (including White Hispanic))	% of watershed population
PERNOPLUMB	Percentage of structures without complete plumbing in 2000. Complete is defined as having 1) hot and cold piped water; 2) a flush toilet and 3) a bathtub or shower	% of watershed population
PERPRE1980	Percentage of structures built in 1979 or earlier in 2000	% of watershed population
PERSENBELO	Percentage of individuals that are Seniors and below the 1999 Poverty Threshold in 2000	% of watershed population
PERSENIOR	Percentage of the population that is age 65 or older in 2000	% of watershed population
POPSQMILE	Population Density (people/square mile) in 2000	% of watershed population
PRDFHOUS	Percent of population aged 5+ in a different house	% of watershed population

INDICATOR	DESCRIPTION	UNIT
	than five years prior	
PREMAENT	Percent employed in arts or entertainment. This is an indicator of amenities within an area.	% of watershed population
PREMSTIT	Percent employed in science, tech, or IT	% of watershed population
PRHHGVAS	Percent households received government assistance	% of watershed population
PRHHWRET	Percent households with retirement income	% of watershed population
PRHMOWN	Percent home owners	% of watershed population
PRHSP	Percent population with high school plus	% of watershed population
PRLNGISL	Percent linguistically isolated. (A linguistically isolated household is one in which all members of the household,14 years and older, have at least some difficulty with English.)	% of watershed population
PRMOBILE	Percent mobile homes	% of watershed population
PRNATIVE	Percent Native American	% of watershed population
PROFITFARM	Percent profitable farms	% of watershed population
PRPSTHS	Percent with post-high school education	% of watershed population
PRRNT30P	Percent with rent greater than 30% of income	% of watershed population
PRSEASPC	Second homes per capita. Indicates a high level of recreational use and potential for natural amenities.	number of homes
PRUNEMP	Unemployment rate	% of watershed population
AVGTRVTM	Average travel time to work. Long commute times suggest traffic congestion and/or long distances traveled.	minutes
WRKRSQMI	Workers per square mile is an indicator of density of economic activity	# of workers per mi^2
SEASAREA	Second homes per square mile indicates magnitude of demand for amenities of an area.	
PRWK2534	Percent workers of prime workforce age (25-34)	% of watershed population
HOMESQMI	Homes per square mile	
SEASAREA	Second homes per square mile indicates magnitude of demand for amenities of an area.	
PRWCBA	Percent of women of childbearing age	% of watershed population
PR.BIA	Percent Bureau of Indian Affairs land. (Includes all lands recognized by the Federal Government as territory in which American Indian tribes have primary governmental authority.)	% of watershed

INDICATOR	DESCRIPTION	UNIT
NETMIG	Net migration from county of residence between 1995 and 2000. Negative values indicate net population movement is out of county of residence (out-migration) and positive values indicate net in-migration. The net migration is divided by the total population to provide a rate of migration per capita. These values have been reaggregated to the watershed and now reflect average net migration (area-weighted) for the counties contained within the watershed.	proportion
	Landcover proportion metrics (derived from ATtILA)	
FORPCT	Percentage of watershed that is forest	% of watershed
WETLNDSPCT	Percentage of watershed that is wetland	% of watershed
SHRBPCT	Percentage of watershed that is shrubland	% of watershed
NGRASSPCT	Percentage of watershed that is natural grassland	% of watershed
NBARPCT	Percentage of watershed that is natural barren land	% of watershed
URBPCT	Percentage of watershed that is urban	% of watershed
UINDEX	Percentage of watershed comprised of human land use	% of watershed
AGCROPPCT	Percentage of watershed that is cropland	% of watershed
AGPASTPCT	Percentage of watershed that is pasture	% of watershed
AGTOTPCT	Percentage of watershed that is any agricultural land use	% of watershed
	Water quality metrics (derived from L-THIA)	
BOD.kgha	Estimated nonpoint source (NPS) Biological Oxygen Demand (BOD) (kg/ha) based on land use cover using the Long-Term Hydrologic Impact Assessment (L-THIA) model	kg/hectare
COD.kgha	Estimated nonpoint source (NPS) Chemical Oxygen Demand (COD) (kg/ha) based on land use cover using the Long-Term Hydrologic Impact Assessment (L-THIA) model	kg/hectare
Cd.kgha	Estimated nonpoint source (NPS) Cadmium (Cd) loadings (kg/ha) based on land use cover using the Long-Term Hydrologic Impact Assessment (L-THIA) model	kg/hectare
Cr.kgha	Estimated nonpoint source (NPS) Chromium (Cr) loadings (kg/ha) based on land use cover using	kg/hectare

INDICATOR	DESCRIPTION	UNIT
	the Long-Term Hydrologic Impact Assessment (L-THIA) model	
Cu.kgha	Estimated nonpoint source (NPS) Copper (Cu) loadings (kg/ha) based on land use cover using the Long-Term Hydrologic Impact Assessment (L-THIA) model	kg/hectare
EcCol.kgha	Estimated nonpoint source (NPS) Fecal Coliform loadings (kg/ha) based on land use cover using the Long-Term Hydrologic Impact Assessment (L-THIA) model	kg/hectare
FecStrep.kgha	Estimated nonpoint source (NPS) Fecal Strep loadings (kg/ha) based on land use cover using the Long-Term Hydrologic Impact Assessment (L-THIA) model	kg/hectare
N.kgha	Estimated nonpoint source (NPS) Nitrogen (N) loadings (kg/ha) based on land use cover using the Long-Term Hydrologic Impact Assessment (L-THIA) model	kg/hectare
Ni.kgha	Estimated nonpoint source (NPS) Nickel (Ni) loadings (kg/ha) based on land use cover using the Long-Term Hydrologic Impact Assessment (L-THIA) model	kg/hectare
OG.kgha	Estimated nonpoint source (NPS) Oil and Grease loadings (kg/ha) based on land use cover using the Long-Term Hydrologic Impact Assessment (L-THIA) model	kg/hectare
P.kgha	Estimated nonpoint source (NPS) Phosphorus (P) loadings (kg/ha) based on land use cover using the Long-Term Hydrologic Impact Assessment (L-THIA) model	kg/hectare
Pb.Kgha	Estimated nonpoint source (NPS) Lead (Pb) loadings (kg/ha) based on land use cover using the Long-Term Hydrologic Impact Assessment (L-THIA) model	kg/hectare
SS.Kgha	Estimated nonpoint source (NPS) Suspended Solids (SS) loadings (kg/ha) based on land use cover using the Long-Term Hydrologic Impact Assessment (L-THIA) model	kg/hectare
Zn.kgha	Estimated nonpoint source (NPS) Zinc (Zn) loadings (kg/ha) based on land use cover using the Long-Term Hydrologic Impact Assessment (L-THIA) model	kg/hectare

Road and Stream Metrics

INDICATOR	DESCRIPTION	UNIT
RDDENS	Road density (km of road per km2 of area)	km road per km^2 area
PCTIA.RD	Percentage of watershed comprised of impervious cover, based on road density	% of watershed
STXRD	Number of road crossings per total stream length (km)	number per length
STRMDENS	Stream density (km of stream per km2 of area)	km stream per km^2 area
RNS30	Length of roads within 30 meters of streams divided by length of streams in watershed	length per length
Forest patch metrics		
FAVGSIZE	Average size of forest patches within the watershed	Hectares
FDENSITY	Patch density within the watershed (number of patches/km2)	number of patches per km^2
FLARGEST	Size of largest forest patch within the watershed	Hectares
FNUMBER	Number of forest patches within the watershed	number
FPLGP	Proportion of largest forest patch to total area of forest within the watershed	proportion
Forest fragmentation/connectivity metrics		
PFF27	Average forest connectivity within the watershed at a 65 hectare scale	number
PFF5	Average forest connectivity within the watershed at a 2 hectare scale	number
PFFEDGE27	Percentage of watershed that is edge forest class at a 65 hectare scale	% of watershed
PFFEDGE5	Percentage of watershed that is edge forest class at a 2 hectare scale	% of watershed
PFFINTR27	Percentage of watershed that is interior forest class at a 65 hectare area	% of watershed
PFFINTR5	Percentage of watershed that is interior forest class at a 2 hectare area	% of watershed
PFFPERF27	Percentage of watershed that is perforated forest class at a 65 hectare scale	% of watershed
PFFPERF5	Percentage of watershed that is perforated forest class at a 2 hectare scale	% of watershed
PFFPTCH27	Percentage of watershed that is patch forest class at a 65 hectare scale	% of watershed
PFFPTCH5	Percentage of watershed that is patch forest class	% of watershed

INDICATOR	DESCRIPTION	UNIT
	at a 2 hectare scale	
PFFTRAN27	Percentage of watershed that is transitional forest class at a 65 hectare scale	% of watershed
PFFTRAN5	Percentage of watershed that is transitional forest class at a 2 hectare scale	% of watershed
Landcover diversity metrics		
HDIVERSITY	Shannon-Weiner diversity	Number (score)
HPRIME	Standardized Shannon-Weiner diversity	Number (score)
SDIVERSITY	Simple diversity	Number (score)
CDIVERSITY	Simpson index	Number (score)
Air pollution metrics (derived from Community Model of Air Quality model)		
SULFTOT.1A	Average SOx Deposition (wet and dry CMAQ)	kg/ha
TDO3.1A	Average Ozone Deposition (CMAQ)	kg/ha
TDTOTN.1A	Average Nox Deposition (wet and dry - CMAQ)	kg/ha
WDTOTN.1A	Average NOx Wet Deposition (CMAQ)	kg/ha
WDTOTS.1A	Average SOx Wet Deposition (CMAQ)	kg/ha
Water use metrics (from USGS)		
TOGWIRR	Percent of total surface water withdrawals used for irrigation	%
TOGWUSE	Average groundwater use per person (residential use)	gallons per day per person
TOSWIRR	Percent of total ground water withdrawals used for irrigation	%
TOSWUSE	Average surface water use per person (residential use)	gallons per day per person
TOWAIRR	Water use for irrigation per hectare	Million gal per year per ha
PRGWLVST	Percent of total groundwater withdrawals used for livestock	%
PRSWLVST	Percent of total surface water withdrawals used for livestock	%
Groundwater contamination risk metrics		

INDICATOR	DESCRIPTION	UNIT
PRHI.N10	Percent area with severe nitrate contamination (>= 10 mg/L) in groundwater (50 m depth). This level is the EPA maximum contaminant level and has been associated with "blue baby" syndrome.	% of watershed
PRHI.N3	Percent area with moderate nitrate contamination (>= 3 mg/l) in groundwater (50 m depth). Values at or above 3 mg/l, are considered elevated as a result of human activities.	% of watershed
NITSUM	Potential exposure to nitrate from groundwater (number of people with domestic self-supplied water where aquifer (at 50 m depth) has elevated nitrate levels(>3 mg/l)	# of people (thousands)
Soil erosion and conservation metrics		
AGTSL3	Percentage of watershed with all agriculture land on slopes that are greater than three percent	% of watershed area
KFACTORMED	Soil erodibility factor that represents both susceptibility of soil to erosion and the rate of water runoff	unitless
PRWEGAREA1	Proportion of soils susceptible to wind erosion (wind erodibility groups 1-4L in US Generalized Soil Map)	Percent
CONSERVATI	Conservation program participation measured as CRP/WRP dollars divided by acres enrolled. (Value reflects farm rental rates and types of projects implemented.)	dollars per acre
CRPWRP.ACR	Percent of total farm acres enrolled in Conservation programs (Conservation Reserve and Wetlands Reserve Programs)	percent

Exchange Network Grant Program Progress Reporting Form

Instructions:
This form is for Exchange Network Grant recipients to report their progress. Recipients should send these to their regional grant project officer for ***spring reports by April 30 for the period September 1-March 31****.* ***Fall reports*** *are due to the regional project officer by* ***October 31 for the period April 1-September 30****.*

Report Type: Semi-Annual (April 1, 2009 through September 30, 2009)

Recipient Information: **Agency Name: Wisconsin DNR**	**EPA Grant Number – OS-83320901-0** **Challenge Grant**
Project Manager: **Name: Dreux Watermolen** **E-mail address:** **dreux.watermolen@wisconsin.gov** **Telephone number: (608) 266-8931**	**Funding Year: 06** **Award Amount: $500,000** **Current Reporting Period (4/1/2009 to 9/30/2009)** **Project Period (09/01/2006 – 08/31/2008)** **Original: same** **Extensions: extended until 03/31/2010**
Project Focus: The Midwest Spatial Decision Support Systems Partnership will develop a web-based, decision-support system for watershed management that includes automated tabular and spatial data discovery, exchange, integration, and analysis tools tailored to meet the needs of Great Lakes region decision makers.	

Exchange Network Grant Program Progress Reporting Form

Goals	*Outputs*	*Scheduled Date*	*Completion date*	*List Outcomes for Each Goal, and, if they differ, each Output*
1. Develop XML schema and data flow protocols to exchange Wisconsin DNR's water quality assessment data with EPA.	1.1. Wisconsin DNR will work with EPA to define data standards, specify requirements for data flow, and define XML schema for water quality assessment data exchanges with EPA.	9/07	Completed .	*New data flows and XML schema for water quality assessment data.* The 2008 Wisconsin electronic submittal is/will be a pilot of integrated reporting using an XML format. (Please see previous semi-annual progress reports.) Additional work is planned over the next two quarters to further refine this pilot approach.
2. Integrate EPA's STORET database into Digital Watershed and make STORET data available via a menu of standard and customized reports.	2.1. MSU will develop a data tool for Digital Watershed that allows users to access and view STORET and water quality assessment data through a query table(s) and/or map interface.	9/07	Completed.	*Improved data availability through the Exchange Network.* *Enhanced ability to analyze data on a watershed basis.* *An improved infrastructure necessary for the flow of additional EPA data sets (e.g., TRIS, SDWIS, etc.) to state and local users.* The MSU Team has completed STORET water quality data access function within the Digital Watershed system based on the EPA STORET Station Web Service and the following EPA STORET Result Web Services: http://www.epa.gov/storet/web_services.html http://iaspub.epa.gov/webservices/StationService/ http://iaspub.epa.gov/webservices/StoretResultService/ The EPA STORET team has fixed several technical issues previously encountered by web service consumers (identified in previous semi-annual report) and therefore enabled users to relatively smoothly chain multiple web services together. Digital Watershed's water quality data access function now
	2.2. MSU will work with the Midwest Partnership to agree on data standards, specify requirements for data flow, and use XML schema defined by EPA for STORET	9/07	Completed.	

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Goals	*Outputs*	*Scheduled Date*	*Completion date*	*List Outcomes for Each Goal, and, if they differ, each Output*
	data exchange with Digital Watershed.			allows users to view all water quality stations within current map extent on a Google mapping interface. By clicking on individual stations, users can also access all water quality parameters for a water quality station in tabular format. See Appendix 1 for screen captures displaying the STORET water quality data access function (Figure 1); stations display in Google Maps (Figure 2); and listing of water quality parameters for an example station (Figure 3). The MSU Team has completed the standard 8-digit watershed reporting function by adding EPA STORET water quality data summary information as a new section in the final report page. The EPA STORET water quality data summary section contains all information derived dynamically online from EPA STORET Watershed Summary Web Services: http://www.epa.gov/storet/web_services.html http://iaspub.epa.gov/webservices/WatershedSummaryService/ See Appendix 2 for an example from the Maple Watershed in Michigan (Figure 1).
3. Integrate locally available tabular watershed data into Digital Watershed and make those data available for viewing via a menu of standard and	3.1. MSU in consultation with RPCs and other partners will develop an automated generic tabular data tool for Digital Watershed that allows users to seamlessly add and	9/07	Ongoing.	*Availability of local data through the Exchange Network and an enhanced ability to analyze data on a watershed basis.* Wisconsin DNR identified numerous county and regional planning commission Internet mapping services in Wisconsin (see previous semi-annual reports). Of these sites, only the Bay-Lake Regional Planning Commission site produced as a part of this project publishes WMS (approximately half dozen county land use themes). No other local sources of tabular

Exchange Network Grant Program Progress Reporting Form

Goals	*Outputs*	*Scheduled Date*	*Completion date*	*List Outcomes for Each Goal, and, if they differ, each Output*
customized reports.	view local data through a query table or map interface.			data appear to be delivered as web services. We are continuing discussions with MSU regarding possible demonstrations using the Bay-Lake RPC WMS.
	3.2. NIPC will work with Chicago Wilderness and BLRPC to agree on data standards, specify data flow requirements, and define XML schema for local data exchange with Digital Watershed.	9/07	Partially completed.	*An improved infrastructure necessary for the flow of additional local data sets via the Exchange Network.* Following our application and prior to the grant award, the State of Illinois changed its laws and NIPC was reorganized into the Chicago Metropolitan Agency for Planning (CMAP). CMAP opted not to enter into a contractual relationship with Wisconsin DNR and the Midwest Partnership due to uncertainties associated with its reorganization and redefined mission. Bay-Lake RPC continued to create, update, and maintain WMS and WFS services for completed county land use inventories. There is now the ability to stream WMS services into ArcMap, ArcGIS Explorer, QGIS, and Kentucky Watershed Model Project from Bay-Lakes' WMS/WFS sites. Bay-Lake RPC Internet mapping services were used for GIS presentations and demonstrations by Wisconsin DNR. At this point, no attempt has been made to integrate these services with Digital Watershed. We are continuing discussions with MSU regarding possible demonstrations using the Bay-Lake RPC WMS.

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4. Create and implement a standardized watershed report tool for Digital Watershed.	4.1. MSU in consultation with the Midwest Partnership will define the structure and contents of standardized watershed reports, with an emphasis on STORET and watershed assessment data.	3/08	Completed.	*An enhanced ability to analyze data on a watershed basis.* *An enhanced ability to analyze data on a watershed basis.* The MSU Team has developed a standard 8-digit watershed report function and integrated it into the Digital Watershed. The watershed report generated by this function contains general watershed information and selected major ecological indicators derived from EPA's ReVa EDT for the Midwest region, and the ATtILA program. A watershed map and land cover characteristics pie chart are included. The selected major ecological indicators are listed below: • Percent irrigated cropland acres (National Agricultural Statistical Service). • Cropland productivity (measured as average yield of corn from NASS). • Percentage of total stream length in the watershed that is adjacent to all (classes of) agriculture land. • Percentage of all (classes of) agricultural land in a 60 meter stream buffer area. • Percentage of total stream length in watershed that is adjacent to urban land (all classes). • Percentage of urban land (all classes) in a 60 meter stream buffer area. • Population Density (people/square mile) in 2000. • Estimated nonpoint source (NPS) Nitrogen (N) loadings (kg/ha) based on L-THIA model. • Estimated nonpoint source (NPS) Phosphorus (P) loadings (kg/ha) based on L-THIA model. • Estimated nonpoint source (NPS) Suspended Solids (SS) loadings (kg/ha) based on L-THIA model. • Road density (km/square kilometer) in 2000.
	4.2. MSU will develop a standardized watershed report tool for Digital Watershed.	3/08	Completed.	

				• Stream density (km/square kilometer) in 2000. • Percent of total surface water withdrawals used for irrigation. • Percent of total groundwater withdrawals used for irrigation. • Average surface water use per person (residential use). • Average groundwater use per person (residential use). • Percentage of watershed with all (classes of) agriculture land on slopes that is greater than three percent. • Soil erodability factor that represents both susceptibility of soil to erosion and the rate of water runoff. See also Section 2.2 above for the standardized STORET summary attributes which were also included in the standard report at the HUC 8 level. Work under a separate agreement was undertaken by MSU to enable similar reporting at the 12-digit HUC level. EPA's ReVA Team did not, however, provide the landscape metrics at the 12-digit level.
5. Define options for a customized watershed report tool for Digital Watershed.	5.1. MSU in consultation with the Midwest Partnership will define options for the structure and contents of customized reports, with an emphasis on STORET and watershed	3/08	Substituted.	*An enhanced ability to analyze data on a watershed basis.* See discussion above, Section 2.1, for the ability to query any station via the Google Maps interface.

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	assessment data.			
6. Add thematic mapping capabilities to Digital Watershed.	6.1. MSU in consultation with the Midwest Partnership will identify relevant attribute data and define needed mapping capabilities.	03/08	Completed.	*Improved data availability through the Exchange Network and an enhanced ability to analyze data on a watershed basis.* *Improved data availability and an enhanced ability to analyze data on a watershed basis.* The MSU team has added a thematic mapping function into the Digital Watershed system which allows users to generate a thematic map of their current selection of layers and map extent. The map is generated as a temporary browser display, which the user can print immediately, or cut and paste to another software package to save. See Appendix 3 for an example of the thematic map display for the Grand River Watershed (Michigan). The layers which are included are listed below; those with metadata downloaded from BASINS are in bold text. • Photo from Terra Server • Streets • Best Management Practices • **Permit Compliance System** • **Industrial Facilities Discharge** • **Toxic Release Inventory** • **Water Quality Stations** • **Bacteria Stations** • National Sediment Inventory Stations • **USGS Gage Stations** • **Water Quality Observation Stations** • **WDM Weather Data Stations**
	6.2. MSU in consultation with the Midwest Partnership will develop a thematic map tool for Digital Watershed.	3/08		

				• Impaired Water (Event) • Impaired Water (Reach) • Impaired Water (Area) • River • **Land cover Change (92-01)** • Land use 2001 • **State Soil** • **County Boundaries** • **State Boundaries** • **EPA Region Boundaries** • **Elevation** • **Cataloging Unit Boundaries** The interface for Michigan also includes: • Flow lines • Contours • **Ag erosion**
7. Modify and enhance the watershed delineation capabilities of Digital Watershed by linking the enhanced OWL to Digital Watershed.	7.1. Purdue University and MSU will build predefined hydrologic units (8, 10, and 12 digit) and multiple ways to initiate delineation (hydrologic unit or address) into the OWL tool.	3/08	Completed.	*An enhanced ability to analyze data on a watershed basis.* Earlier reports detailed the development of a Google Maps-based interface for L-THIA for Region 5 states. Tasks 7 and 8 of this project determined several upgrades included in that interface development. The process to have multiple ways to initiate watershed delineation is completed for the six states of Region 5. The new Google Maps-based interface allows easy search to street address or zip code for all states. The interface also allows entry of latitude-longitude pairs or of projected X,Y coordinates for all states. In addition, the Indiana and Wisconsin versions allow selection of a HUC12 watershed. The outline used is that of the new EPA national layer of HUC12 watersheds. The Wisconsin
	7.2. Purdue University, in consultation with MSU, will build options	3/08		

	in to the OWL tool to add local data (e.g., land use, elevation, soils) and the capability to summarize existing STORET data by delineated watershed.			Google Maps interface for L-THIA includes a WMS layer of the National Hydrography Data flowlines, the high-resolution version. This has a checkbox so the user can toggle the service on and off. The point of the display of this streaming data service is to locate channels and streams in the urban areas where Google does not depict it in their images. The grid below (Appendix 4, Table 1) illustrates the distribution of the new capabilities. The team built new 10 and 8 digit watersheds from the new EPA national layer of HUC12 watersheds. Implementing this new layer as the base structure for L-THIA means discarding previously built collections of watershed data, since there are significant changes in the HUC 12 layer outlines throughout the Midwest. The L-THIA watershed delineation model is built on 8 or 10 digit (clipped) watershed units that include DEM, slope, flow accumulation, direction, land use and soils all clipped to the watershed. The new watershed outlines meant redoing this data manipulation, a fairly significant task. In this process, the Wisconsin L-THIA watershed delineation capability was re-constructed and implemented with the USGS 10 meter DEM, as well as NLCD 2001 land use and SSURGO soils as base layers. This version also uses the WMS-based service of NHD – high resolution streams to portray the mapped flow across the landscape. The Michigan State Digital Watershed interface can connect with the Google Maps L-THIA interface, meaning Digital Watershed can send a point to delineate and get a KML watershed outline in return. The new interfaces are available from the page: https://engineering.purdue.edu/~lthia/ (Note: See Appendix 4.)

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8. Modify and link impervious surface calculation capabilities to Digital Watershed.	8.1. Purdue University will modify Purdue's impervious surface tool to build in an option to add local data.	8/08	Completed.	*An enhanced ability to analyze data on a watershed basis.* This is completed for all of US EPA Region 5. The new Google-based interface includes the tool to "Calculate Impervious Area" based on the NLCD 2001 Land cover data. This calculation is made from land cover and not from the impervious surface product from the USGS. This tool covers all US EPA Region 5 states. The tool allows local users to edit the NLCD land use to portray either historical condition or proposed changes. The result is available to use in L-THIA models or spreadsheets. (Note: See Appendix 4, Table 1.)
	8.2. Purdue, in consultation with MSU, will link the impervious surface calculator to Digital Watershed.	8/08		
9. Add model calibration capabilities to the decision-support system.	9.1. Purdue will modify the WHAT tool so that it can be used to calibrate the L-THIA tool, includes an option to add local data instead of default USGS data, and to report relevant results that can be used to calibrate other hydrologic models.	8/08	Completed	*An enhanced ability to analyze data on a watershed basis.* During the early portions of this process, the investigators identified the need to extend L-THIA to include a baseflow component. This became apparent when attempting to calibrate L-THIA to predict some pollutant loads. Pollutant loads that are carried primarily during baseflow could not be adequately predicted with the current L-THIA. Thus, to adequately predict the full range of nonpoint source pollutant loads of interest to L-THIA users, it is necessary to introduce a baseflow capability. Note that for most applications, L-THIA provides results that are suitable. For some cases, the addition of a baseflow capability will be required – this will be a future effort. The L-THIA calibration effort also has several steps. Step one was to optimize the curve numbers based on observed flow data. Step two was to rebuild WHAT into a web-based tool that allowed upload of local flow and quality data as well as the

				ability to input USGS data automatically. Step 3 will be to add base flow capability to the new L-THIA interface. The development of an optimization tool (L-THIA V2) for the regional calibration of CNs and baseflow coefficients was completed by coding, in FORTRAN, the Shuffled Complex Evolution Algorithm (SCE-UA) version 2.2, developed in the Department of Hydrology and Water Resources of the University of Arizona, to fit the L-THIA model automatically with observed flow. The program generates calibrated CN values for streamflow estimations as well as Alpha Factor and Base-flow Index (BFI) max values for estimating base flow for different land uses and soils. The tool has been used to obtain regionalized calibrated CN parameters from eight gauged watersheds (for calibration) and six ungaged watersheds (for validation) in Indiana. Regionalized calibrated CNs for six gauged watersheds (for calibration) for Wisconsin has also been completed. The optimized curve numbers for Indiana are installed in a calibrated version of L-THIA; the user selects the button to "Run Calibrated L-THIA." Optimized CN for Wisconsin may be added to the calibrated version of L-THIA in the future. The effort to provide services for calibration is completed with the release of the "Load Duration – Flow Duration Web-based Tool" which allows user to pick a USGS gauge from a Google Map interface and download flow from that location or upload local flow, and upload quality data measurements to use in constructing a flow and load duration curve set. These products are graphical and downloadable. This tool is available here: https://engineering.purdue.edu/~ldc . The tool is closely tied in to the TMDL process and has video-based and screen-based tutorial materials linked to the page. The web-

				based tool can easily provide results relevant to a wide range of other hydrologic models.
10. Make XML schema and protocols for all data flow and decision-support tool functions available nationally.	10.1. Wisconsin DNR, in coordination with the Exchange Network, will publish and make available on the Exchange Network Registry the XML schema and protocols for all data flows, data integration, and decision-support tool applications included in this proposal.	Ongoing.	Ongoing.	*Improved data availability through the Exchange Network and an improved infrastructure for the flow of additional data sets.* The emergence of web services from EPA during the course of this project enabled the use of standard, available protocols, and did not require the development of additional XML schema. The final report will summarize all data sources incorporated in the project.
11. Conduct effective project outreach activities to ensure transferability and application of technology.	11.1. Wisconsin DNR will host a workshop for end users to provide user testing of tools developed as part of this project. Workshop will be coordinated closely with the Midwest Partnership.	8/08	Ongoing.	*Developed tools will meet the needs of end users and EPA technology investments will be leveraged.* A workshop is planned for fourth quarter 2009 to evaluate the tools, and provide feedback to the developers.
	11.2. Wisconsin DNR will assess and document any training requirements for users for each tool addressed in this proposal.	8/08	On-going	*Developed tools will meet the needs of end users.* The workshop discussed above will provide the opportunity for feedback on existing and needed documentation and training materials. One way to gauge the enhancement of tools developed as part of

				this project is through web site statistics. In July 2009 the Purdue team embedded Google Analytics code into the L-THIA tool web pages. This allows us to track accurately the use of the web site. From July to October 2009, the US EPA Region 5 L-THIA tools had 1441 site visitors with about 5000 page views. Several hundred visitors made return visits, and spent an average 6 minutes on the site. About 90% of the traffic was from US EPA Region 5 cities and 5% from the East Coast of the US, including New York and Washington D.C. (See Appendix 4, Figure 1).

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Comments
If you have had any problems during the current period please report them here. Describe any actions your organization has taken or plans to take to resolve the problem: Incorporation of local geospatial data as web services, for both visualization and spatial analysis, is believed to be premature at this time. We can demonstrate these concepts with the Bay-Lake Regional Planning Commission WMS and WFS sites developed as part of this project, but the availability and stability of these services at the local level remain limited. Publishing geospatial data as OGC-compliant WMS, WFS, KML/KMZ, REST, and SOAP services from within state and local governments is only at the very initial stage. Additional emphasis must be placed on OGC and similar standards and a catalog/registry for discovering these services as they are developed.
If you need help from EPA you may request it here: Geocoding all STORET stations to current HUC 12, 10, 8 codes would be extremely useful and time saving for subsetting large data sets and generating watershed reports. Updating of STORET caches in EPA's EnviroMapper for Water is needed; Wisconsin appears particularly dated. The ability to label STORET Stations individually and in batch is desirable. Demonstration of effective data discovery via Catalog Web Services could be demonstrated if EPA's site was fully functioning in ArcGIS 9.3. see: http://www.epa.gov/geospatial/data.html
Other comments:

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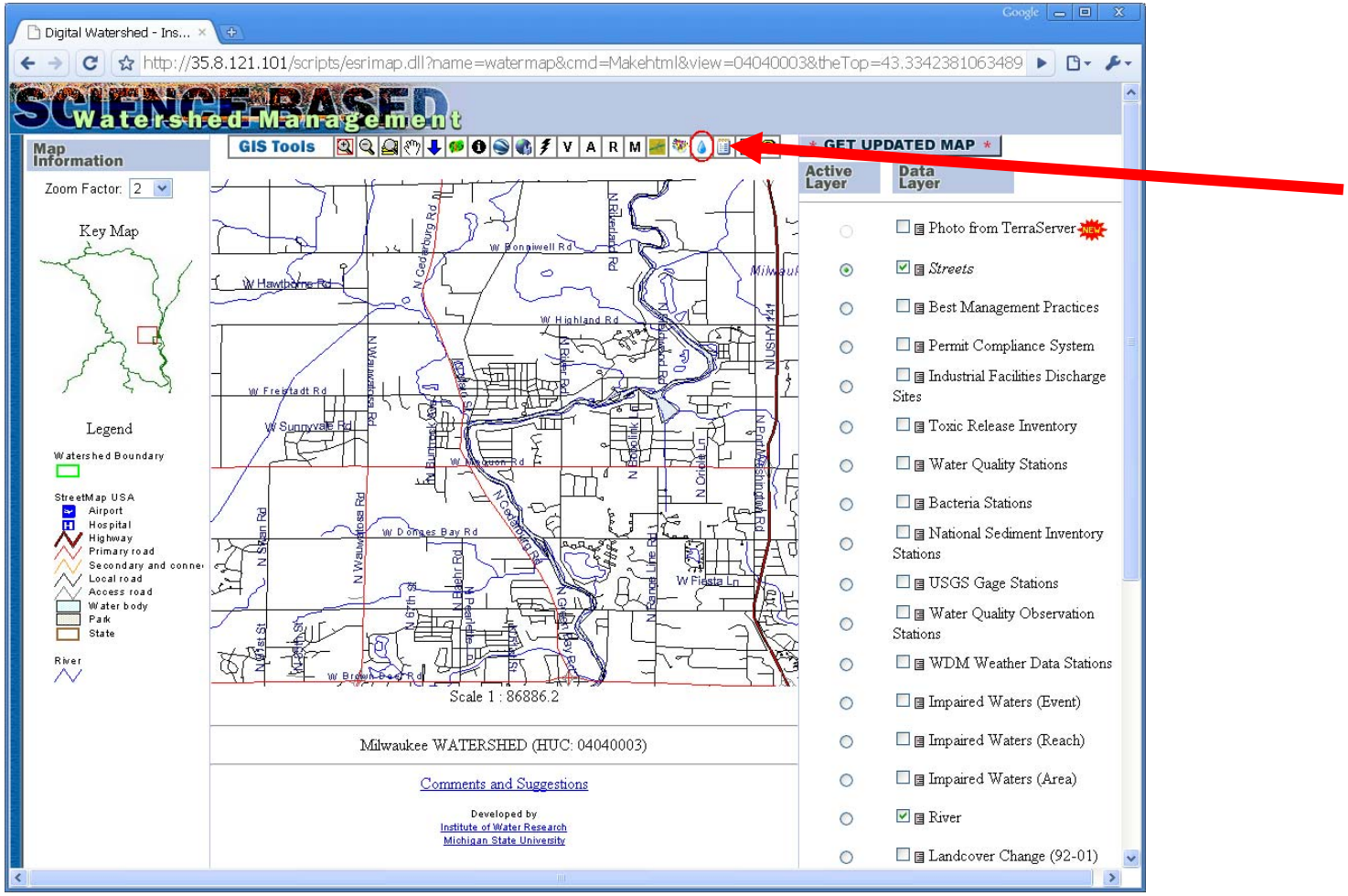
Appendix 1, Figure 1. Water Quality Data Access Function for Milwaukee River Watershed (Wisconsin).



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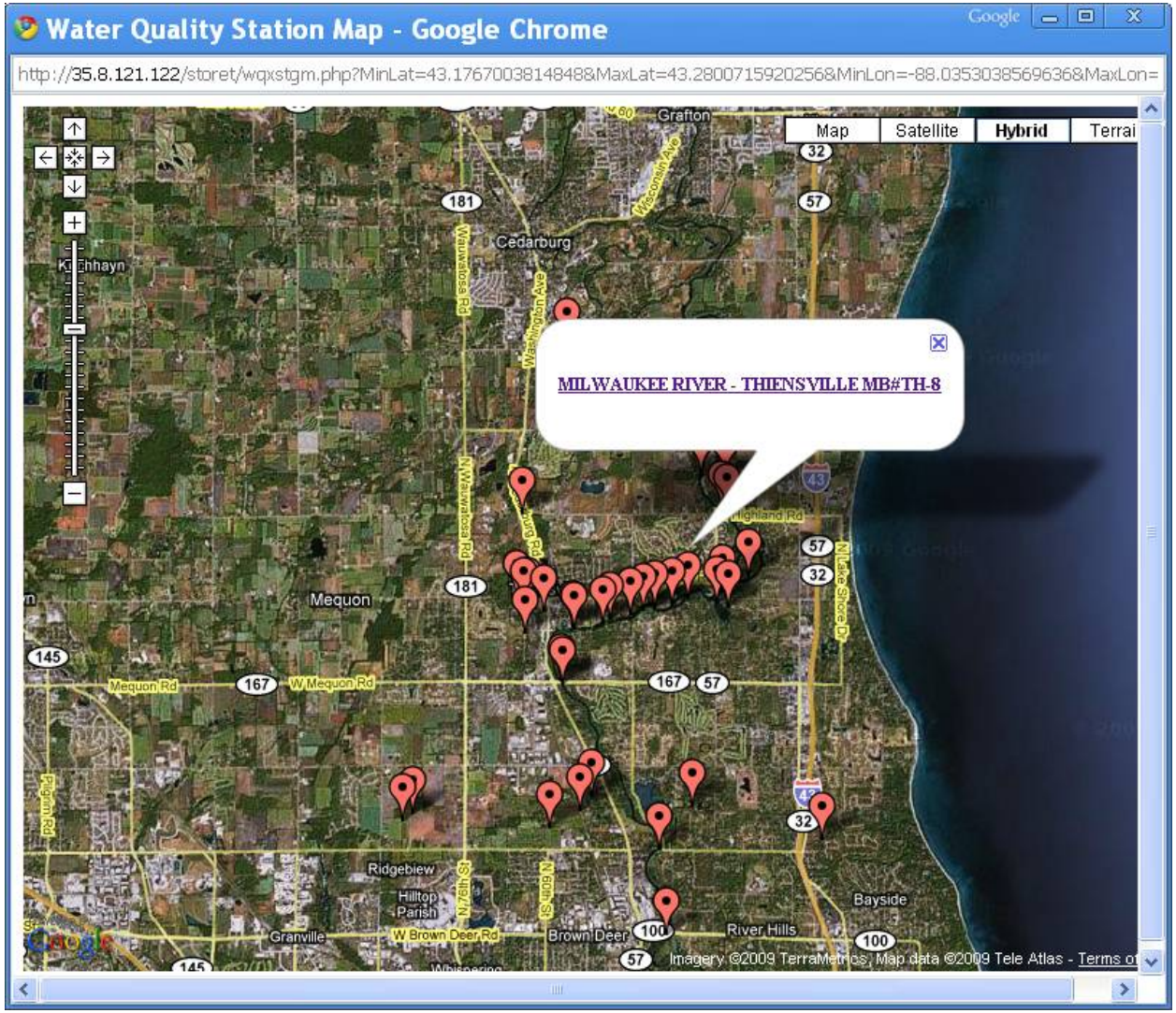
Appendix 1, Figure 2. Water Quality Stations for Milwaukee River Watershed (Wisconsin) Displayed on Google Maps Interface.



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Appendix 1, Figure 3. Listing of Water Quality Parameters for Example STORET Station from Milwaukee River Watershed (Wisconsin).

http://35.8.121.122/st...

http://35.8.121.122/storet/wqxwqr.php?Org=WIDNR_WQX&MonLoc=463109

EPA STORET Water Quality Data Results :

Organization ID :: WIDNR_WQX
Organization Name :: Wisconsin Department of Natural Resources
Monitoring Location Name :: MILWAUKEE RIVER - THIENSVILLE MB#TH-8

Characteristic	Result Value	Units	Sample Date	Value Type	Depth	Depth Units
Carbon	19400000	ug/kg	1993-10-26	Actual		
Carbon	28000000	ug/kg	1993-10-26	Actual		
2,4,4',5-Tetrachlorobiphenyl	1.9	ug/kg	1993-10-26	Actual		
2,2',3,5'-Tetrachlorobiphenyl	3.4	ug/kg	1993-10-26	Actual		
2,2',4,5'-Tetrachlorobiphenyl	3.9	ug/kg	1993-10-26	Actual		
2,2',3,3',6,6'-Hexachlorobiphenyl	1.5	ug/kg	1993-10-26	Actual		
PCB-195/208	7.3	ug/kg	1993-10-26	Actual		
2,3'-Dichlorobiphenyl		ug/kg	1993-10-26	Actual		
2,3',4,4',5,5'-Hexachlorobiphenyl		ug/kg	1993-10-26	Actual		
PCB-56/60	3.1	ug/kg	1993-10-26	Actual		
PCB-171/202	3.2	ug/kg	1993-10-26	Actual		
PCB-196/203	13	ug/kg	1993-10-26	Actual		
PCB-138/163	25	ug/kg	1993-10-26	Actual		
PCB-182/187	18	ug/kg	1993-10-26	Actual		
2,3',4'-Trichlorobiphenyl	1	ug/kg	1993-10-26	Actual		
2,2',3,4,5'-Pentachlorobiphenyl	4.2	ug/kg	1993-10-26	Actual		
Carbon	37200000	ug/kg	1993-10-26	Actual		
PCB-137/176	1.1	ug/kg	1993-10-26	Actual		
2,2',3,3',4-Pentachlorobiphenyl	1.1	ug/kg	1993-10-26	Actual		
2,2',3,4,4',5',6-Heptachlorobiphenyl	7.5	ug/kg	1993-10-26	Actual		
2,4-Dichlorobiphenyl		ug/kg	1993-10-26	Actual		
PCB-47/48	3.6	ug/kg	1993-10-26	Actual		
2,2',3,4',5,5'-Hexachlorobiphenyl	9.5	ug/kg	1993-10-26	Actual		
PCB-41/64/71	2.7	ug/kg	1993-10-26	Actual		
PCB-70/76	5.6	ug/kg	1993-10-26	Actual		
2,3',5-Trichlorobiphenyl	.62	ug/kg	1993-10-26	Actual		
2,2',3,4,5,5'-Hexachlorobiphenyl	5.9	ug/kg	1993-10-26	Actual		
2,2',5-Trichlorobiphenyl	1.3	ug/kg	1993-10-26	Actual		
PCB-172/197	3	ug/kg	1993-10-26	Actual		
2,2',3,6-Tetrachlorobiphenyl	.33	ug/kg	1993-10-26	Actual		
2,2',5,5'-Tetrachlorobiphenyl	5.1	ug/kg	1993-10-26	Actual		
2,3,4'-Trichlorobiphenyl	1.3	ug/kg	1993-10-26	Actual		
PCB-5/8	2	ug/kg	1993-10-26	Actual		
PCB-77/110	12	ug/kg	1993-10-26	Actual		

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Appendix 2, Figure 1. Example of EPA STORET Water Quality Data Summary from Maple Watershed (Michigan).

- ☐ Total number of organizations collecting water quality data: 1
- ☐ Total number of water quality stations: 15
- ☐ Total number of water quality characteristics: 28
- ☐ Total number of water quality data results: 937
- ☐ Summary Table of Water Quality Characteristic Data Collected by Michigan Department of Environmental Quality from 15 Station(s):

Characteristic Type	Characteristic	Result Count	Start Date	Stop Date
Metal	Calcium	4	04/16/2002	04/16/2002
Metal	Magnesium	4	04/16/2002	04/16/2002
Metal	Mercury	1	11/06/2001	11/06/2001
Metal	Potassium	4	04/16/2002	04/16/2002
Metal	Sodium	4	04/16/2002	04/16/2002
Nutrient	Nitrogen, Ammonia + Organic	24	04/16/2002	08/15/2002
Nutrient	Nitrogen, Kjeldahl	26	06/18/2002	11/09/2005
Nutrient	Nitrogen, Nitrite (NO2) + Nitrate (NO3) as N	50	04/16/2002	11/09/2005
Nutrient	Nitrogen, Nitrite (NO2) as NO2	26	06/18/2002	11/09/2005
Nutrient	Nitrogen, ammonia (NH3) as NH3	50	04/16/2002	11/09/2005
Nutrient	Nitrogen, mixed forms (NH3)+(NH4)+organic+(NO2)+(NO3)	42	04/16/2002	08/15/2002
Nutrient	Nitrogen, organic	24	04/16/2002	08/15/2002
Nutrient	Phosphorus	50	04/16/2002	11/09/2005
Nutrient	Phosphorus, orthophosphate as P	26	06/18/2002	11/09/2005
Other	Chloride	4	04/16/2002	04/16/2002
Other	Chlorophyll a (probe)	13	04/16/2002	08/18/2004
Other	Nitrogen, ammonia as N	24	04/16/2002	08/15/2002

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Other	Sulfur, sulfate (SO4) as SO4	4	04/16/2002	04/16/2002
Physical	Acid Neutralizing Capacity (ANC)	4	04/16/2002	04/16/2002
Physical	Depth	127	04/16/2002	08/15/2002
Physical	Depth, Secchi disk depth	8	04/16/2002	08/15/2002
Physical	Dissolved oxygen (DO)	96	11/06/2001	08/15/2002
Physical	Hardness, carbonate	4	04/16/2002	04/16/2002
Physical	Hardness, non-carbonate	4	04/16/2002	04/16/2002
Physical	Solids, Total Suspended (TSS)	26	06/18/2002	11/09/2005
Physical	Specific conductance	96	11/06/2001	08/15/2002
Physical	Temperature, water	96	11/06/2001	08/15/2002
Physical	pH	96	11/06/2001	08/15/2002

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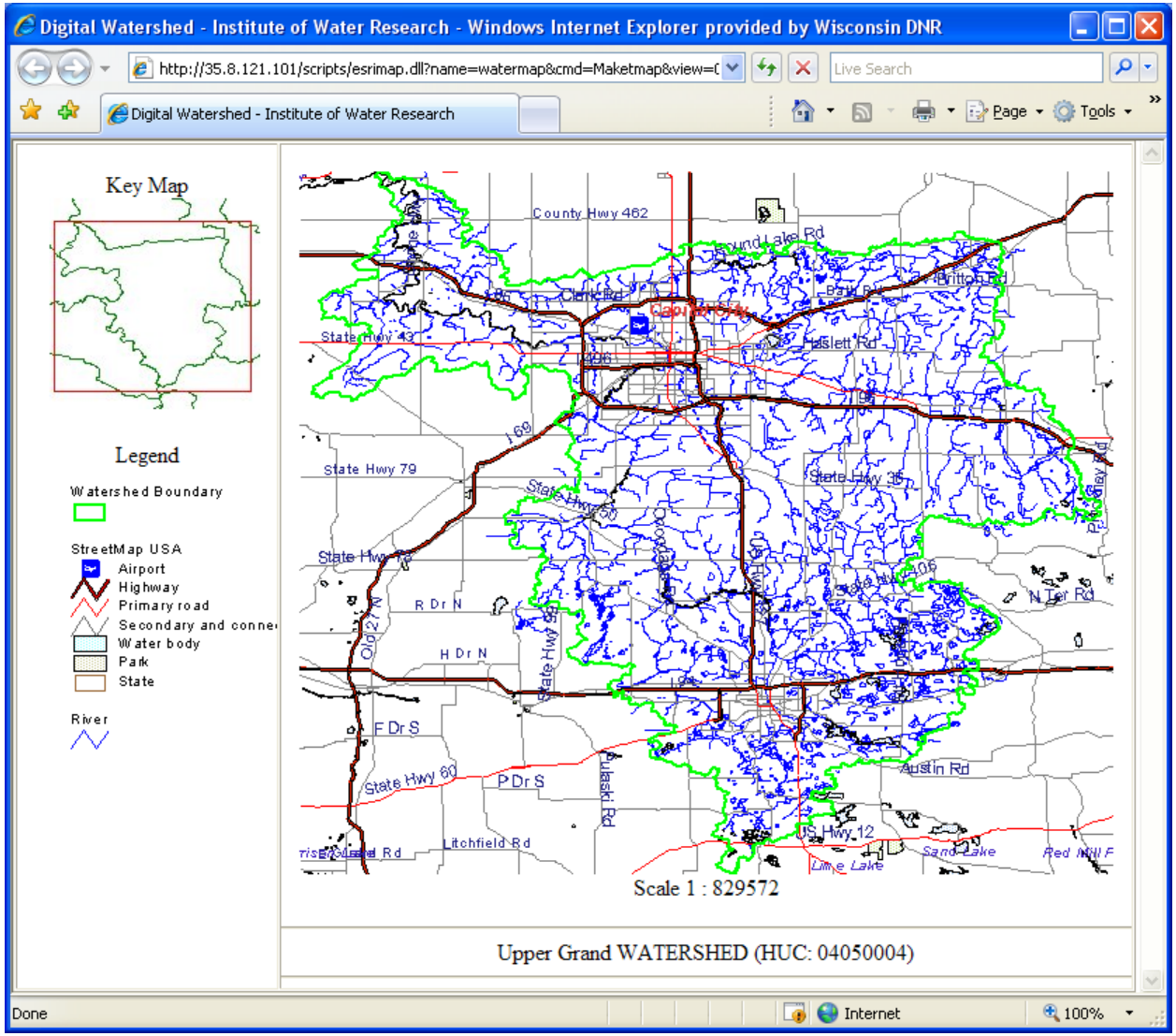
Appendix 3, Figure 1. Example of Output from Thematic Mapping Function (Grand River Watershed, Michigan).



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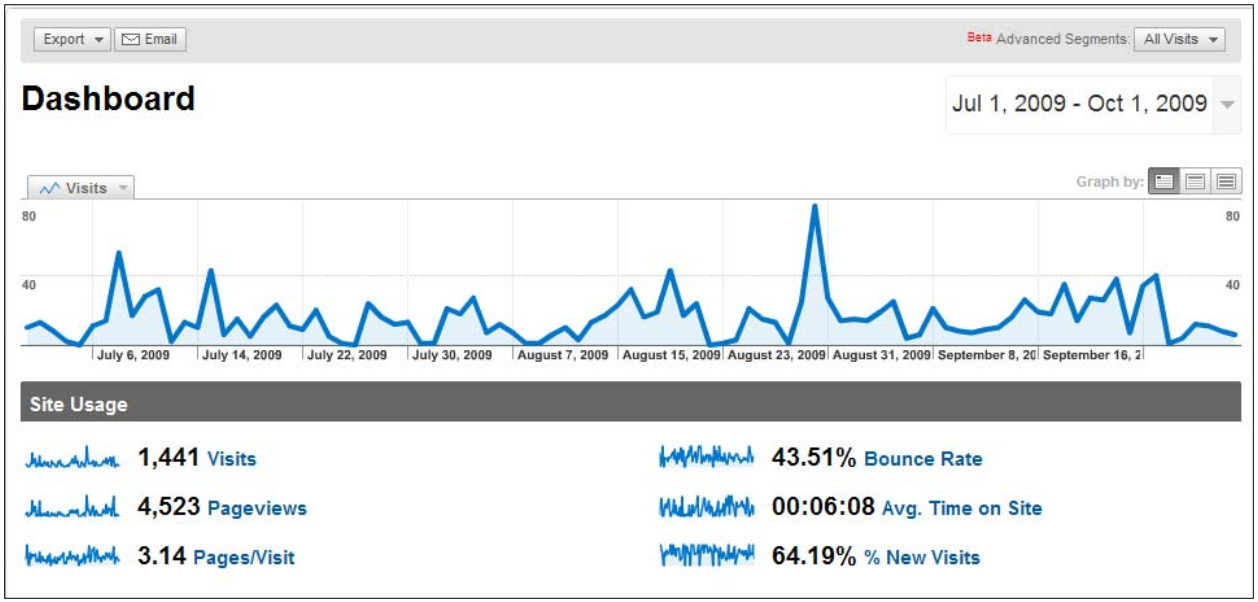
Appendix 4, Table 1. The Distribution of New Delineation, Connection, and Edit Capabilities within the L-THIA Tool (Tasks 7.1 and 8.1).

State	Item Number						
	Item 7.1 Delineate by address	Item 7.1 Delineate by XY	Item 7.1 Delineate by Huc 12	Item 7.1 Connect with DW	Item 8.1 Impervious surface from NLCD 2001	Item 8.1 Local Edit Impervious surface	Item 8.1 Delineate by Huc 12
Indiana	yes	yes	yes	yes	yes	yes	yes
Wisconsin	yes	yes	yes	yes	yes	yes	yes
Michigan	yes	yes	yes	yes	yes	yes	yes
Minnesota	yes	yes	no	yes	yes	yes	yes
Illinois	yes	yes	no	yes	yes	yes	yes
Ohio	yes	yes	no	yes	yes	yes	yes

Appendix 4, Figure 1. Google Analytics Results for L-THIA Web Pages. From July to October 2009, the US EPA Region 5 L-THIA tools had 1,441 site visitors with about 5,000 page views. Several hundred visitors made return visits, and spent an average 6 minutes on the site. About 90% of the traffic was from US EPA Region 5 cities and 5% from the East Coast of the US, including New York and Washington D.C.



C. Applications (with emphasis on Spatial Decision Support System)

C.1 High Impact Targeting - HIT

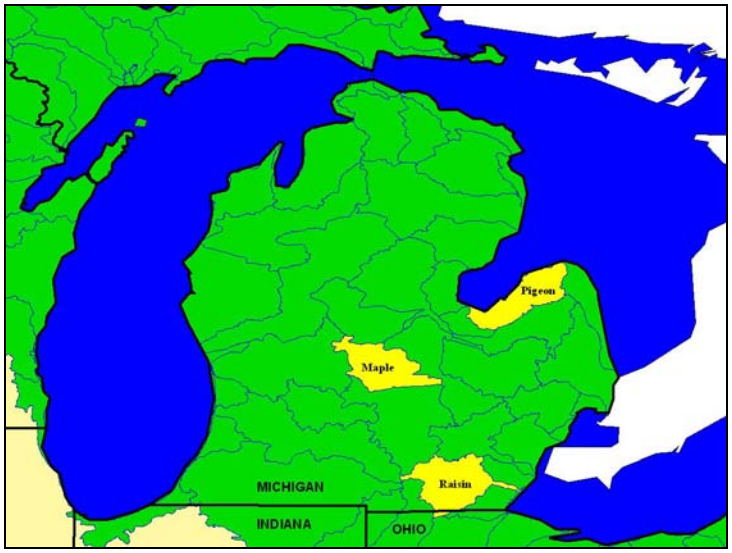


Figure 1: Project pilot watersheds.

The following is an excerpt of a final report summarizing a recent project related to sediment modeling and watershed management.

This is the final report submitted by the Institute of Water Research (IWR) to describe work to date on the Michigan Department of Agriculture's (MDA) Natural Resource Conservation Service (NRCS) funded Conservation Innovation Grant (CIG), *Impact Targeting: applying conservation tools to the worst areas for maximum sediment/nutrient reductions*. The primary project objective was to reduce agricultural sediment/nutrient loadings to the river networks of the Maple, Raisin, and Saginaw River watersheds. The Pigeon-Wiscoggin River watershed was subsequently identified as the focus for the Saginaw-area analysis, as it is the primary watershed served by the Huron Conservation District (a central partner in the CIG). The Maple River is a Conservation Security Program (CSP) watershed and the River Raisin and Saginaw River are Conservation Reserve Enhancement Program (CREP) watersheds.

IWR's primary contribution was the development of GIS computer models to identify agricultural areas at high-risk for yielding sediment loadings, and construction of a Web-accessible High Impact Targeting (HIT) (www.iwr.msu.edu/hit) tool that displays erosion and sediment data in geographic and tabular formats.

Background

IWR has worked with various organizations and government agencies to protect water quality in the Great Lakes basin for over 30 years. In regards to erosion and sediment load reduction, IWR began a

Integrated Erosion and Sediment Delivery Model Flow Chart

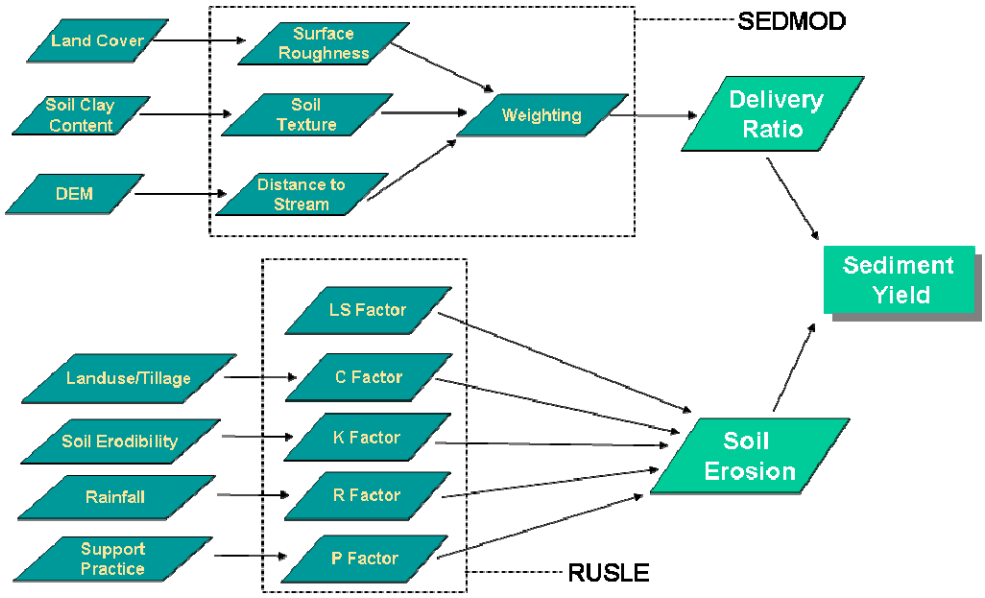


Figure 2: The HIT model.

partnership with the U.S. Army Corps of Engineers in 2001 to help reduce its dredging responsibilities in Great Lakes channels and harbors. IWR developed methods to evaluate sediment contributions to the tributaries of the Great Lakes and its harbors, and map the locations contributing the greatest amounts. The principle outcome of this effort was a sediment loading model that combined a soil-erosion model called RUSLE (Revised Universal Soil Loss Equation – Renard, et al. 1997), and a sediment delivery ratio model called SEDMOD (Spatially Explicit Delivery Model – Fraser, 1995) (Figure 2). IWR utilized these integrated models to estimate sediment loads for all of the 8-digit watersheds of the Great Lakes Basin (Ouyang, et al., 2005). This allowed the Corps to begin targeting sediment reduction efforts at the macro scale. However, to accommodate the broad geographic scope of the analysis, IWR had to generate these sediment models at very coarse resolutions (90-meter square rasters).

This CIG project attempted to extend this approach to more local levels, with finer-resolution data and an on-line information distribution system. Most importantly, the project included partners in local conservation districts who have access to government funding for conservation programs and whose trusted relationships with land owners encourage best-management practice (BMP) adoption. We call this approach HIT (High Impact Targeting), and piloted it in the CIG's three study watersheds.

Project Highlights

- High-resolution (10-meter) sediment models were developed to allow for field-level identification of areas at high-risk for erosion and sediment loading.

C.2 Swan Creek Urban and Rural Landscape Watershed Project

Introduction

The Institute of Water Research (IWR) at Michigan State University (MSU) and Purdue University have built the Swan Creek Watershed Management System (currently at http://www.iwr.msu.edu/swancreek), a decision support tool for the northwestern Ohio watershed. The system utilizes dynamic online modeling to allow users to evaluate the environmental impacts of different agricultural and urban BMP best management practices (BMPs) within the watershed. Examples of the system's functionality include cost-benefit analyses of conservation tillage's ability to reduce sediment run-off from farmland, and the impacts of urbanization on run-off volume and pollutant loading. The system's development was a collaborative process between the two universities, with Purdue leading the development of urban analysis components, and MSU leading the development of the agricultural analysis components. MSU and Purdue coordinated efforts amongst each other to facilitate a seamless system and the use of common data across models. The two universities also solicited and incorporated feedback from potential users in the Swan Creek region. Additional technology transfer will occur in the coming months.

Tasks and Deliverables

Tasks 1 (10%) and 2 (10%): ***Assessing user/data needs; project planning***

The team initiated contact with several key stakeholders in the Swan Creek region prior to beginning work on the GIS system in October 2007. Matt Horvat, the Maumee River watershed coordinator from the Toledo Metropolitan Area Council of Governments (TMACOG) and Marcus Ricci, an urban conservation specialist of the Lucas County Soil and Water Conservation District, provided early guidance regarding user/data needs. Both individuals are highly involved in conservation efforts within the Swan Creek watershed.

A formal stakeholder meeting was held at TMACOG in Toledo, OH in November 2007. Those attending included Matt Horvat, Marcus Ricci, Molly McGuire, an associate planner for the Toledo –Lucas County Plan Commissions, Lara Kurtz, a staff member of the division of Environmental Services, City of Toledo, Beatrice Miringu, also a staff member of the City of Toledo division of Environmental Services. Staff members present from Purdue University included Bernie Engel and James Hunter. Staff present from MSU included Glenn O'Neil, Jon Bartholic and Rosemary Fanelli. During this meeting, the team demonstrated for the stakeholders the primary tools to be included in the Swan Creek Watershed Management System. The group discussed the utility of these tools within the Swan Creek watershed, current activities in the watershed, and potential users of the system. The stakeholder feedback was recorded and consulted during the development of the system.

Task 3 (65%): *Modeling and system development*

Data Preparation

In January, MSU and Purdue began developing the data that would be needed for the models that would drive the Swan Creek Watershed Management system. To avoid errors that can be found in USGS 10-meter digital elevation models (DEMs) in flat areas (the dominant topography of the Swan Creek Watershed), MSU built sounder 10-meter DEMs from scratch. In addition MSU acquired and processed the necessary land cover (2001 National Land Cover Dataset) and soils data (USDA SSURGO). These datasets were shared with Purdue to ensure that the two universities' models utilized consistent data. From these datasets, derivative products were developed to feed into the different models.

In February, with the data in place, MSU and Purdue then focused on running the various models, and integrating the results into on-line decision support systems. Detailed descriptions of these models and systems follow.

Digital Watershed

Digital Watershed (www.iwr.msu.edu/dw) is an online mapping application that allows users to view and model environmental data for any 8-digit watershed in the contiguous U.S. It displays data layers from the EPA BASINS database, TerraServer, and NLCD (National Land Cover Dataset) in addition to data generated by MSU and its partners (Figure 1). Digital Watershed's suite of tools allow for a rich analysis of watershed features. Users can view watersheds in 3-dimensions, link to Google Earth or Microsoft Virtual Earth, analyze quantitative landscape characteristics through EPA's ATtILA (Analytic Tools Interface for Landscape Assessments) and REVA (Regional Vulnerability Assessment) programs, and conduct land cover change assessments through L-THIA (described in greater detail below). Digital Watershed's flexible design allows it to work interoperably with environmental analysis systems housed at other universities or organizations. Examples include REVA (housed at EPA ORD), L-THIA (housed at Purdue University), and also the Swan Creek BMP Evaluator (described below).

HIT (High Impact Targeting)

MSU generated erosion and sediment analyses through the High Impact Targeting (HIT) model. HIT relies on two underlying models to estimate, for a given area, the annual amount of sediment loading to nearby streams. First, an estimate of the percentage of eroded soil that ends up in nearby streams was obtained from the Spatially-Explicit Delivery Model (SEDMOD). Second, the actual annual volume (in tons/acre/year) of

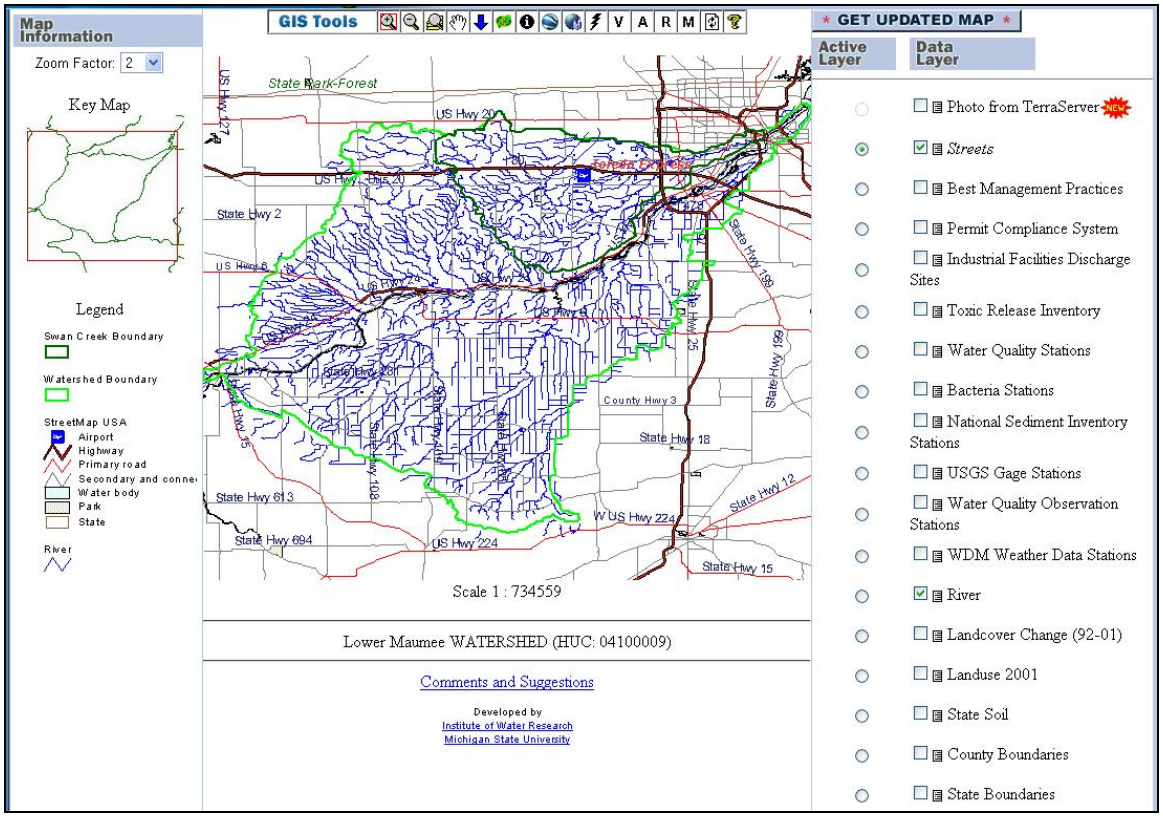


Figure 1: Digital Watershed's mapping window.

eroded soil was obtained from the Revised Universal Soil Loss Equation (RUSLE). These two models were then combined to estimate the annual volume of sediment transported to nearby streams. This value was calculated for every 10-by-10 meter area in the Swan Creek Watershed, yielding not only valuable information about sub-basins experiencing high amounts of sediment loading, but also identifying specific locations within a field where the sedimentation is starting. This will significantly aid efforts to target sediment loading through BMP placement. These results were then incorporated into the on-line HIT system (www.iwr.msu.edu/hit) where users can prioritize watersheds and sub-basins by sediment loading, conduct cost-benefit analyses for BMPs (Figures 2 and 3), and view high-risk areas spatially within Digital Watershed (Figure 4).

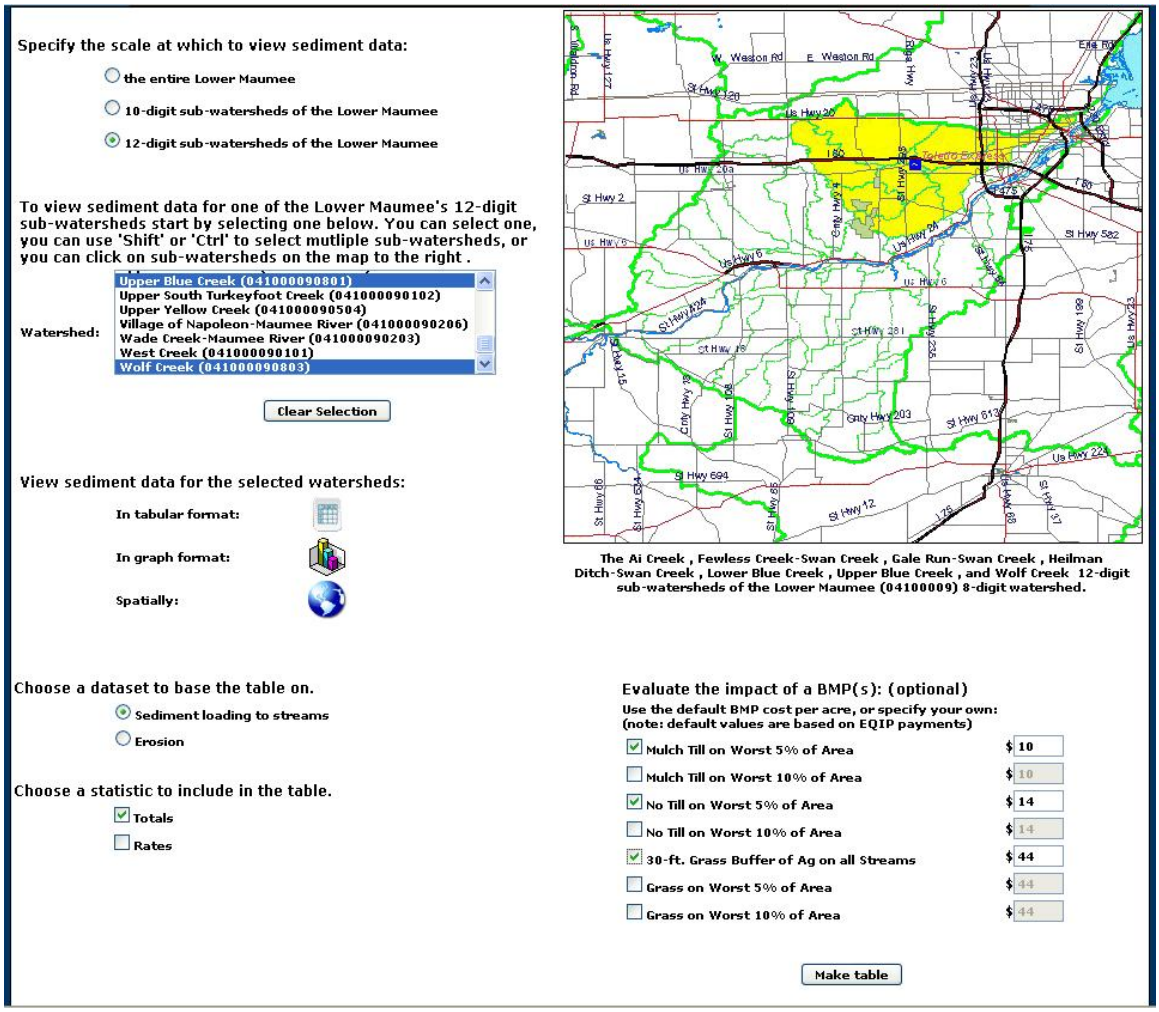
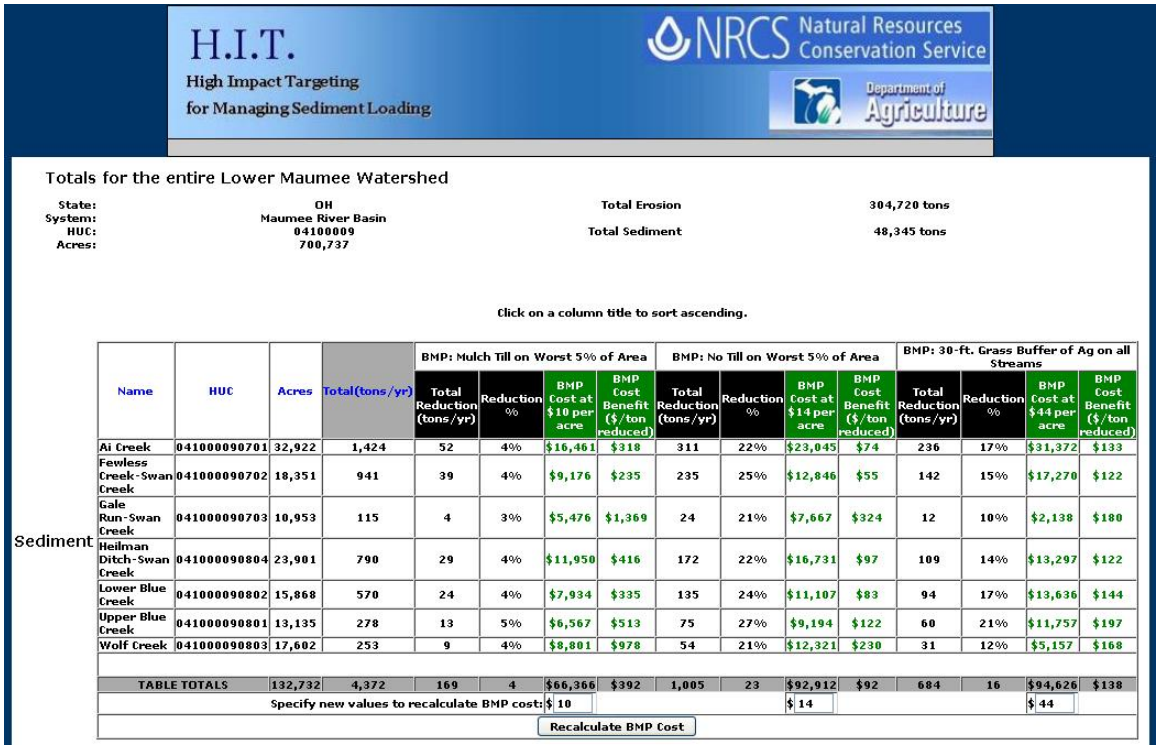


Figure 2: Swan Creek sub-watersheds in HIT



H.I.T.
High Impact Targeting
for Managing Sediment Loading

NRCS Natural Resources Conservation Service
Department of Agriculture

Totals for the entire Lower Maumee Watershed

State: OH
System: Maumee River Basin
HUC: 04100009
Acres: 700,737

Total Erosion 304,720 tons
Total Sediment 48,345 tons

Click on a column title to sort ascending.

	Name	HUC	Acres	Total(tons/yr)	BMP: Mulch Till on Worst 5% of Area				BMP: No Till on Worst 5% of Area				BMP: 30-ft. Grass Buffer of Ag on all Streams			
					Total Reduction (tons/yr)	Reduction %	BMP Cost at $10 per acre	BMP Cost Benefit ($/ton reduced)	Total Reduction (tons/yr)	Reduction %	BMP Cost at $14 per acre	BMP Cost Benefit ($/ton reduced)	Total Reduction (tons/yr)	Reduction %	BMP Cost at $44 per acre	BMP Cost Benefit ($/ton reduced)
Sediment	Ai Creek	041000090701	32,922	1,424	52	4%	$16,461	$318	311	22%	$23,045	$74	236	17%	$31,372	$133
	Fewless Creek-Swan Creek	041000090702	18,351	941	39	4%	$9,176	$235	235	25%	$12,846	$55	142	15%	$17,270	$122
	Gale Run-Swan Creek	041000090703	10,953	115	4	3%	$5,476	$1,369	24	21%	$7,667	$324	12	10%	$2,138	$180
	Heilman Ditch-Swan Creek	041000090804	23,901	790	29	4%	$11,950	$416	172	22%	$16,731	$97	109	14%	$13,297	$122
	Lower Blue Creek	041000090802	15,868	570	24	4%	$7,934	$335	135	24%	$11,107	$83	94	17%	$13,636	$144
	Upper Blue Creek	041000090801	13,135	278	13	5%	$6,567	$513	75	27%	$9,194	$122	60	21%	$11,757	$197
	Wolf Creek	041000090803	17,602	253	9	4%	$8,801	$978	54	21%	$12,321	$230	31	12%	$5,157	$168
	TABLE TOTALS		132,732	4,372	169	4	$66,366	$392	1,005	23	$92,912	$92	684	16	$94,626	$138
	Specify new values to recalculate BMP cost:						$ 10				$ 14				$ 44	

Recalculate BMP Cost

Figure 3: HIT cost-benefit analysis of agricultural BMPs.

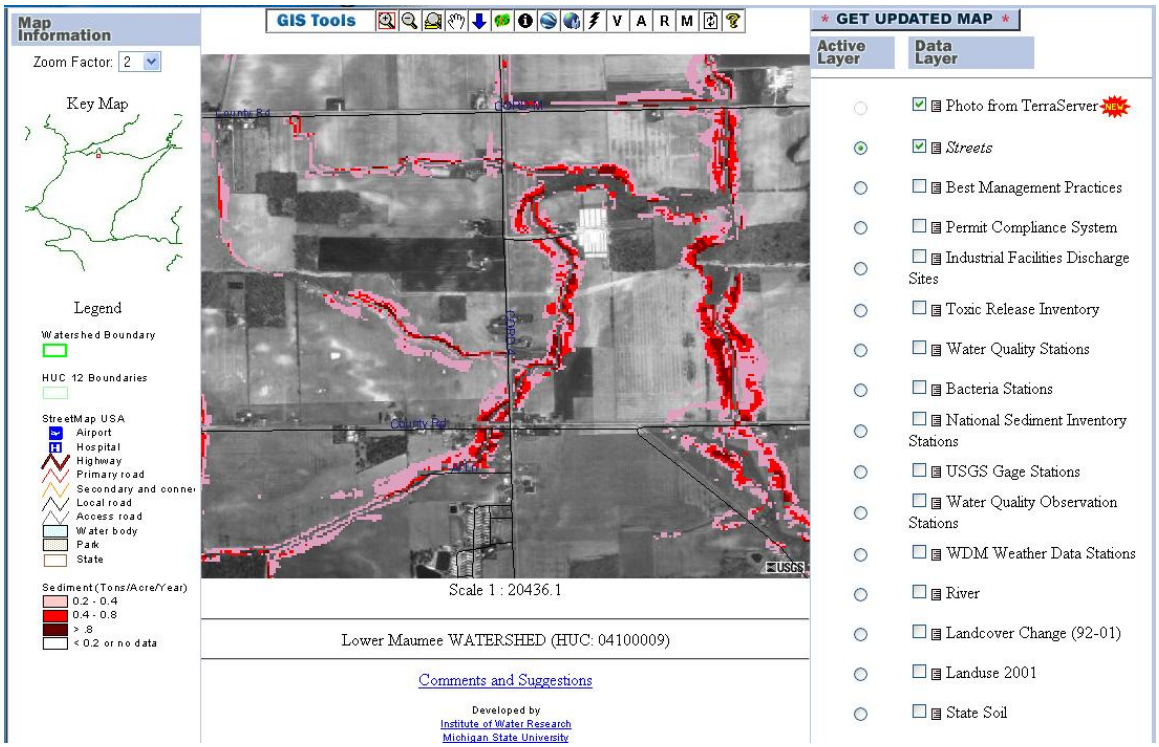


Figure 4: Field-level areas at high-risk for sediment loading, as displayed in Digital Watershed.

L-THIA

Purdue's L-THIA, Long-Term Hydrologic Impact Assessment (http://cobweb.ecn.purdue.edu/runoff/lthia/lthia_index.htm), an analysis tool designed to quantify the impact of land use change on the quantity and quality of their water. The tool takes land use and soil characteristics provided by the user along with thirty years of precipitation data to determine the average impact that a particular land use change or set of changes will have on both the annual runoff and the average amount of several non-point source pollutants. The L-THIA model employs the SCS curve number (CN) and event mean concentration (EMC) methods for simulation of surface runoff and nonpoint source (NPS) loading. L-THIA simulations are based on 30-year rainfall data, hydrologic soil groups, and land use data for an area (Figure 5). The CN, used for surface runoff estimation, is determined as a combination of land use and hydrologic soil group, and NPS pollutant loads are predicted by multiplying estimated runoff volume by the EMC value for each pollutant for each land use type.

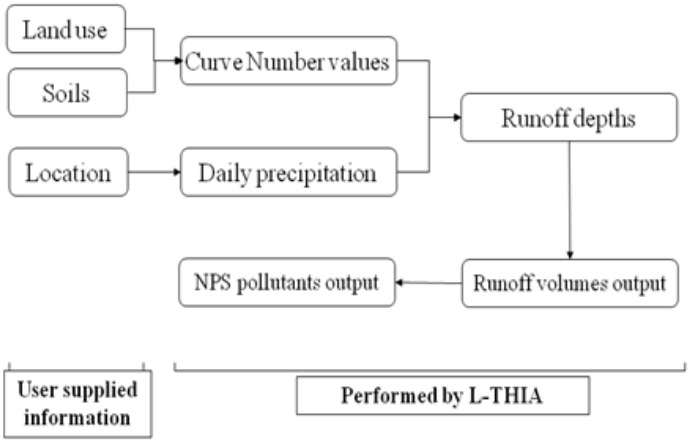


Figure 5: Data requirements and components for analysis in L-THIA

There are various input options for L-THIA, either through interface with the Web-GIS tools provided with the Swan Creek Watershed Management System or as a standalone spreadsheet tool for quick land use evaluations. Runoff quantity and water quality impact of current land use and proposed scenarios are displayed in tables, bar charts, and pie charts. Additional information about long-term impacts of land use change and L-THIA can be found in the Documentation section (click on the words in the navigation bar to the left) (see Figure 6). Along with background information about L-THIA, there is information on how to interpret results and how to minimize the impacts of land use change.

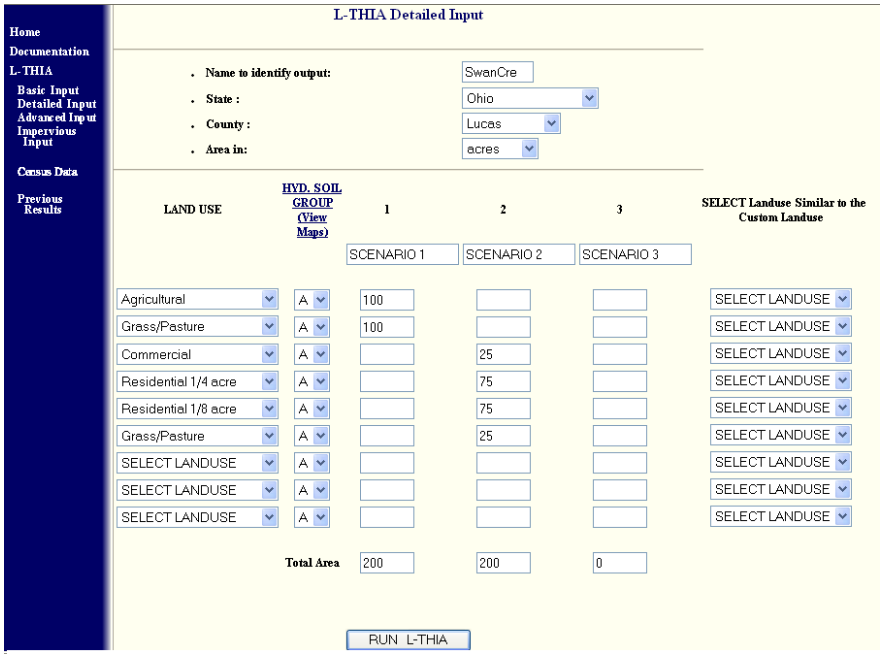


Figure 6: View of L-THIA's Detailed Input Screen

L-THIA LID

L-THIA/LID (Low Impact Development) is an easy to use screening tool intended to promote a better understanding of the quantifiable runoff and pollution reduction benefits of LID practices and assist with their adoption. The web-based L-THIA/LID tool, which builds on the capabilities of L-THIA, will enable the stakeholders of the Swan Creek Watershed to quickly and easily evaluate: (1) the impact of urban development on average annual runoff volume; and (2) the potential stormwater and pollutant reduction of proposed LID practices. Runoff quantity and water quality impact of proposed land use change are displayed in tables, bar charts, and pie charts.

The L-THIA/LID model concept is shown in Figure 7. The L-THIA/LID model consists of two screening levels for the LID approach. "Basic" screening (Figure 8) allows the users to adjust the percent of imperviousness for particular land uses at the watershed and site level to reflect the following "basic" LID concepts:

- Reduce impervious surfaces / percent area for developed land use
- Conserve infiltratable soils
- Conserve hydrologically functional/sensitive landscape
- Minimize land disturbances.

"Lot Level" screening (Figure 9) consists of a suite of LID practices such as bio-retention (rain gardens), porous pavement, disconnectivity of downspouts, narrowing impervious surfaces (streets, sidewalks and driveways), rain barrels, and vegetated rooftops. The user can customize CN at the "Lot Level" based on adjustments to landscape features to reflect LID practices at the microscale. Provided is a list of the LID practices that complement the L-THIA/LID "Lot Level" analysis:

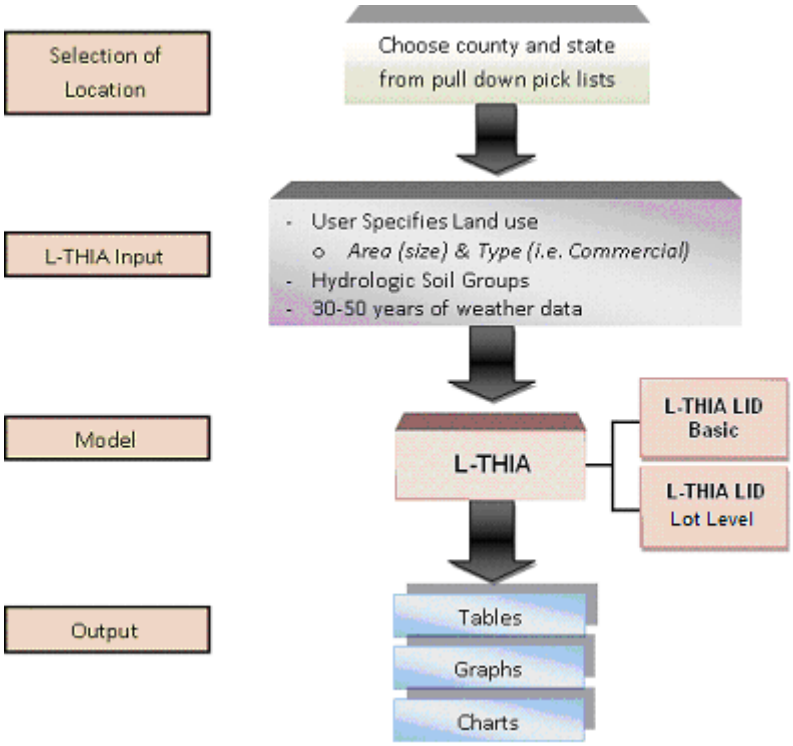


Figure 7: Conceptual diagram of L-THIA/LID model

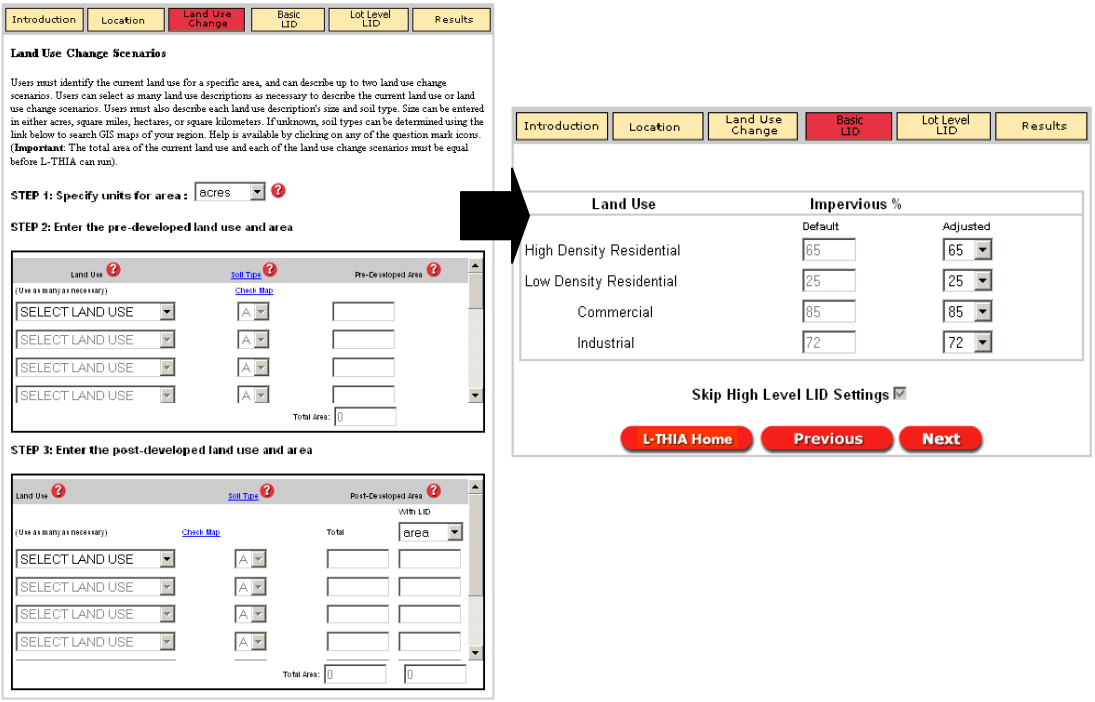


Figure 8: Input screens for L-THIA/LID "Basic"

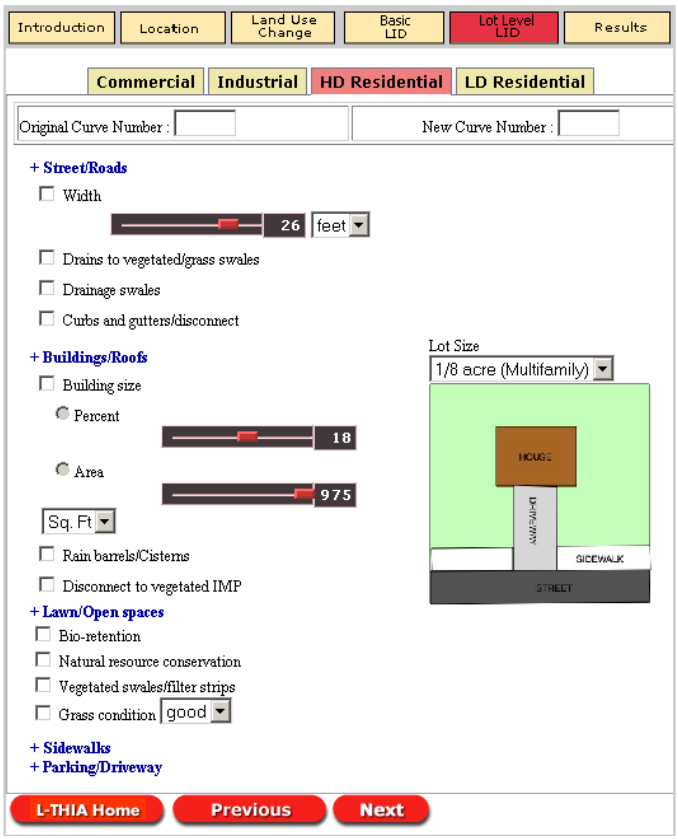


Figure 9: Input screen for L-THIA /LID "Lot Level" analysis of a high residential land-use.

Swan Creek BMP Evaluator

The Swan Creek BMP Evaluator integrates MSU's Digital Watershed system and Purdue University's Web-GIS based hydrologic modeling and spatial decision support system. The overall architecture of the Web-GIS SDSS is shown in Figure 10. There are three common components in the Web-based modeling system, the user interface, backend server databases and modeling programs, and the Web server situated in between handling Hypertext Transfer Protocol (HTTP) connection and Web Service calls.

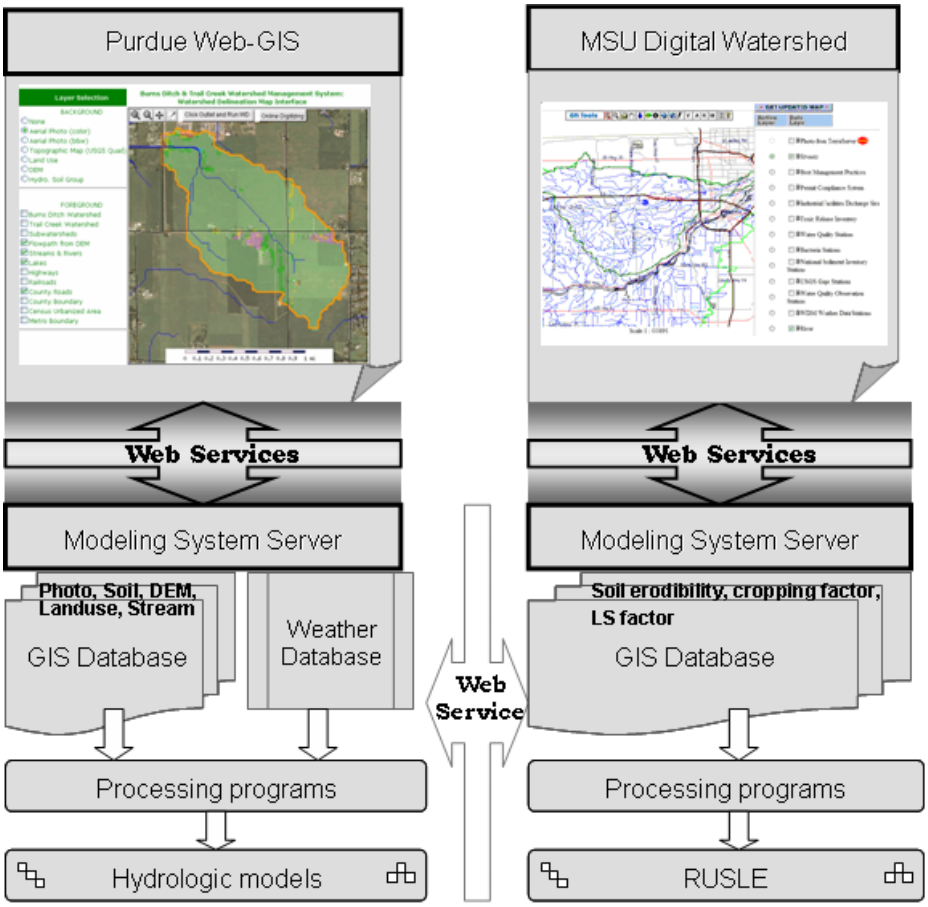


Figure 10: Swan Creek BMP Evaluator architecture.

The Purdue Web-GIS interface is built using the open source MapServer (http://mapserver.gis.umn.edu/) software with a Java applet front end. It handles watershed delineation based on a user-specified outlet point and user digitization of areas within a delineated watershed for land use change or erosion BMP implementation. Its hydrologic model, L-THIA, can provide before and after land use change hydrologic impact assessment for the delineated watershed.

The MSU Digital Watershed Web-GIS system is built using Internet Mapping software from ESRI. It provides a mapping interface for pertinent spatial environmental data, and stores the raster data layers necessary for erosion/sedimentation simulation within a study area.

Figure 11 illustrates how the two systems work together. Users start by identifying a drainage outlet point on a stream line, within either Digital Watershed or Purdue's Web-GIS. Purdue then delineates a watershed boundary upland of the selected outlet point, and then allows users to define BMP areas within the resulting watershed. These digitized BMP boundaries are sent to MSU Digital Watershed, which uses them to clip the required raster data layers for erosion/sedimentation calculations. BMP specific

RUSLE factors are then incorporated into these data layers for the user-defined areas. Next, the RUSLE model is run for the watershed to calculate total erosion, which is then modified by a sediment delivery ratio to arrive at long-term average annual sediment yield for the watershed. Erosion and sedimentation are then calculated once more, with the effects of the user-delineated taken into account. Finally, the results are displayed back in the user's Web browser. The interoperability of the MSU and Purdue systems allows for data passing and processing operations to be carried out behind the scenes without the need of explicit user input. This ensures seamless integration of the two Web-GIS systems.

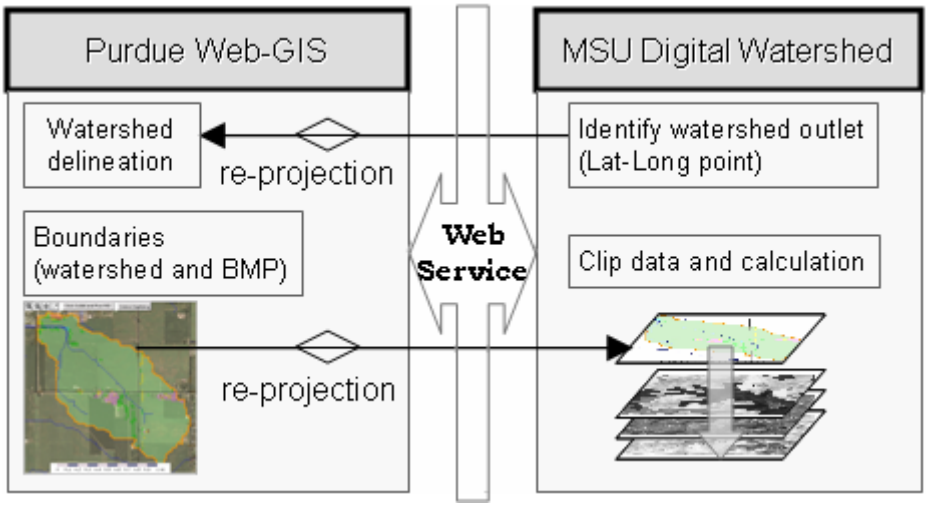


Figure 11: Interoperability

The Swan Creek BMP evaluator is directly accessible online at http://cobweb.ecn.purdue.edu/~eqip/swancreekoh.

The Front-end

With the various models completed and integrated into their respective on-line systems, MSU began building a web-interface to link the various tools together into a seamless, user-friendly decision support system (Figure 12). The site's layout was designed to accommodate both novice and sophisticated users of the tools, but also to steer users to the tools most relevant for them. For example, if an experienced user comes to the system's front page knowing that she wanted to use HIT, she could simply select the 'Pick a Tool' (Figure 13) option and begin her analysis promptly. However, if a user is interested in a particular scale of Swan Creek, but is unfamiliar with the abilities of the various tools, she could select the 'Specify a Scale' (Figure 14) option and answer a series of questions until she is shown which tools could best address her problem. These design choices were informed by inputs from prospective system users, such as Matt Horvat and Marcus Ricci. To foster a sense of seamlessness in the system, pieces of the HIT and L-THIA websites were re-coded so users could quickly access the data and tools for the Swan Creek Watershed specifically. Instead of having to negotiate HIT's and L-

THIA's menus from their respective main pages, users are sent directly into the systems with the Swan Creek region already delineated and ready for analysis (Figures 2 and 15).

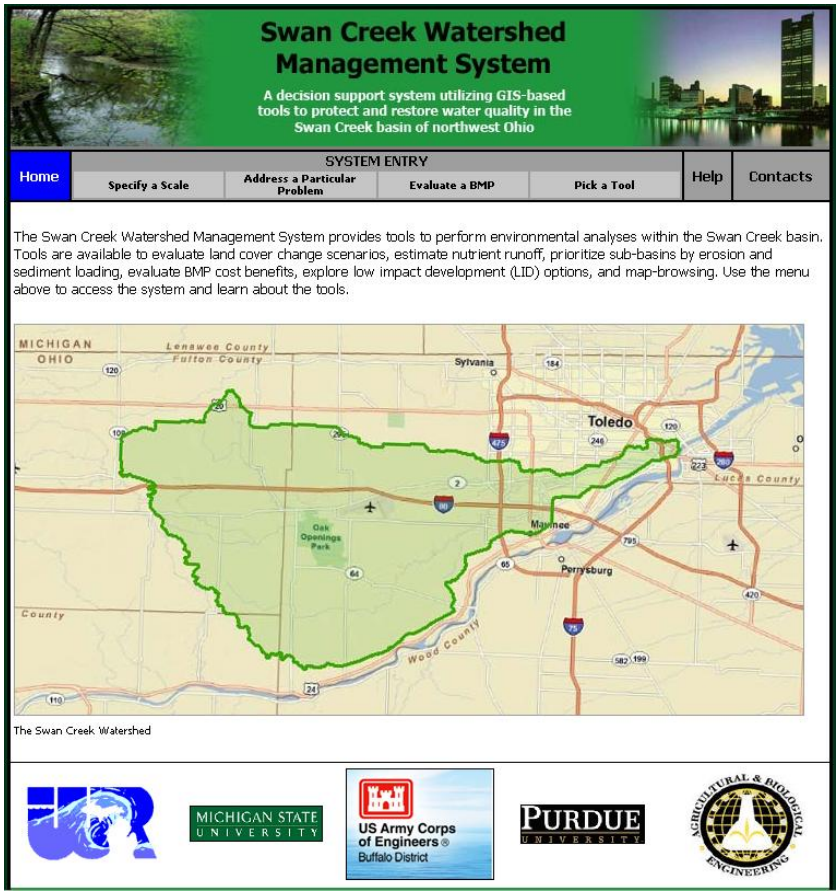


Figure 12: Front page of the Swan Creek Watershed Management System.

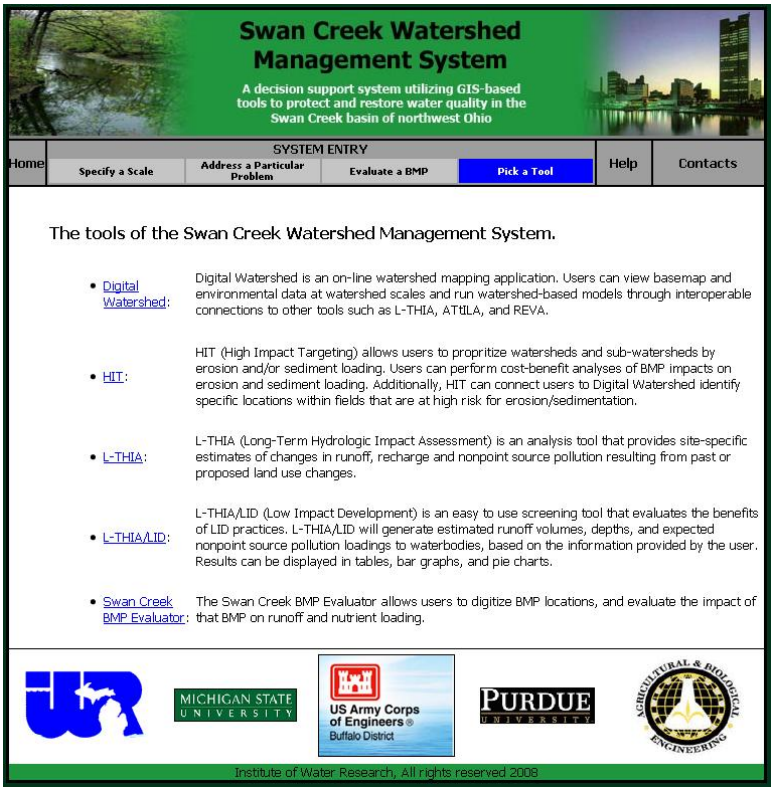


Figure 13: Accessing tools directly.

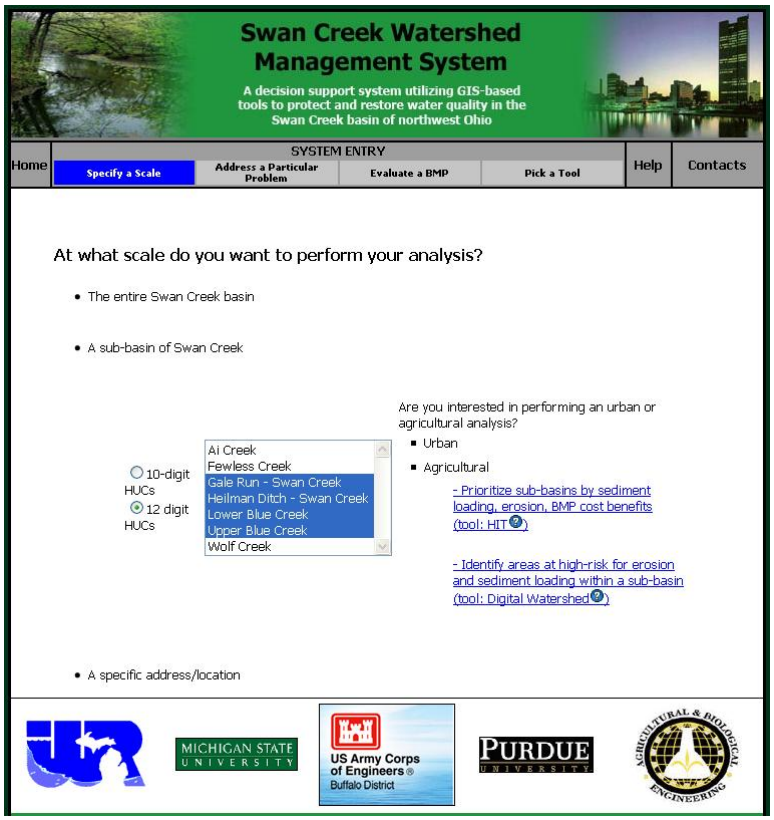


Figure 14: Accessing tools by scale.

Watershed Summary and Tools

[*NOTE: All links open in new window. Please turn off your Web browser's popup blocker to use the modeling tools in the toolbox.]

Total watershed Area:		131365.9 (acres)
Land use	**Soil group**	**Area(acres)**
Water	A	86.9
Water	B	39.5
Water	C	9.6
Water	D	465.5
Commercial	A	176.8
Commercial	B	399.6
Commercial	C	674.3
Commercial	D	2425.7
Agriculture	A	8597.3
Agriculture	B	8214.4
Agriculture	C	8328.3
Agriculture	D	42268.1
HD-Residential	A	872.1
HD-Residential	B	1327.3
HD-Residential	C	1674.4
HD-Residential	D	5627.8
LD-Residential	A	2547.3
LD-Residential	B	2237
LD-Residential	C	1360.2
LD-Residential	D	7433.9
Grass/Pasture	A	2726.1
Grass/Pasture	B	1676.8
Grass/Pasture	C	375.9
Grass/Pasture	D	3916.4
Forest	A	8970
Forest	B	3190.4
Forest	C	546.8
Forest	D	11982.4
Industrial	A	24.4
Industrial	B	19.2
Industrial	C	6.4
Industrial	D	142.2
Total Area		131365.9

Modeling Toolbox	
View watershed/Apply BMPs	Use this tool to view the watershed, change land use, add agricultural best management practices (BMPs) to farm fields, and apply structural BMPs in the watershed.
Estimate sediment	Use this tool to estimate long-term average annual sediment yield (tons/year) from the watershed using the Revised Universal Soil Loss Equation (RUSLE) and the sediment delivery ratio approach.
Estimate Imperviousness	Use this tool to estimate percent imperviousness in the watershed.
Estimate Peak Runoff	Use this tool to estimate the peak rate of runoff, depth of runoff (computed using the SCS CN method), computed time of concentration (using the Kirpich formula), and the corresponding rainfall depth for the watershed.
Run L-THIA Model	The Long-Term Hydrologic Impact Assessment Model estimates average annual runoff and nonpoint source pollutant levels in the watershed.
Run SEDSPEC Model	The Sediment and Erosion Control Planning, Design and SPECification Information and Guidance tool allows user to design a channel, culvert, sediment basin, level terraces, runoff diversion, or low water crossing for the watershed.

Download data for the delineated watershed Metadata

- Watershed data (boundary, landuse raster etc) from this site (Purdue ABE)

Figure 15: Quick access to L-THIA's functionality within the Swan Creek Watershed.

MSU will continue to refine and enhance the Swan Creek Watershed Management System's interface as it receives additional user input.

Task 4 (10%): Verifying system utility

In an effort to evaluate the accuracy of some of the Swan Creek Watershed Management System tools, and in support of other on-going projects, MSU conducted a thorough field-evaluation of the HIT tool. Technicians from three Michigan county conservation districts visited 120 locations within three watersheds and assessed how accurately HIT identified areas at high-risk for sediment loading. Half of the sites were locations flagged "at-risk" by HIT and half were flagged "not at-risk" but could potentially be at-risk because they were farmed lands adjacent to streams. The reason for this segregation was to evaluate not only whether HIT's high-risk areas were accurate, but also whether HIT missed locations where sedimentation was occurring. This analysis was conducted twice, once with 30-meter resolution HIT results and once with finer-resolution 10-meter results. The 30-meter results reported a 70% accuracy results, meaning 70% of the time HIT correctly categorized the landscape as either "at-risk" or "not at-risk." The results of the 10-meter evaluations are still coming in. Ten-meter resolution HIT predictions were also evaluated for select sites of the Lower Maumee Watershed in Ohio (the basin

containing Swan Creek). HIT's predictions were generally accurate in these locations as well (Figures 16 – 19).

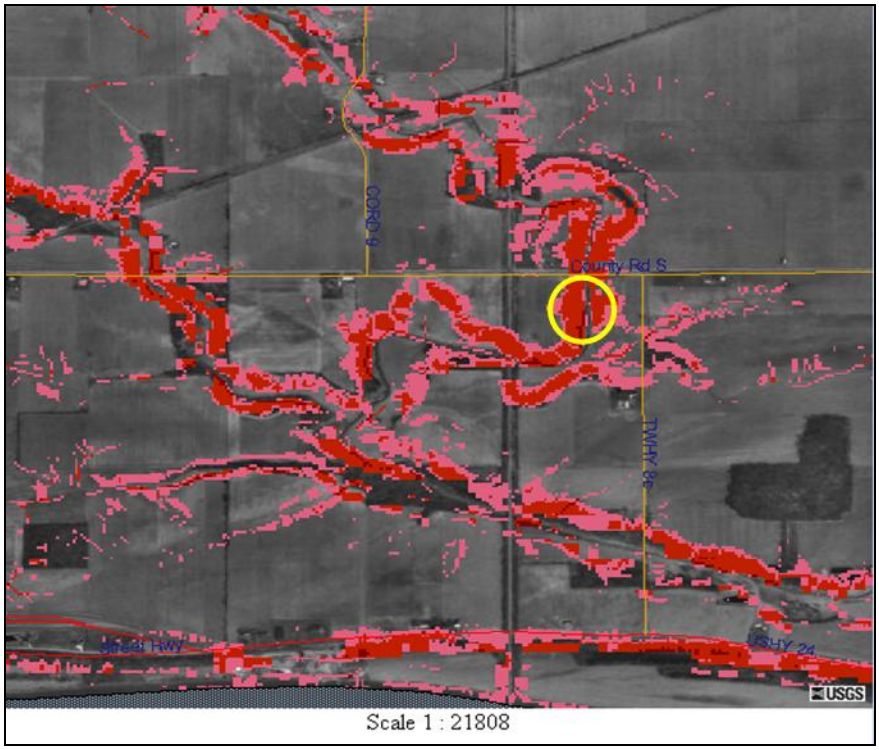


Figure 16: High-risk area evaluated in the Lower Maumee Watershed.

Figure 17: Evidence of gullies at location. Accurately labeled "at-risk" by HIT.

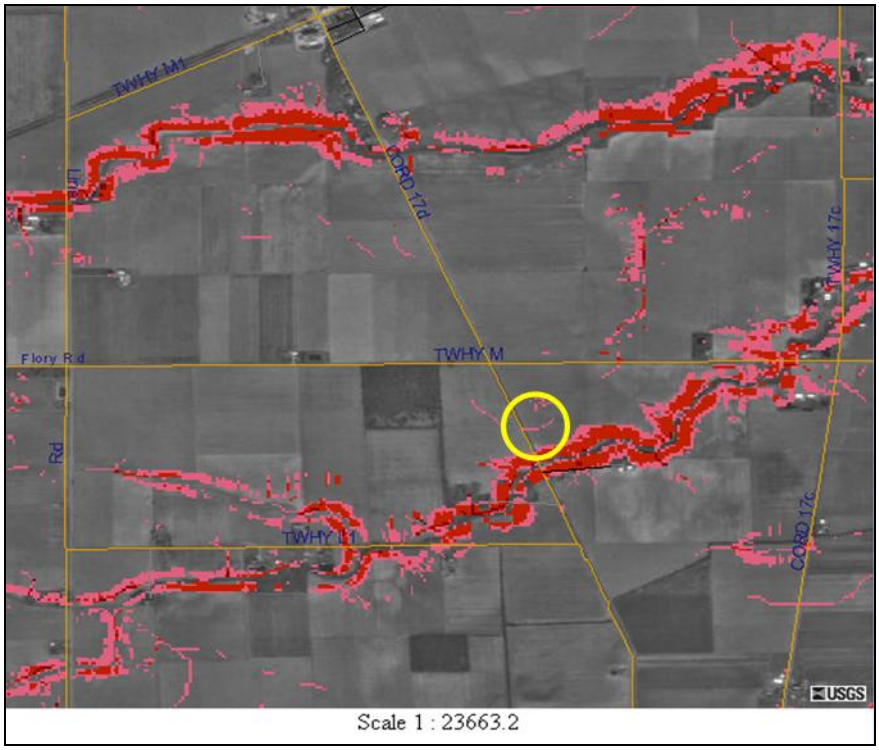


Figure 18: High-risk area evaluated in the Lower Maumee Watershed.

Figure 19: Evidence of gullies at location. Accurately labeled "at-risk" by HIT.

Task 5 (5%): Technology transfer to user community

On August 18th, 2007 the MSU and Purdue team traveled to the offices of the Toledo Metropolitan Area Council of Governments (TMACOG) to demonstrate the Swan Creek Watershed Management System to potential users. The team received positive feedback on the system's design, and was even able to help TMACOG use the system to address a current issue it is facing. TMACOG needs to evaluate the environmental impact that a proposed airport would have on a section of the Swan Creek Watershed. The group conducted a land-cover change impact analysis using Digital Watershed, L-THIA, and the Swan Creek BMP Evaluator (all linked seamlessly by the Swan Creek Watershed Management System) to quantify the negative environmental impacts the increased imperviousness would have on the area. The group made plans for additional presentations and training to a larger audience in the coming months.

Authors

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Dr. Bernie Engel and Dr. James Hunter, Purdue University

C. 3 Watershed Comprehensive Assessment Tool - WCAT

Introduction: The final report for the Watershed Comprehensive Assessment Tool will address each project task as described in the WCAT proposal. For each project task, there is a detailed explanation of the work performed to complete the task. This explanation will not only serve to demonstrate that our organization has completed and met all requirements as set forth within the WCAT proposal, but will further elaborate on future improvements to the WCAT system. The WCAT website is available at the following web address: http://35.9.116.206/IWR/WCAT/index.asp.

Project Tasks Completed

Identify and Contact Project Advisory Group Members.

To meet this project task we set down as a team and discussed who should be a part of the WCAT advisory group. We wanted to get professionals with a wide variety of expertise as well as those that were familiar with watershed management. Member backgrounds include: Michigan Department of Environmental Quality, Michigan Department of Agriculture, Environmental Protection Agency, Environmental Consulting Groups, Local Watershed Planning Commissions, Michigan State University Faculty, and Ohio State University Faculty.

We contacted these individuals back in May, 2009 about their willingness to serve on the WCAT advisory group. After securing their commitments, we scheduled and held a WCAT introductory meeting on June 18th, 2009. Some members of the advisory group were not able to attend the meeting in person. However, we solved this problem by having a webinar and presentation concurrently. Those members that couldn't attend were able to see and hear what we presented via the Web and telephone. During this advisory group meeting, we demonstrated the concept of the WCAT system and provided a background of the tools/models utilized in the WCAT system. At the end of our WCAT Advisory Group meeting we held a question and answer session. We put together a list of questions for the advisory group that covered a variety of topics.

Topics/questions for discussion included: What is the best method or approach to introduce the WCAT system to watershed organizations, stakeholders, consultants, and watershed planners? Should the EPA recommend the WCAT system to watershed groups in their 319 watershed plan development and if so, what would the EPA need from our organization and WCAT system? How can your (advisory group member's) organization help us to improve the WCAT system? More specifically, based on your individual experience and background with watershed planning, what do you think the WCAT system is lacking or needs improvement on? With regard to the WCAT system content, do you have any suggestions for possible additions to the system, such as tools, models, or GIS? Lastly, did any of the tasks require more technical skill than could be expected of a watershed organization? If so, which tasks did you feel needed more explanation or improvement? These topics and the discussion that took place at the WCAT introductory advisory group meeting provided us with many great ideas for improvement to the system. These advisory group comments will be discussed in more detail under **Section 3.1** of the Recommendations From Advisory Group section of this report.

In addition to these comments, we put together a survey to hand out to the advisory group after the meeting. This survey is attached to the end of this report. The purpose of this survey was to get feedback on the WCAT system in more detail. The format of this survey consisted of specific questions about the tools and webpage content of the WCAT system. The results of this survey will be discussed in more detail under **Section 3.2** of the Recommendations From Advisory Group section of this report.

2.1.1 Identify Prospective System Users and Advisory Group Members.

Over the course of the WCAT project there has been much discussion within our project team as to who the prospective users of the WCAT should be. It was through this discussion that we determined that the ideal WCAT user should be a watershed planner. A watershed planner will have previous experience working with GIS data and will be familiar with what is required in a watershed planning document. Also, as mentioned in the Section 2.1, we assembled and held our WCAT Advisory group meeting in June, 2009. During our advisory group meeting, there was discussion that pertained to the prospective users of the WCAT system. Many members of the WCAT Advisory group were concerned that a user not familiar with GIS data and Watershed Models/Tools would have a difficult time working through the WCAT system. Since the WCAT will be available online, anyone with internet access will be able to use this system. While the

WCAT system is intended for experienced watershed planners, it doesn't mean that other potentially less experienced users won't utilize the system. It is because of this fact that it really tends to complicate the design and direction of the WCAT system. The best approach we can take is to continue to develop the WCAT system with an experienced watershed planner/consultant user in mind while still being conscientious of the experience levels of other potential users.

2.1.2 Develop User Needs Assessment Framework.

We put together a WCAT user survey to get feedback on the WCAT system and to better understand the current level of user difficulty. More specifically, we wanted to receive feedback on how user friendly the WCAT system and its tools/models are. Our WCAT advisory group contains members with a variety of academic and professional backgrounds. Some members have a strong background in science and are quite familiar with GIS data and watershed management Models/Tools. Other members have more experience working with people involved in watershed planning and are quite familiar with what is required in a watershed planning process. We felt that this diverse group of people would be excellent candidates for the WCAT user needs survey.

This four part survey contains specific questions about the tools and the webpage content of the WCAT system. The first portion of the WCAT user needs survey contains questions about the WCAT user's background. These questions will help us to learn more about the user's academic and professional background, as well as their experience working with GIS data and watershed models/tools.

The second portion of the user needs survey contains questions based on the WCAT user's experience of working with the Steps portion of the WCAT. The Steps portion that is being referred to is what contains the tasks of the WCAT system. Each of the Steps in the WCAT system contains tasks for the user to complete. The Steps portion is the bulk of the WCAT webpage content. Questions in this portion of the survey will help us to learn about a WCAT user's level of difficulty when working through the tasks of each step.

The third portion of the user needs survey contains questions about the WCAT user's experience with the Digital Watershed Tool portion of the WCAT system. The Digital Watershed Tool is the main operating platform base of the WCAT. A user of the WCAT will work with the Digital Watershed Tool many times throughout the Steps portion of the WCAT system. Therefore, it's important that the Digital Watershed components be as user friendly as possible. Questions in this portion of the survey will help us to target user problem areas and further improve upon the components of the Digital Watershed Tool.

The fourth and last portion of the user needs survey contains questions about the WCAT user's experience with the Webpage design of the WCAT. It's important that we develop a WCAT webpage that is neat, modern, informative, and easy to navigate. Questions in this portion of the

survey will help us to improve upon the design of our WCAT website and to achieve these important aforementioned elements.

A complete copy of the WCAT user needs survey can be found in the **Appendix** of this report. Comments and feedback from this survey will be discussed in more detail under **Section 3.2** of the Recommendations From Advisory Group section of this report.

2.2 Conduct Personal Interviews and Focus Groups with Key Prospective System Users.

2.2.1 Develop Online Survey to Evaluate effectiveness of the Web-accessible Watershed CAT.

Early on in the WCAT project, a survey and a website for distributing this survey, was developed. We had planned on distributing the survey to folks across the region who are involved in watershed management. However, we were informed by our EPA contact that we couldn't conduct surveys for an EPA-funded project. We discovered that there are certain regulations for conducting surveys for EPA research. We were told that we could contact people and invite them to participate in the development of the tool in a generic sense, but could not send them specific questions to answer. More specifically, we were informed that we cannot send out a request for information to 10 or more people that asks a series of identical questions if it appears that the EPA is the chief party interested in the results, even if it just mentions the EPA, just incorporates a logo, or involves separate funding. It is because of these regulations that we were unable to use the survey that we developed.

In an attempt to make up for this loss of input, we created the WCAT advisory group and held an "in house" meeting to establish feedback on the WCAT system. This allowed us to ask the appropriate questions, to build a foundation for feedback, and more importantly, to create ongoing support of the WCAT project. As we continue to develop the WCAT system we will turn to our advisory group for input and advice. Having this capability ensures that our project will keep moving forward and continue to improve.

2.3 Develop User Interface.

This project task is, in itself, continually evolving. Our organization has put a lot of time and effort into completing this task. Within the last year, the majority of the WCAT website design has been completed. The following paragraphs and screen captures will help to explain the structure of the WCAT site and to describe the website content of the WCAT system.

WCAT Homepage: The first thing a WCAT user will see after typing in our web address is the WCAT homepage. (**See Figure 1.0 below**) The homepage consists of four blue headings that, when clicked upon with the mouse, expand out to display text. The four headings are labeled: What is the WCAT, Who Developed it and the Purpose for Development, What Watershed Tools are Available in WCAT, and How can the WCAT Help the Watershed Planning Process. A WCAT user can click on a heading to have the corresponding text expand out so that they can read it. Or there is an "expand all" button located on the right side of the webpage that a user can click on in order to expand all 4 headings. The "expand all" button is featured throughout the WCAT website.

Located in the top right hand corner of the WCAT homepage there are four hyperlinks labeled, Home, Contact Us, Site Map, and Project Log-In. It's important to note that these four hyperlinks are located on every single webpage of the WCAT website. When clicked upon, the "Home" hyperlink will bring the user back to the WCAT homepage. The "Contact Us" Button will bring

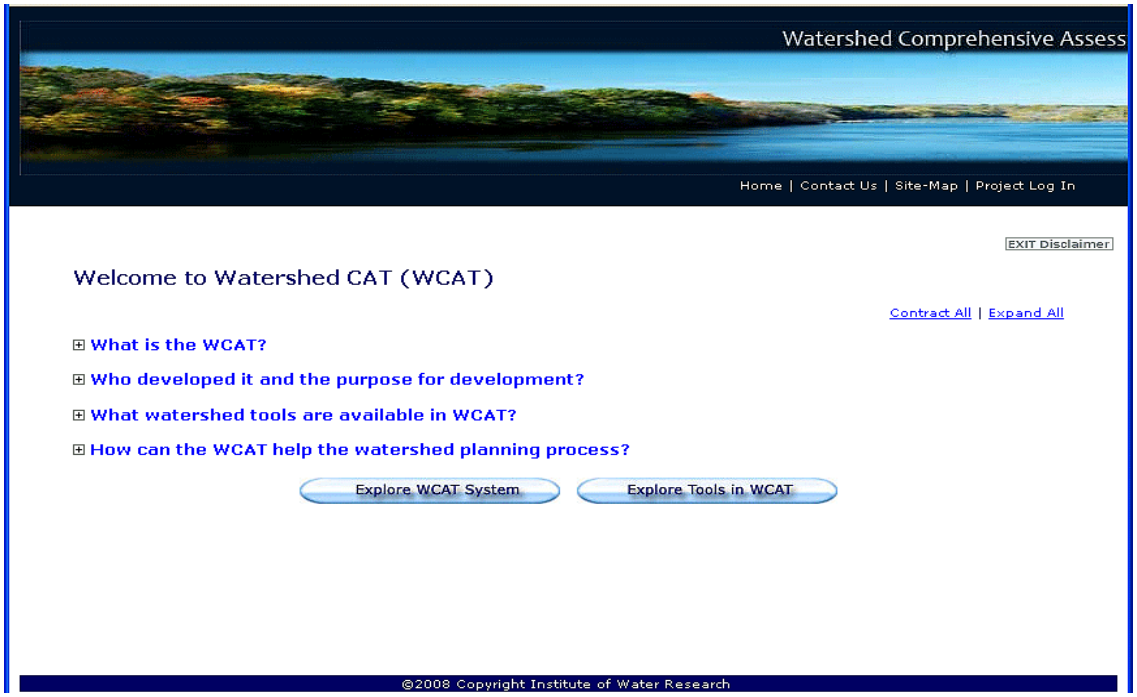


Figure 1.0 WCAT Homepage

the user to the WCAT help page. The information on this page tells them who to contact with questions or comments about the WCAT website. The "Site Map" hyperlink will take the user to the WCAT site map page. The information on the site map page is a listing, by name, of all the pages in the WCAT website that can be viewed. Each page name is hyperlinked so that when the user clicks on the name of the webpage, they will be taken directly to that page. The "Project Log-In" button, when clicked upon, will take the user to the Project Log-In webpage. This page will allow a WCAT user to log in to their user account, or to create an account if they don't have one. The Project Log-In webpage is currently under construction. Creating the Project Log-In feature was not a project task requirement. However, after much discussion within our WCAT Team, we felt that it would be beneficial for a WCAT user to have access to a workspace in order to save their work and notes as they move through the WCAT system. The Project Log-In page will be discussed in more detail under **Section 4.1** of the Future & Ongoing Improvements section of this report.

At the bottom of the WCAT homepage there are two buttons labeled "Explore WCAT System" and "Explore Tools in WCAT." If a user clicks on the "Explore Tools in WCAT" button they will be taken to the Explore Tools webpage (**See Figure 1.1 below**). This page describes the tools that a user will be working with throughout the WCAT system. Each tool has a paragraph or two that explains what the tool is and where a user can go to find out more information about the tool.

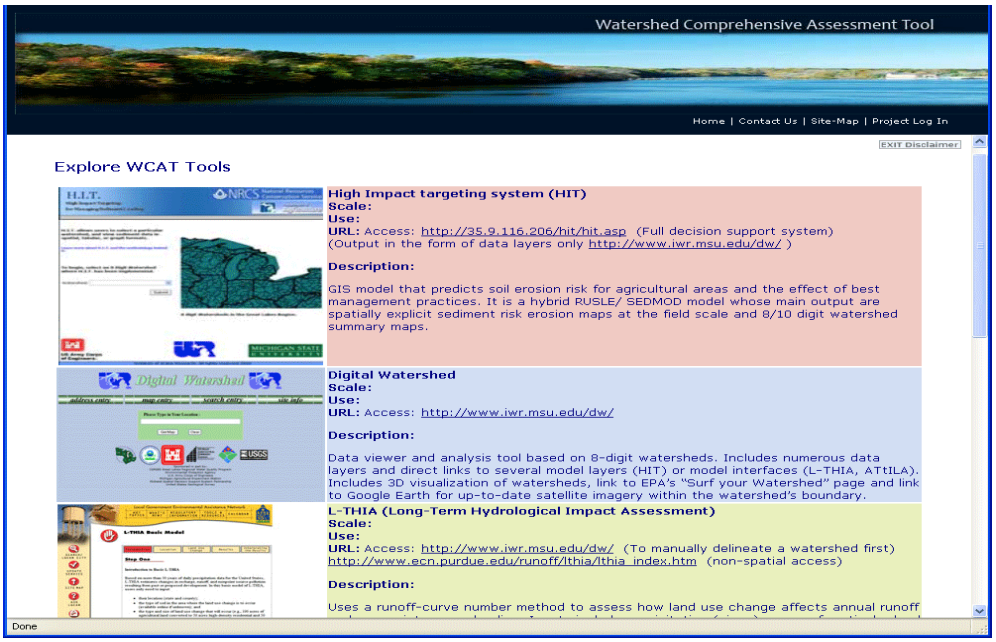


Figure 1.1 WCAT Explore Tools Page

Explore WCAT System Page: If a user clicks on the "Explore WCAT System" button they will be taken to the Explore WCAT System webpage (**See Figure 1.2 below**). By clicking this button, a user will begin working through the WCAT system. The Explore WCAT system page is the main page of the WCAT system. Along the left hand side of the page, there is a series of hyperlinked vertical tabs. Except for the top most tab labeled, "Explore WCAT System" and the bottom most tab labeled, "Social Tools/BMP's" each tab is labeled based on a data intensive step of the watershed planning process. Currently there are seven tabs and they are labeled (Order is top to bottom): Explore WCAT System, Define Watershed Plan, Gather Existing Data, Assess WS Conditions, Estimate Pollutant Loads, Evaluate Options, and Social Tools/BMP's. When a user clicks on a tab, the corresponding information will open up in the center of the page. Similar to the WCAT Welcome page, the information is presented under blue colored headings, which expand to show text when clicked. Each blue heading indicates a task for the user to complete. Once each blue task is complete for that specific tab, the WCAT user will move on to the next tab in the series.

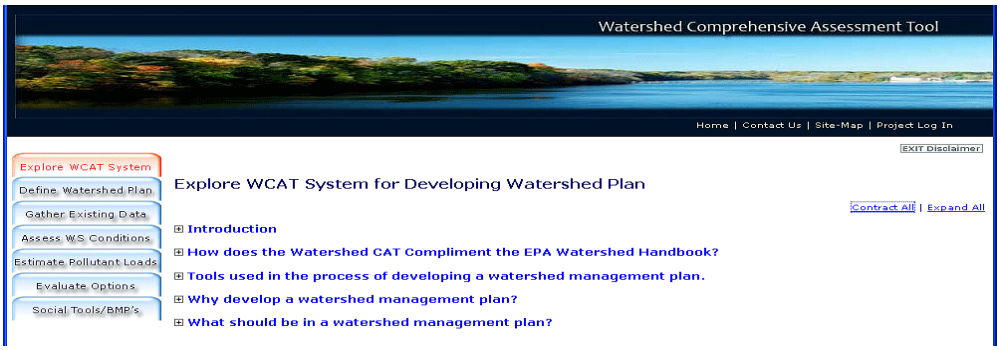


Figure 1.2 Explore WCAT System Page

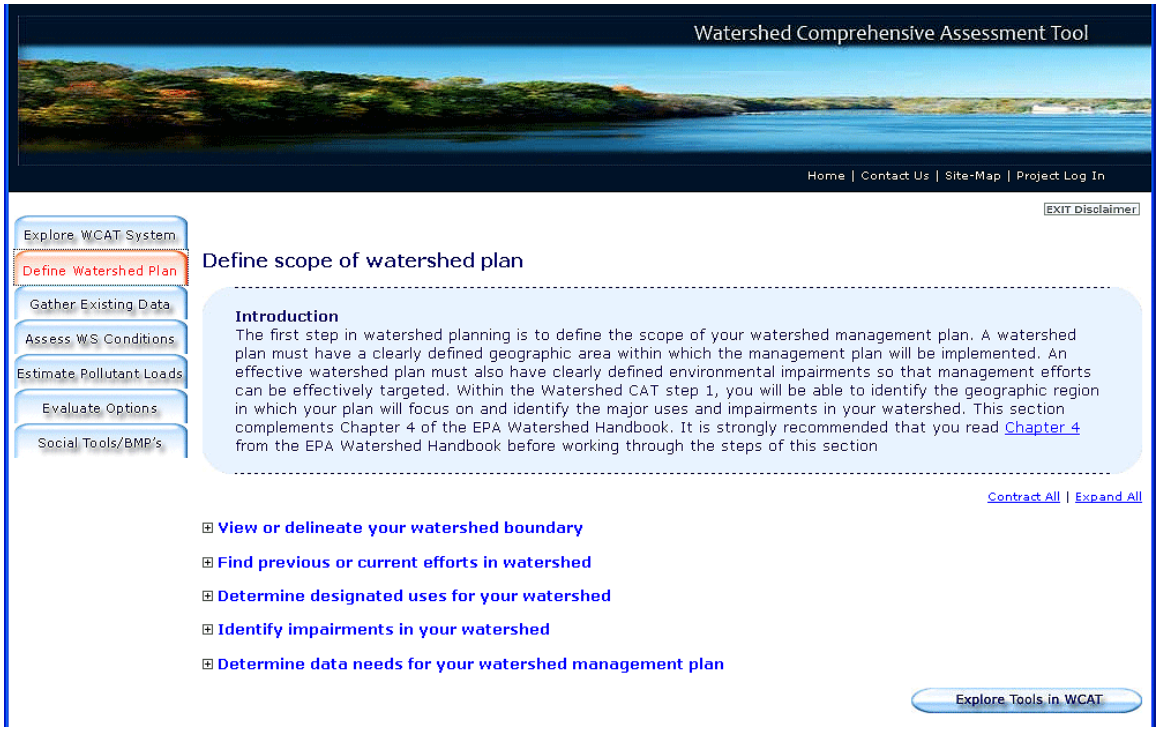


Figure 1.3 Define Watershed Plan

The first tab labeled, "Explore WCAT System" is what the user will work through first. This tab automatically loads up after a user clicks on the "Explore WCAT System" button which is located back on the WCAT Homepage. There are five blue headings/tasks within this tab: Introduction, How does the Watershed CAT Compliment the EPA Watershed Handbook, Tools used in the process of developing a watershed management plan, Why develop a watershed plan, and What should be in a watershed management plan.

The second tab labeled, "Define Watershed Plan" is the next tab the user will work through (**See Figure 1.3**). There are five blue headings/tasks within this tab: View or delineate you watershed boundary, Find previous or current efforts in your watershed, Determine designated used for your watershed, Identify impairments in your watershed, and Determine data needs for your watershed management plan.

The third tab labeled, "Gather Existing Data" is the next tab the user will work through (**See Figure 1.4 below**). There are seven blue headings/tasks within this tab: View land use and land cover change in your watershed, View sediment deposition for your watershed, Find point sources in your watershed, Find water quality and quantity monitoring stations in your watershed, Find water quality data in your watershed EPA STORET, View streams, lakes and wetlands in your watershed, and View topography of your watershed.

The forth tab labeled, "Assess WS Conditions" is the next tab the user will work through (**See Figure 1.5 below**). There are three blue headings/tasks within this tab: Determine land use characteristics of your watershed using ATtILA, Calculate the amount of impervious surfaces using ATiLA, and Identify potential landscape stressors in your watershed using ReVA.

Figure 1.4 Gather Existing Data

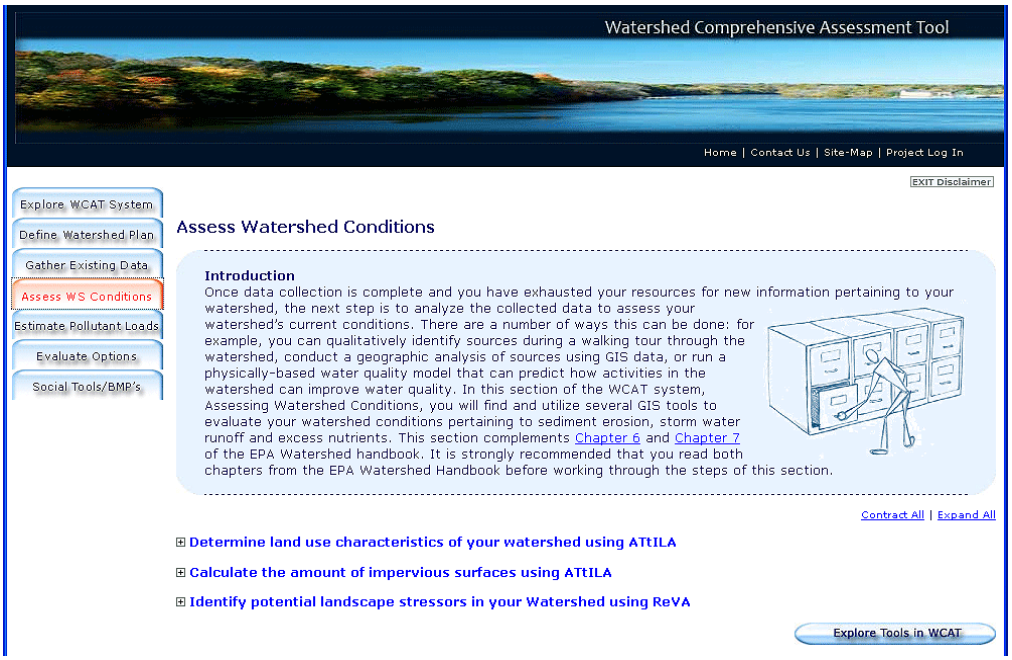


Figure 1.5 Assess WS Conditions

Figure 1.6 Estimate Pollutant Loads

The fifth tab labeled, "Estimate Pollutant Loads" is the next tab the user will work through (**See Figure 1.6**). There are 7 blue headings/tasks within this tab: Estimate annual runoff from your watershed using L-THIA, Estimate nutrient and heavy metal loading from your watershed using L-THIA, Analyze stream flow using the Web-based Hydrograph Separation Analysis Tool, Estimate sediment loading from your watershed using the HIT system, Identify critical areas of sediment erosion using the HIT system, Learn about additional models that will estimate watershed pollutant loading, and Additional Reading.

The sixth tab labeled, "Evaluate Options" is the next tab the user will work through (**See figure 1.7 below**). There are 3 blue headings/tasks within this tab: Evaluate options and select management strategies, Estimation of base line sediment/erosion before implementing BMPs, and Evaluation and selection of BMPs.

Figure 1.7 Evaluate Options

The seventh tab labeled, "Social Tools/BMP's" is the last tab the user will work through (**See Figure 1.8 below**). Currently this tab is under construction. There will be more explanation about the future plans of this tab later on under **Section 4.2** of the Future & Ongoing Improvements section of this report.

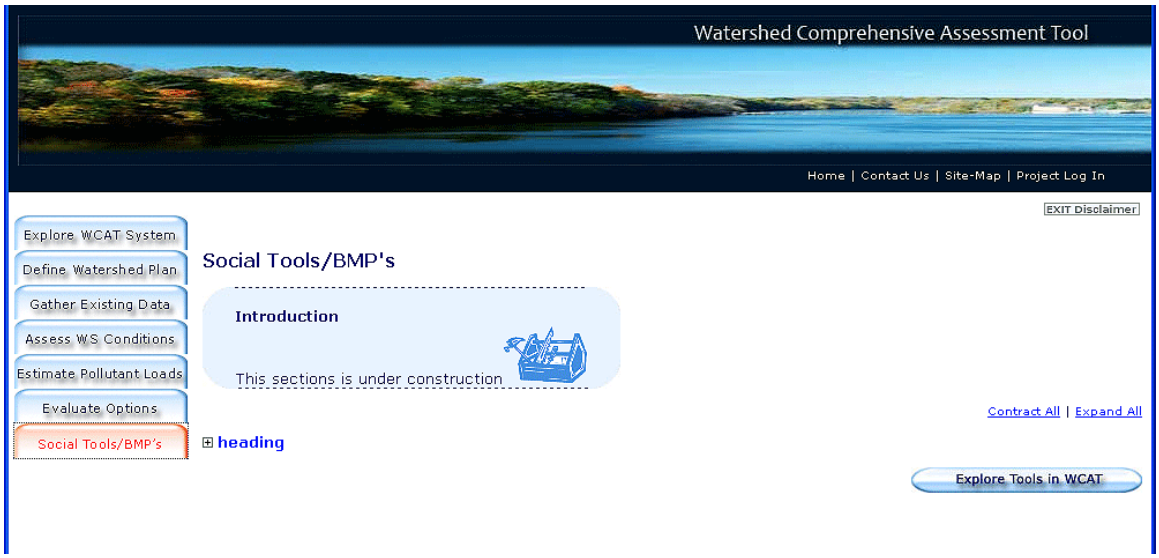


Figure 1.8 Social Tools/BMP's

2.3.1 Review Feedback from Interviews in task 2.0.

As mentioned previously, we were unable to use the initial survey that we had created early on in the project. Essentially, this prevented us from conducting interviews with those that would have filled out our survey. However, we did put together a select group of professionals which represents our WCAT Advisory Group. These folks have agreed to assist us with their expertise, as we continue to develop the WCAT system.

2.3.2 Generate Graphics and Color Schemes.

2.3.3 Create Interface.

The IWR technical team met in the early stages of this project to ideally generate a user friendly interface for individuals to access information pertaining to the watershed planning/building process. Our hopes were to create the Watershed Comprehensive Assessment Tool website to enhance the EPA Watershed Plan Builder which would bring both systems to the forefront of watershed planning as well as learning and utilizing the tools used to help the watershed planning process. The graphics for the WCAT website were obtained through various sources with permission and have been optimized to fit the web site.

Within our WCAT Advisory Group Survey, we had several questions that dealt with the current state of the WCAT website structure and design. The feedback that we received was very positive. Advisory group members especially enjoyed the expandable blue headings. They felt that it kept the website looking neat and organized. Overall, the advisory group members approved of the WCAT website design. Based on the feedback that we received from the WCAT advisory group, our team feels that the initial structure and design of the WCAT website is a verified success.

2.4 Refine Digital Watershed Mapper Functions.

Reporting Function: A standard 8-digit watershed report function was developed and integrated into the Digital Watershed. The watershed report generated by this function contains general watershed information and selected major ecological indicators derived from EPA ReVa EDT for Midwest region and ATtILA program. Watershed map and land use characteristics pie chart are also included. The layout of the report is illustrated in **Figure 2.0** and **Figure 2.1**.The selected major ecological indicators are listed below:

- Percent irrigated cropland acres (NASS)
- Cropland productivity (measured as average yield of corn from National Agricultural Statistical Survey)
- Percentage of total stream length in watershed that is adjacent to all agriculture land
- Percentage of all agricultural land in a 60 meter stream buffer area
- Percentage of total stream length in watershed that is adjacent to urban land
- Percentage of urban land in a 60 meter stream buffer area
- Population Density (people/square mile) in 2000
- Estimated nonpoint source (NPS) Nitrogen (N) loadings (kg/ha) based on L-THIA model
    - Estimated nonpoint source (NPS) Phosphorus (P) loadings (kg/ha) based on L-THIA model
- Estimated nonpoint source (NPS) Suspended Solids (SS) loadings (kg/ha) based on L-THIA model
- Road density (km/square kilometer) in 2000
- Stream density (km/square kilometer) in 2000
- Percent of total surface water withdrawals used for irrigation
- Percent of total groundwater withdrawals used for irrigation
- Average surface water use per person (residential use)
- Average groundwater use per person (residential use)
- Percentage of watershed with all agriculture land on slopes that are greater than three percent
- Soil erodibility factor that represents both susceptibility of soil to erosion and the rate of water runoff

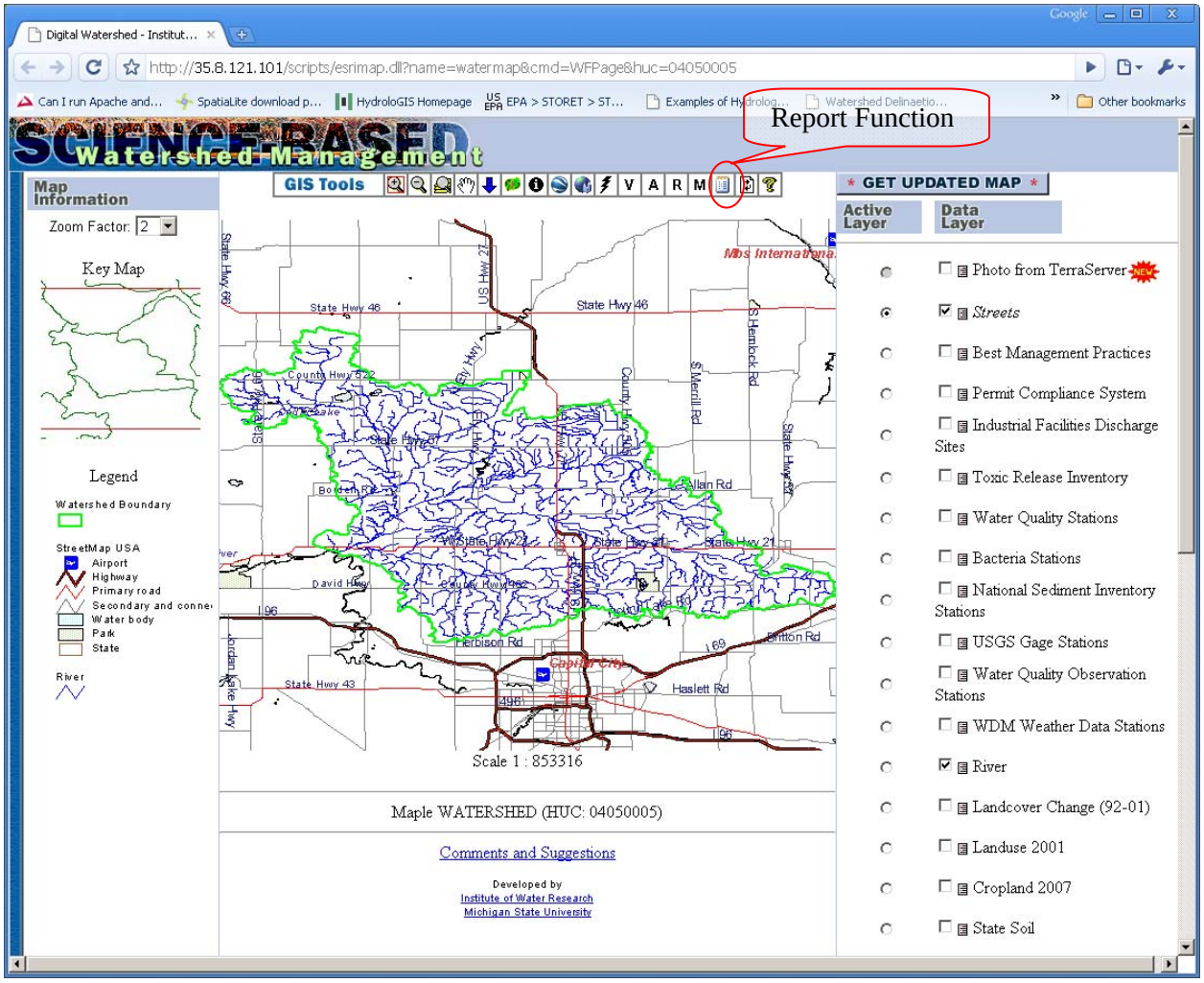


Figure 2.0 Watershed Report Function in Digital Watershed

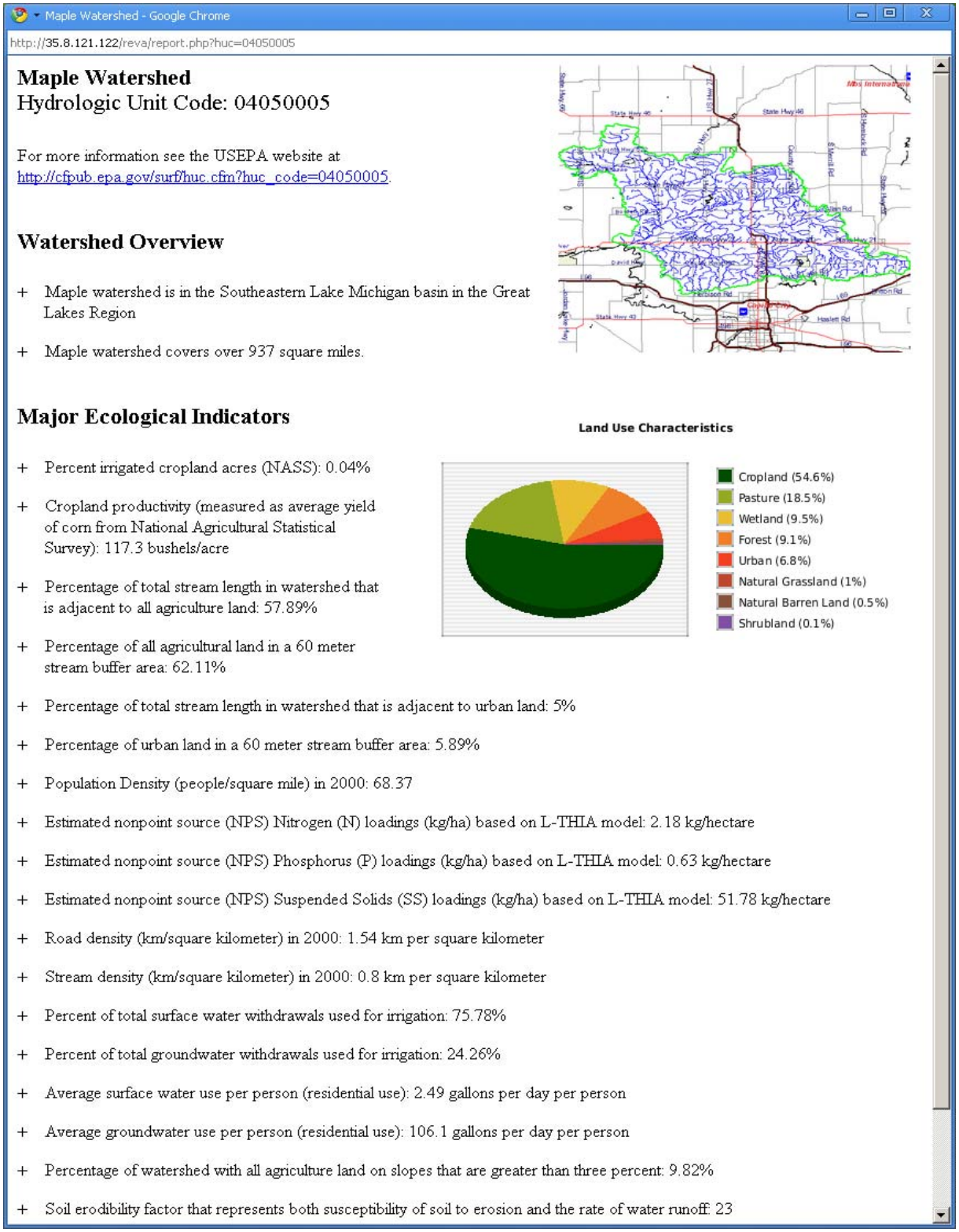


Figure 2.1 Watershed Report Layout and Content

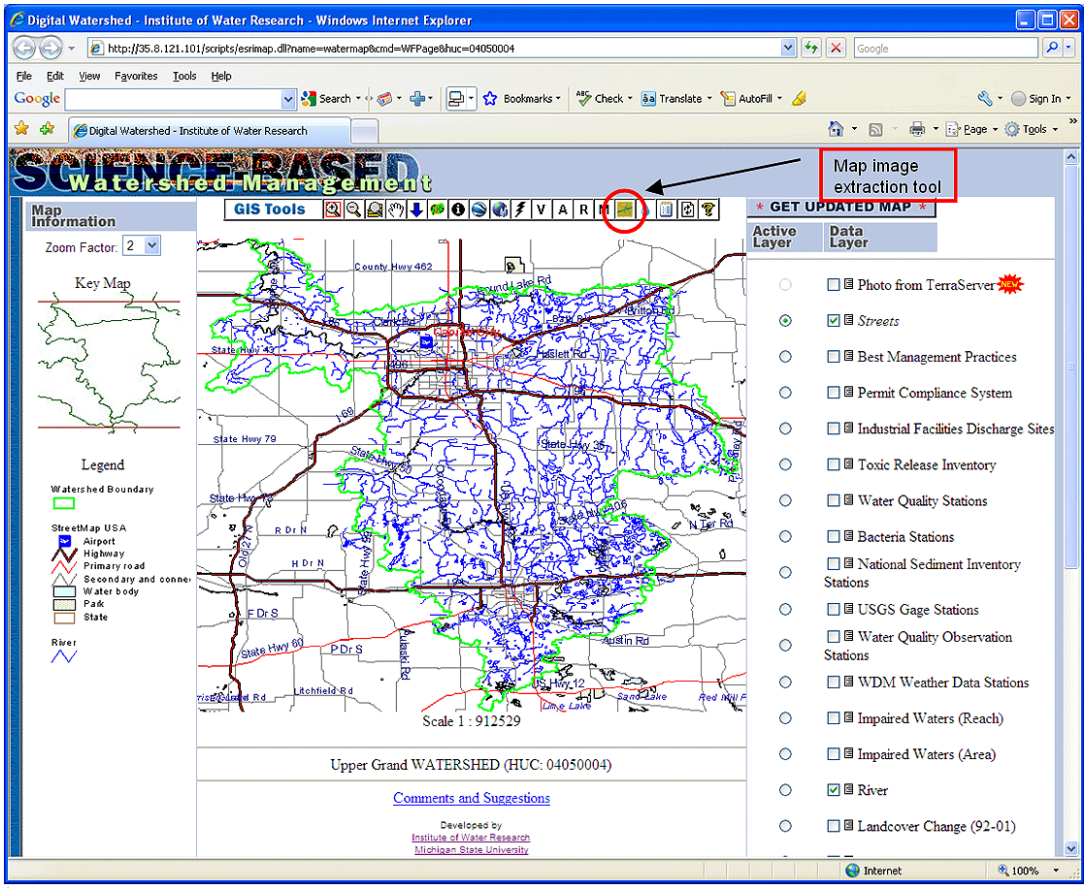


Figure 2.2 Map Extraction Tool

Digital Watershed Mapping Function Refinement: A new Google Mapping function was added to Digital Watershed to allow users to view watersheds on the Google Mapping interface and Google Earth 3D environment. Microsoft Virtual Earth interface was also developed to take advantage of its better high resolution aerial photo coverage for rural areas. To facilitate users' mapping needs for watershed planning, a map image extraction function was integrated into the system so that WCAT users can put Digital Watershed generated maps into their watershed plans (**See Figure 2.2**).

2.5 Merge and Integrate Components Listed in Table 1.

Component (Original System)	Scope	Web Access/ Model Type	Capacity or Type of Data
Digital Watershed Mapper	National	Yes/Analytical	Watershed boundaries, BASINS data layers
L-THIA Long-Term Hydrological Impact Assessment	Region V	Yes/ Analytical	Runoff volume and depth; NPS pollutant loads. Subwatershed level analysis (~11,000 acres)
ATILA Analytical Tools Interface for Landscape Assessments	Under development in Region V	No/ Analytical	Landscape metrics & urban indicators; landscape, riparian, physical characteristics; human stressors
ReVA Regional Vulnerability Assessment (data layers only)	Under development in Region V	No/ Descriptive	Spatial analysis of ecological systems to identify vulnerable areas
HIT High Impact Targeting (data layers only)	Under development in the selected watersheds	No/Descriptive	Incorporates SEDMOD and RUSLE
Social Indicators System	Under development; may be added subsequent to this project.	No/Analytical	Knowledge/awareness; Attitudes; Financial Capacity; Behavior/Adoption. Measure intermediate outcomes indicating progress in w.q. improvement

With the exception of the Social Indicators System Component, each of these tools listed in Table 1 have been successfully implemented into the WCAT system. At the time the WCAT tool was proposed, the Social Indicators System was in the early ages of development. We had hoped that we could incorporate the Social Indicators System into the WCAT system as we developed it. However, at this time the Social Indicators System remains under development. We plan to try and incorporate the Social Indicators System into the WCAT at a later date. The following paragraph will describe how each tool has been implemented into the WCAT website.

Digital Watershed

Digital Watershed is the platform base of the WCAT system. A WCAT user will be working with Digital Watershed early on in the WCAT system. The first time a WCAT user works with the Digital Watershed tool is in the Define Your Watershed Step, which is the very first step in the WCAT system. In the Define Your Watershed step section, a WCAT user will utilize the Digital Watershed Tool to locate, view, and delineate their watershed boundary. They will also view and identify any impairments in their watershed.

In Step 2, Gather Existing Data, a WCAT user will work with the Digital Watershed Tool to; View Land Use and Land Cover Change (92-01); View sediment deposition for their watershed; Locate permitted point source emissions; Locate water quality and quantity monitoring stations in their watershed; View streams, lakes, and wetlands in their watershed and; View topography of their watershed. For each of these tasks, there is a hyperlink included in the explanation that links the user directly to the Digital Watershed tool. To complete these tasks, a WCAT user can choose to open up the Digital Watershed Tool (via the hyperlink) in another window or they can open it up within the WCAT window itself. It is important to note that a WCAT user has the option to save the map images they generate in Digital Watershed. As mentioned previously in the Task 4.0 section of this report, we have integrated a map image extraction function into Digital Watershed. This allows the user to save the map images that they generate in Digital Watershed and put them into their watershed plans. This extraction function compliments the WCAT Project Log-In feature, which is discussed in more detail later on under **Section 4.1** of the Future & Ongoing Improvements portion of this report.

L-THIA (Long-Term Hydrological Impact Assessment)

A WCAT user will work with the L-THIA tool to understand how land use change in their watershed affects annual runoff and non-point source loading. The L-THIA tool can be used to calculate average annual runoff volume (acre-ft), average annual runoff depth (inches), nitrogen (lbs), Phosphorus (lbs), suspended solids (lbs), heavy metals (Lead, Copper, Zinc, Cadmium, etc (lbs)), BOD, COD, and fecal coliform for any given watershed. A WCAT user will begin working with the L-THIA tool in the Estimate Pollutant Loads section of the WCAT. In this section, they will use the L-THIA tool to estimate annual runoff and nutrient and heavy metal loading from their watershed. The L-THIA tool is linked to our Digital Watershed system. A user will need to open up Digital Watershed and delineate their watershed using the Delineate Tool (**see Figure 2.3 below**) from the GIS toolbox before working with L-THIA. The documentation that explains this process is included in the WCAT Estimate Pollutant Loads Section.

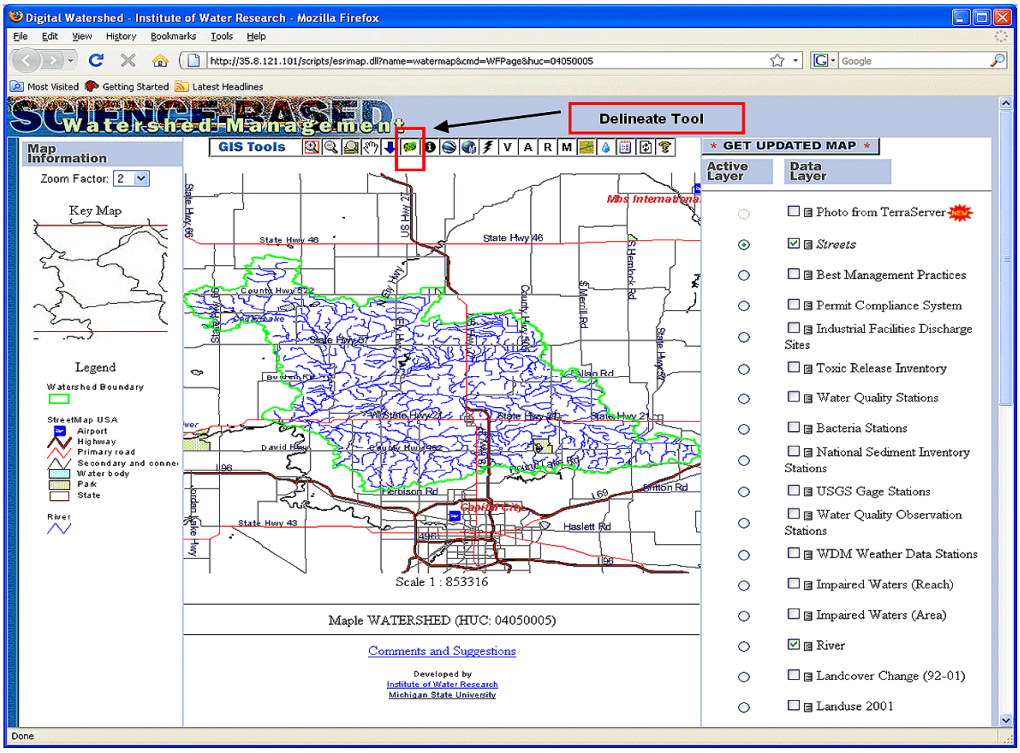


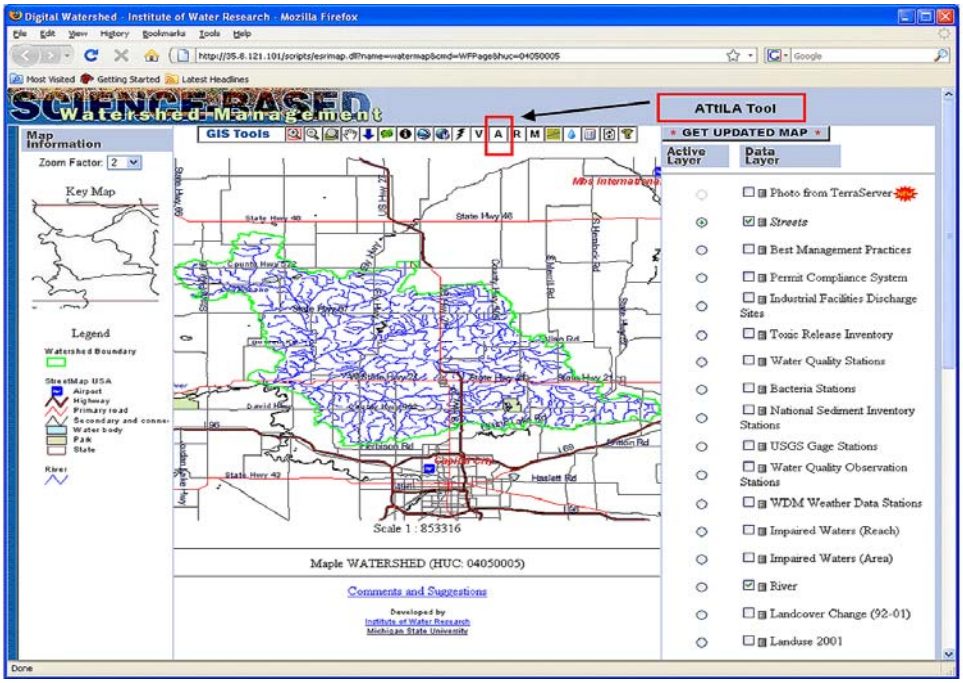
Figure 2.3 Digital Watershed Delineate Tool

ATtILA (Analytical Tools Interface for Landscape Assessments)

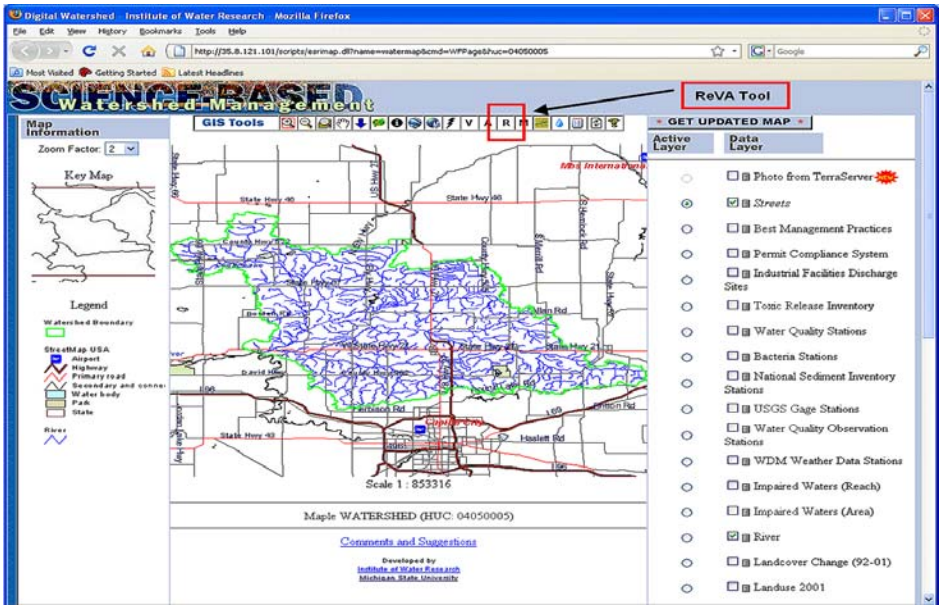
A WCAT user will work with ATtILA to calculate landscape characteristics, riparian characteristics, human stressors, and physical characteristics for a given area/watershed. A WCAT user will begin working with the ATtILA tool in the Assess WS Conditions Section of the WCAT. In this section they will use the ATtILA tool to determine land use characteristics of their watershed and to calculate the amount of impervious surfaces in their watershed. Similar to the L-THIA tool, the ATtILA tool is integrated into our Digital Watershed system. Since ATtILA is a downloadable ArcView extension, we were able to integrate it directly into the GIS Toolbox of Digital Watershed. To view the landscape characteristics and percent impervious surfaces for their watershed, the user can simply click on the capital A in the GIS Toolbox (**See Figure 2.4 below**). A new window will load up and display the appropriate information.

ReVA (Regional Vulnerability Assessment)

ReVA is a risk assessment tool that uses physical, political and socioeconomic parameters of 8-digit watersheds to assess overall stress on its natural resources. The goal of the ReVA tool is to help a user interpret current conditions of their watershed, anticipate future issues, set management and ecosystem protection priorities and proactively assess current conditions that may impact multiple outcomes. A WCAT user will work with the ReVA tool to assess the vulnerability and stress on their watershed's natural resources. A WCAT user will begin working with the ReVA tool in the Assess Watershed Conditions Step of the WCAT. In this section they will use the ReVA tool to identify the land use /land cover characteristics, social/economical characteristics, and social/economical characteristics of their watershed. The ReVA tool is also integrated into our Digital Watershed GIS Toolbox and is represented as a capital R (**See Figure 2.5 below**).



(Figure 2.4 Digital Watershed ATtILA Tool)



(Figure 2.5 Digital Watershed ReVA Tool)

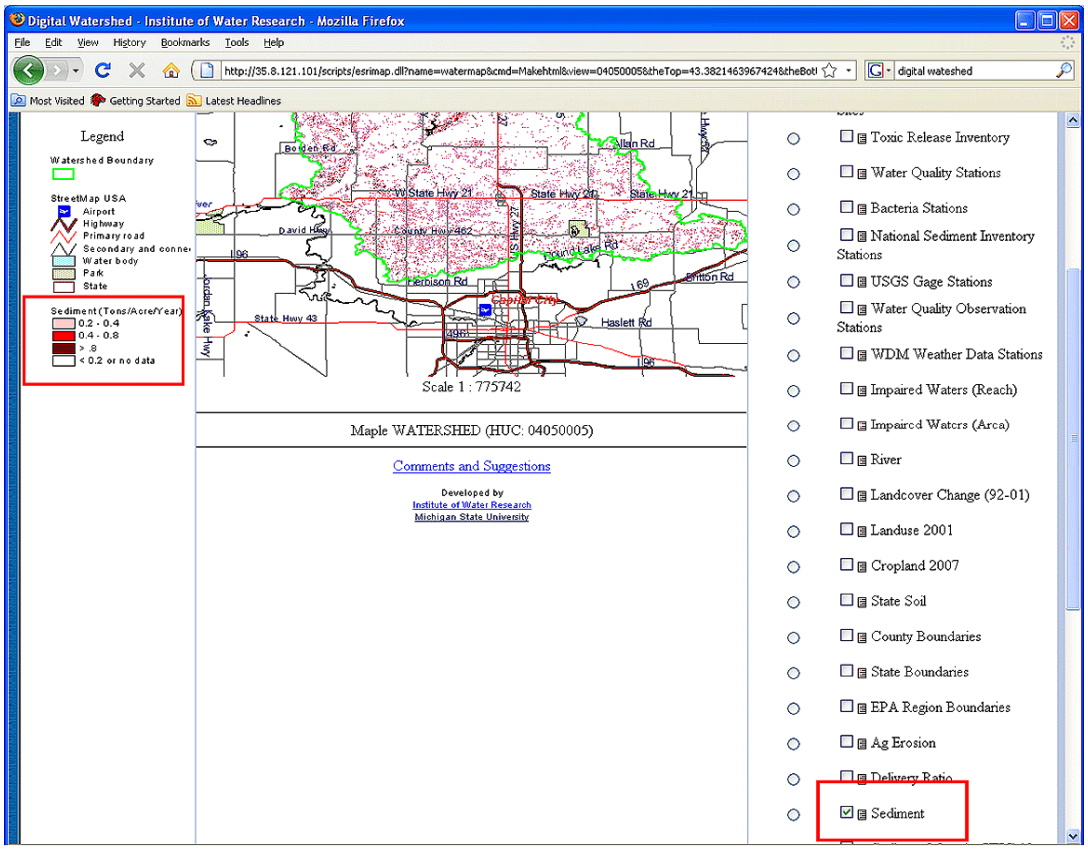


Figure 2.6 Digital Watershed HIT Data Layer

HIT (High Impact Targeting)

HIT is a GIS model that predicts soil erosion risk for agricultural areas and the effect of best management practices. It is a hybrid RUSLE/SEDMOD model whose main output are spatially explicit sediment risk erosion maps at field scale and 8/10/12 digit watershed summary maps. The HIT system uses land use, topography, soils and the presence/absence of management practices to model soil erosion and delivery to streams.

A WCAT user will first begin working with the HIT tool in the Estimate Pollutant Loads Step of the WCAT. Here they will estimate sediment loading into their watershed and identify critical areas of sediment erosion. The HIT tool can display its output spatially on a field-scale level. This output is displayed in our Digital Watershed tool, where a user can overlay aerial photos, land use, rivers and streams, topography and other data layers to determine the cause for high sediment erosion in a specific location. This spatial output is represented by the Sediment data layer in Digital Watershed (**See Figure 2.6 below**).

A WCAT user will use the HIT tool again in the Evaluate Options Step of the WCAT. In this step of the WCAT, the user will run best management practice scenarios on their watershed. These hypothetical scenarios will allow the user to calculate annual loads of sediment and erosion on farmland before and after implementation of BMP practices at several watershed scales/HUCs. With their watershed goal set up, the HIT tool makes it easy for a user to compare various management options and to select the options that are the most cost effective. This makes its possible to prioritize and implement the proper BMP's for the sub-watersheds of a user's complete 8-digit watershed.

2.6 Map High Risk Areas for Major Contributions of Sediment and Nutrients.

2.6.1 Run SEDMOD/RUSLE with 10-meter Grid for the Selected 8-digit Watersheds.

At the time of the project proposal, the SEDMOD/RUSLE or (HIT) model required a significant amount of processing time; single 8-digit watersheds could take to complete. Therefore, given the length and scope of the project, we proposed developing fine resolution (10 meter) HIT models for a few select watersheds. We were confident that we could provide the 10-meter resolution models (as opposed to the coarser but more feasible 30-meter models) because of an ongoing contour digitizing project with the USGS, which was generating the necessary finer resolution model inputs. However, internal issues at USGS halted the project and, subsequently, our efforts to build 10-meter models. To make up for our inability to deliver the finer models, we sought ways to produce the 30-meter models for a larger area than had originally proposed. We improved and automated the HIT processing, reducing model generation time from weeks to hours. This new efficiency enabled us to produce 30-meter models for the entire Great Lakes Basin, but necessitated a re-design of HITS's online decision-support interface. The prototype has been built, but is still being refined. However, local groups and consultants are currently using the raw model outputs, which we provided to them on disc, within their own GIS. In the coming weeks, a final and enhanced version of HIT will be available, allowing users to prioritize erosion and sedimentation conservation efforts anywhere in the Great Lakes Basin.

2.7 Link WCAT System to EPA's Enviromapper for Waters for TMDL Data.

This task was accomplished over the past several months. Since we have our Digital Watershed tool as the main platform of the WCAT, we wanted to try and get the TMDL data from the EPA's Enviromapper for Waters Tool incorporated into the Digital Watershed system. We contacted the EPA administrator in charge of the Enviromapper for Waters program to see if we could get a hold of the TMDL impaired waters spatial data and attributes. Unfortunately, the EPA was not able to accommodate a custom request for data. However, they informed us that it was possible to download the TMDL data through the EPA WATERS Reach Address Data Download website.

We downloaded the TMDL impaired waters spatial and attribute data for the entire U.S. in March of 2009. We then incorporated this data into our Digital Watershed system. We created two separate data layers to display this information; Impaired Waters (Reach) which displays the impaired rivers and streams, and Impaired Waters (Area) which displays impaired water bodies. It's important to note that as the EPA continuously updates the TMDL data within the WATERS database, we will do the same. Our Digital Watershed system will make it possible for the user to locate an impaired stream/lake and identify the parent cause of the impairment via the Identify Tool from the Digital Watershed Toolbox.

2.7.1 Link CAT System to EPA's Social Indicators Data Management and Analysis System.

The Social Indicators project funded by EPA through MDEQ was discussed as being a possible addition to the CAT system at the beginning of the project. However, the project is still under development and being tested by 319 grant projects within Region 5. Managers of the Social Indicators project are not allowing the system to be publically accessible particularly during development. For this reason, we have not included the Social Indicators project into CAT. Once the Social Indicators project has been developed, we plan to incorporate the project into our WCAT system.

2.7.2 Link CAT to Websites with Text and Scenarios for Model Ordinances, Zoning Rules, Master Plans, and Setback Examples as Social Tools/BMP's to Improve Water Quality.

We felt that the best method of approach for this task would be to talk with watershed and land use professionals that are familiar with utilizing solid, well written model ordinances, zoning rules, master plans, and setbacks as social tools/BMP's to improve water quality. Fortunately, our Institute of Water Research shares the same building as the Land Policy Institute.

The Land Policy Institute is an excellent group of professionals that are familiar with using ordinances, zoning rules, setbacks, and master plans for managing and protecting our land/water. We contacted the Director of Faculty Research Development at the Land Policy Institute, Dr. John Warbach, to discuss our project and to see if he had any suggestions to get us started. Dr. Warbach made an interesting point, that there are a number of websites that include such information. He suggested that we think about whether these links (links to websites with examples of Social Tools/BMP's to improve water quality) should be general in nature, or specific to a place or community as plans and regulations vary between communities. We spent a significant amount of time researching and exploring the suggestions by Dr. Warbach and have several great examples of social tools/ BMP's to improve water quality. We are currently discussing what the most effective method should be for including this information into the WCAT website. The proposed next steps for this task will be explained in more detail under **Section 4.2** of the Future & Ongoing Improvements section of this report.

2.8 Modify Virtual University Modules to Provide Training in use of Watershed CAT.

The WCAT web-based system is being incorporated into the MSU online Watershed Management Program, Module 2 "Building and Implementing Watershed Plans" beginning Fall, 2009. The main objective is to introduce an "additional watershed tool" to help develop a more comprehensive watershed plan. In addition, we expect to receive feedback from students as an input for future improvements to the system. WCAT will be assigned as part of a student term project. Students will need to go through the WCAT system step by step and answer questions about the usefulness in terms of helping in the development of a watershed plan as well as the user friendly design of the system. A two to three page written summary of the students' experience with the WCAT system and tools will be required to complete the assignment of the term project.

2.9 Establish Security and Backup Protocols for the CAT System.

2.9.1 Move from Development Server to Production Server to Host the CAT System.

The CAT system has been moved from the development server to the production server for increased security and long-term hosting. Due to the inter-operable nature of the CAT, IWR will only be able to provide firewall security and regularly scheduled backups for data and programs stored directly on IWR servers. Other tools, models, programs, etc. hosted outside of IWR are the sole responsibility of the organizations that host them. IWR will commit to hosting CAT for three years at which time the CAT program will be evaluated for use and EPA will be contacted to discuss any next steps if needed. IWR intends to continue hosting CAT after this three year commitment, contingent on the size of audience and other server related factors.

3.0 Recommendations from Advisory Group

3.1 Discussion & Comments on Advisory Group Questions (During Meeting)

The following paragraph summarizes the WCAT advisory group responses to the questions that we asked during our WCAT advisory group meeting on June 18th, 2009. After presenting the WCAT system to the advisory group, we wanted to receive initial feedback on the WCAT system while the information was fresh in their minds. We also felt that this would be a great opportunity to open up discussion of the WCAT system among the members of the advisory group. We have summarized the most important comments from the advisory group for each of the five questions. These comments will be discussed within the WCAT project team so that we can formulate a proper strategy of implementation. Once a strategy has been established, we intend to put these suggestions into action over the coming months.

3.1.1 Advisory Group Question One: What do you think is the best method/approach to introduce the WCAT system and engage potential users such as watershed organizations, consultants, stakeholders, and other interested groups?

Response: The advisory group suggested that we hold workshops with the Department of Environmental Quality in order to connect with watershed groups and consultants so that a "train the trainer" approach can be implemented. The idea behind the "train the trainer" approach is to get consultants, watershed groups, stakeholders, etc. intricately familiar with the WCAT system. They could then turn around and began training others on the use of the WCAT system. This would help to get the word out on the WCAT system and engage potential users.

Response: The advisory group suggested that we try and get a referral to the WCAT website included on watershed planning grant websites, such as the EPA's, to expose potential grantees to the WCAT system and explain to them how the WCAT can assist them with their 319 plan development. This is a great suggestion and will definitely be something to think about as we promote the WCAT system.

Response: The advisory group made the comment that there needed to be more interactions between watershed groups and the Department of Natural Resources, the Department of Environmental Quality, and other environmental regulatory institutions. For example, the DNR regularly schedules information sessions and educational sessions in which we could showcase the WCAT system. This would provide the opportunity to explain how the WCAT fits in with and satisfies the requirements for 319 watershed plan development.

Response: The advisory group suggested that we interact more effectively with lake/stream "leaders" and other watershed groups/organizations to get the word out on the WCAT system. We could branch out to prominent watershed organizations within the Great Lakes region in order to establish a solid foundation and future launching point for a more national initiative. By forming relationships with these organizations, our Institute of Water Research would have much to gain. Increasing communication lines would make the passing of new tool and model development information much more effective thereby increasing the exposure of new watershed management projects.

Response: We had mentioned to the WCAT advisory group that we plan on incorporating the WCAT system into our organization's Online Watershed Modules program. They made a great suggestion that we could use these modules to perfect a WCAT tool delivery method that could be implemented at other online training programs, webinars, and web training programs. While students take the online Watershed Modules, we could incorporate surveys and discussion sessions into the module to gain valuable insight and feedback. This feedback could then be used to improve the WCAT system and how it is delivered.

3.1.2 Advisory Group Question Two: *Should the EPA recommend the WCAT system to watershed groups in their 319 plan development? If so, what would the EPA need from our organization and the WCAT system to make it possible?*

Response: An advisory group member who is a representative of the DEQ suggested that we get more information about what local organizations (Conservation districts, drain commissioners, public works/utilities, etc.) are applying for 319 grant funding. Once we have this information, we can design a more effective marketing campaign that targets these organizations. He also suggested that it may be more effective to contact these organizations directly, introduce the WCAT system, and then secure referrals to the WCAT system on these organizations' websites. Once we've finished up the development of the WCAT system, we intend to work with the EPA and other organizations to establish referrals to our system.

3.1.3 Advisory Group Question Three: *How can your organization help us to improve the WCAT system? More specifically, based on your individual experience and background with watershed management, what do you think the WCAT system is lacking?*

Response: An advisory group member that represents a local watershed planning commission suggested that we should put together a tutorial that explains how the system works on the homepage of the WCAT website. She felt that users with less watershed planning experience may be overwhelmed by the information and tools of the WCAT. This tutorial could be broken up into three portions. The first portion could explain how the WCAT compliments the EPA Watershed Plan Builder and the EPA Watershed Handbook for Developing Watershed Plans to Restore and Protect Our Waters. We received several comments from the advisory group that we need to do a better job explaining the relationship between the WCAT system and the two EPA documents.

The second portion of the tutorial could explain the structure of the WCAT website and how the user should work through the system. The advisory group felt that first time users of the WCAT might get lost as they work their way through the system. This portion of the tutorial could explain each step of the WCAT system and exactly what outputs a user can expect.

The last portion of the tutorial could explain the tools/models (ATtILA, ReVA, L-THIA, and HIT) utilized within the WCAT system. Each of the tools could have their own step by step demo that explores the tool and gives the user a chance to familiarize themselves with each of the tool's mechanics.

Response: An advisory group member that specializes in GIS spatial data and geography suggested that we try and add more GIS data layers to our Digital Watershed tool that addresses urban areas and helps with targeting non-point source pollution areas.

He felt that that the current state of the Digital Watershed tool didn't address this issue as most of the data layers deal more with agricultural impacts. He made a very good point, and we intend to follow up on this great suggestion. We will be adding and updating the Digital Watershed data layers over the next few months. There is more discussion on this topic in **Section 4.3** of the Future & Ongoing Improvements portion of this report.

3.1.4 Advisory Group Question Four: *With regard to the WCAT system content, do you have any suggestions for possible additions to the system? (i.e. tools, models, GIS systems, etc.)*

Response: The advisory group suggested that we add a data layer to our Digital Watershed tool that deals with wetlands on a national scale. The Wetlands data layer that we currently have on Digital Watershed is only available for Michigan. As mentioned, we will be adding/updating several Digital Watershed data layers over the next few months. There is more discussion on this topic in **Section 4.3** of the Future & Ongoing Improvements portion of this report.

3.1.5 Advisory Group Question Five: In your opinion, did any of the tasks require more technical skill than could be expected of a watershed organization? If so, which ones were they and how might we make them more user friendly?

Response: The advisory group suggested at every possible application that we should have as much seamless interaction as possible. This comment was made in respect to the Steps/Tasks portion of the WCAT website. The advisory group would like to see easy access to help and more explanation when working through the WCAT tasks. Each task has several steps that explain how to gather the information. The advisory group would like to see further elaboration on what the user should do with the information once they have gathered it. The advisory group felt that by being as descriptive as possible, it would make it less likely for the user to make a mistake as they work through the system. In other words, we need to have less interaction that relies solely upon a user to make the information viable.

3.2 Advisory Group Survey Discussion/Comments

A copy of the WCAT advisory group survey can be found in the Appendix of this report. Please view this copy for all survey question content. The following paragraph summarizes the most important comments that we received from the WCAT advisory group survey. This paragraph will also give the average rating (from all advisory group participants) for each question. By providing the average values for each question, we can begin to see which aspect of the WCAT system needs improvement. We then plan on incorporating this feedback into the WCAT system over the next few months.

3.2.1 With respect to the Explore WCAT Section

Thorough presentation and organization of information: Average = 8
Word content was easy to read/understand: Average = 8.1667
Rationale for watershed planning: Average = 8.5
The purpose of the WCAT is understood: Average = 7.1667
The introduction of the WCAT system tools was thorough and informative: Average = 7.5

Response: The WCAT advisory group felt that we could do a better job explaining the purpose of the WCAT and how it is intended to compliment the EPA Watershed Handbook and the EPA Watershed Plan Builder. More explanation and emphasis is needed on why it's crucial to use the WCAT, Watershed Plan Builder, and the EPA Watershed Handbook all together to achieve a comprehensive plan.

Response: An advisory group member made the comment that in the Explore Tools page you can move directly to the Explore WCAT System page, but not the other way around. They suggested that we include a link to the Tools page somewhere in the Explore WCAT section.

Response: A few advisory group members felt that the paragraph that discusses what should be in a watershed plan seems to general. They gave the following example, that in Michigan there are three levels of plans; Phase 2 Stormwater Watershed Plan, Certified to Receive Clean Michigan Funding, and 319 Plan Development (9 elements). They felt that we should include a more in depth discussion of watershed plan development and possibly include links to corresponding websites for more information. We agree and will address this issue in the coming months.

3.2.2 With respect to the Define Watershed Plan Section

Thorough presentation and organization of information: Average = 7.83
Word content was easy to read/understand: Average = 8
Ease of following step instructions: Average = 8
Explanation of step instructions: Average =8
Ease of use when working with the Digital Watershed system: Average = 7.5

Response: The advisory group felt that there needs to be more explanation about what designated uses are and how a user can identify designated uses for their waterbody. The description as it stands now is too vague and needs to be re-written.

Response: Within this section, a user will get to work with the Digital Watershed Tool for the first time. The advisory group felt that there needed to be a tutorial for Digital Watershed to prevent first time users from becoming confused. This tutorial could cover both the mechanics and functionality of our Digital Watershed system. We agree and plan on implementing a tutorial into Digital Watershed in the coming months. This tutorial is discussed in more detail under **Section 4.3** of the Future & Ongoing Improvements section of this report.

Response: Some members of the advisory group felt that a WCAT user will be confused with this first step in the system. They commented that most watershed groups would need to have a set of questions in their head about their watershed to make the Define Watershed Plan section a good beginning. Most watershed groups' start from, "We have a problem" not defining the watershed. We want the WCAT to flow logically and smoothly throughout each step of the system. Over the next few months, we will continue to improve upon the website design and develop a more comprehensive method of step delivery.

3.2.3 With respect to the Gather Existing Data Section

Thorough presentation and organization of information: Average =8
Word content was easy to read/understand: Average = 8
Ease of following step instructions: Average = 7.83
Explanation of step instructions: Average = 7.83
Ease of use when working with the Digital Watershed system: Average = 7.33

Response: An advisory group member made the comment that since this section and the section before it (Define Watershed Plan) contains so many tasks, it would be helpful to have a printable handbook that a user can work with in order to stay on track. This guidebook could be introduced at the beginning of the WCAT system so that the user can follow along as they work through the system. This guidebook would offer security and explanation to the user if they get lost.

Response: An advisory group member felt that the tasks and tools in this section are geared more towards larger watersheds. She indicated that current watershed planning is encouraged at 12 HUC or smaller and some of the tools in this section don't drill down that far. We understand that

that could be an issue especially for users who live in smaller watersheds. However, some of the tools that we have linked to the WCAT system are not under our control. The best solution for this problem is to try and find other tools that we could include in this section that deals with smaller watersheds. This is something we will continue to research over the coming months.

Response: An advisory group member suggested that it would be helpful for several of these steps to have an example section of the appropriate use and analysis of the data types found within each category including limitations of the data. He felt that it would be beneficial to the WCAT system to have data limitations and availability addressed as a main category for each step. This would help the user to better understand what they can do with the data for each section and to help them to find alternatives to address any data limitations.

3.2.4 With respect to the Assess Watershed Conditions Section

Thorough presentation and organization of information: Average= 7.667
Word content was easy to read/understand: Average = 7.667
Ease of following step instructions: Average = 7.833
Explanation of step instructions: Average = 7.833
Ease of use when working with the Digital Watershed system: Average = 8

Response: An advisory group member made a comment about the ReVA tool within our Digital Watershed system. He felt that the ReVA statistics were misleading. More specifically, the scale at which they are presented makes them seem inaccurate. Currently, when you click on the ReVA tool within Digital Watershed a list of parameters for your current watershed is displayed. For each parameter there is a map that when clicked upon will display the parameter for the whole region. The advisory group member is referring to the size of the map that is displayed. Rather than show the entire region, he wanted to be able to scale down to the sub-basin level. This would allow for more accuracy and would accommodate a user that has a smaller watershed.

This advisory group member had similar comments about the ATtILA tool that is utilized in this step section. The ATtILA tool is based on the 8 digit HUC scale which does a decent job of covering statistics for the whole watershed. Currently, when you click on the ATtILA tool within Digital Watershed, several important land-cover statistics for your chosen watershed are calculated and then displayed in a new window. He felt that there should be an option that allows the user to scale down to the smaller sub-basin watersheds in order to address greater accuracy of the system. Furthermore, he suggested we include a description of the ATtILA categories and how they relate to one another so that there is no confusion.

3.2.5 With respect to the Estimate Pollutant Loads Section

Thorough presentation and organization of information: Average = 8
Word content was easy to read/understand: Average= 7.833
Ease of following step instructions: Average = 7.667
Explanation of step instructions: Average = 8
Ease of use when working with the L-THIA tool: Average = 8
Ease of use when working with the HIT tool: Average = 8.167

Response: The advisory group really loved working with the L-THIA tool and felt that it was very easy to use. One member, who represented a local environmental consulting firm, commented that the L-THIA results could not be any more reliable than would be produced by a consultant if they were supplied with the same background information.

3.2.6 With respect to the Evaluate Options Section

Presentation and organization of information was thorough and complete: Ave = 7.33
Word content was easy to read/understand: Average = 7.833
Ease of following step instructions: Average = 7.833
Explanation of step instructions: Average = 8
Ease of use when working with the HIT system: Average = 8.167

Response: The WCAT advisory group felt that this section was the weakest as a whole. They would like to see more models/tools added to this section. Our HIT tool provides evaluation of before and after scenarios in regards to BMP implementation. However, they would like to see other types of evaluation included. Additionally, the advisory group felt that this section of the WCAT system is too focused on agriculture. The tools provided in this section are not broad enough for urban and residential neighborhoods. They suggested linking this section up to the Region 5 Social Indicators Project (SIDMA on-line tool) which is located at the following address: http://35.9.116.206/si/index.asp The Social Indicators Data Management and Analysis (SIDMA) tool organizes, analyzes, and visualizes social indicators related to nonpoint source management efforts through statistical and spatial relationships. A member of our WCAT development team is currently involved with this project. We will continue to develop a strategy as to how we will include the SIDMA project into our WCAT system once it is finished.

3.2.7 Question about Digital Watershed User Friendliness

The IWR's Digital Watershed is the platform base of the WCAT system. It is important that the DW tool be easily understood and as user friendly as possible. On a scale of 1-10, with 1 being the lowest, please rate the Digital Watershed's user friendliness. Please explain. Average = 7.5

Response: Some members of the advisory group had issues with navigating the Digital Watershed tool and felt that the system was slow to refresh when loading up data. As with any GIS program, the amount of time it takes to load up spatial data can vary depending on the size and scope of the data layer. The type of internet connection will also affect how long it takes to load up. This is something we cannot change. Additionally, our advisory group felt that there should be some sort of tutorial that explains both the functionality and GIS Toolbox of the Digital Watershed system in greater detail. This suggestion has been mentioned before in previous WCAT team meetings and is definitely something we have been thinking about for quite some time. We intend on incorporating a comprehensive tutorial into the Digital Watershed System over the next few months. This tutorial is discussed in more detail under **Section 4.3** of the Future & Ongoing Improvements section of this report.

3.2.7.1 Question about GIS Toolbox of Digital Watershed

The GIS Toolbox of the Digital Watershed allows the user to manipulate the data layers of the map. On a scale of 1-10, with one being the lowest, please rate your level of difficulty when working with the tools of the GIS Toolbox. (**A rating of 1 would indicate no difficulty while a rating of 10 would indicate a very high level of difficulty**) Please explain. Average = 2

Response: Several advisory group members felt that the zoom tool and the pan tool in Digital Watershed needed to be re-worked. In its current state, the zoom tool does not allow the user to define a box area to zoom down to. Letting the user set the parameters of the zoom will allow for greater accuracy and control of the map interface. The pan tool also lacks user control. Currently, the pan tool functions simply by clicking on the area of the map that you would like the viewpoint

to shift towards. The advisory group suggested that there should be a drag feature incorporated into this tool. For example, when you want the map to pan to the left you should be able to click on the left side of the map while holding down the mouse button. Then, as you drag the mouse pointer to the right, the map should begin to move in that direction. This way, the user can judge how far they want the map view to move, resulting in greater accuracy and more user control.

3.2.7.2 Question about Data Layers of Digital Watershed

The data layers of the DW system provide many types of watershed information. On a scale of 1-10, with one being the lowest, please rate the data layers with respect to the following attributes. Please explain.

Ease of use: Average= 8.167
Ability to understand the information presented: Average = 8
Names of data layers appropriate (i.e. you can tell what type of information will be displayed based solely on the name of the data layer.): Average = 8.33
Links to the meta-data (background info about the data layer) are informative: Average = 7.833

Response: As a whole, the comments on this portion of the survey were very good. The advisory group had no problem understanding the data layers and what they represent. However, we did receive a few comments that some of the links to the data layer Meta data were broken or unavailable. We are now aware of which links need to be updated and plan to fix these issues over the next few months.

3.2.7.3 Question about Digital Watershed Improvement

If there was anything about the Digital Watershed tool that you felt needed improvement or if you have any other comments about the tool, please do so here.

Response: A member of the advisory group that specializes in GIS spatial data suggested that we look at updating the Soils data layer in Digital Watershed. Currently, the Soils data set that is used in DW is the State Soil Geographic Data Set (STATSGO) set. The STATSGO database is a digital general soil association map developed by the National Cooperative Soil Survey. It consists of a broad based inventory of soils and non-soil areas that occur in a repeatable pattern on the landscape and that can be cartographically shown at the scale mapped. More information on the STATSGO Soils data layer can be found here: http://www.epa.gov/waterscience/basins/metadata/statsgo.htm He suggested that we replace the STATSGO data set with the richer, more detailed, Soil Survey Geographic Database (SSURGO) data set. The SSURGO data set is derived from detailed soil survey maps at scales between 1:12,000 to 1:63,000. Information from soil survey sheets is recompiled onto a 3.75 minute digital orthophoto quarter quadrangle, a 7.5 minute digital orthophoto quadrangle or other planimetrically accurate base map, producing geo-referenced data compatible with GIS programs. The soil map units are linked to the attributes in the Map Unit Interpretations Record (MUIR) relational database, which includes over 25 physical and chemical soil properties and interpretations for use, as in STATSGO. More information on the SSURGO data set can be found here: http://soils.usda.gov/survey/geography/ssurgo/description.html. We will have the appropriate WCAT team member look into this suggestion over the next few months. Making a

change like this requires a large amount of programming/editing work which is a task that could take several months to complete.

3.2.7.4 Question about WCAT Website Design

The overall design/structure/layout of the WCAT website is visually appealing to the eye.
Rating and Explanation: Average = 8.33

3.2.7.5 Question about WCAT Font

The WCAT website utilizes a font color scheme that compliments the overall layout and is easy to see.
Rating and Explanation: Average = 8.167

Response: A few members of the WCAT advisory group felt that the color scheme of the WCAT website might make it difficult for some users to read the text. Currently, the WCAT website displays text as dark blue on a light blue background. They also suggested that we use a larger font size. This issue can be easily addressed as we continue to improve the WCAT website in the coming months.

3.2.7.6 Question about WCAT Format & Layout

The format or layout for each step of the WCAT is easy to follow. (i.e. you don't get lost when working through the content for each step.).
Rating and Explanation: Average = 8.167

Response: The advisory group commented that they really enjoyed the structure of the tasks for each step in the WCAT system. The expandable headings/tasks made the WCAT very accessible and organized. They also felt that this organization made it very easy to make the transitions over to Digital Watershed and the other tools/models.

3.2.7.7 Question about WCAT Headings

The headings for each step of the WCAT are clearly visible and appropriately labeled.
Rating: Average = 8.5

3.2.7.8 Question about WCAT Hyperlinks

All hyperlinks work correctly and are up to date.
Rating: Average = 9.33

Response: Several of the advisory group members commented that the links associated with the ReVA system took several minutes to load up. We don't feel that the links are necessarily broken. We think it has more to do with the server that the ReVA system is requesting information from. This issue will be investigated by the appropriate WCAT team member.

Figure 3.0 Project Log-In Page New User

4.0 Future & Ongoing Improvements

4.1 Project Log-In Development

Over the next few months we will continue to develop the WCAT Log-In feature and improve upon its functionality. The following paragraph describes the Project Log-In page in its current state.

When a first time user clicks on the "Project Log- In button" they will need to create a new user account (**See Figure 3.0**). To create an account, they will need to click on the hyperlink labeled, "No account login? Click here to create an account." They will then be asked to provide a user name, password, and contact name (First and Last Name). Once the proper information has been filled in, the user will need to click on the blue button labeled "Review". The user will be then be prompted to verify that the information is correct before clicking on the blue submit button. The webpage will reload and prompt the user to fill in more detailed information. The following information is required: Contact Title, Business Name, Address, Watershed, County, Phone number, Email, and Website if applicable. Once the user fills out this information they will be taken back to the Project Log-In page, where they will be required to enter in their new user name and password.

Once the user provides their password and user name they will be taken to the Project Log-In Homepage (**See Figure 3.1 below**). While at the homepage, the user is presented with several options. They can edit their profile information, add a new watershed assessment plan, open an existing watershed management plan, or they can log out.

To create a new watershed assessment plan, the user will click on hyperlink labeled, "Add New Watershed Assessment Plans." The Watershed Plan Creation Page will then load up (**See Figure 3.2 below**).The user will need to type in the name of their watershed and then select the county that their watershed lies in from the drop-down box. Once the user is satisfied with their

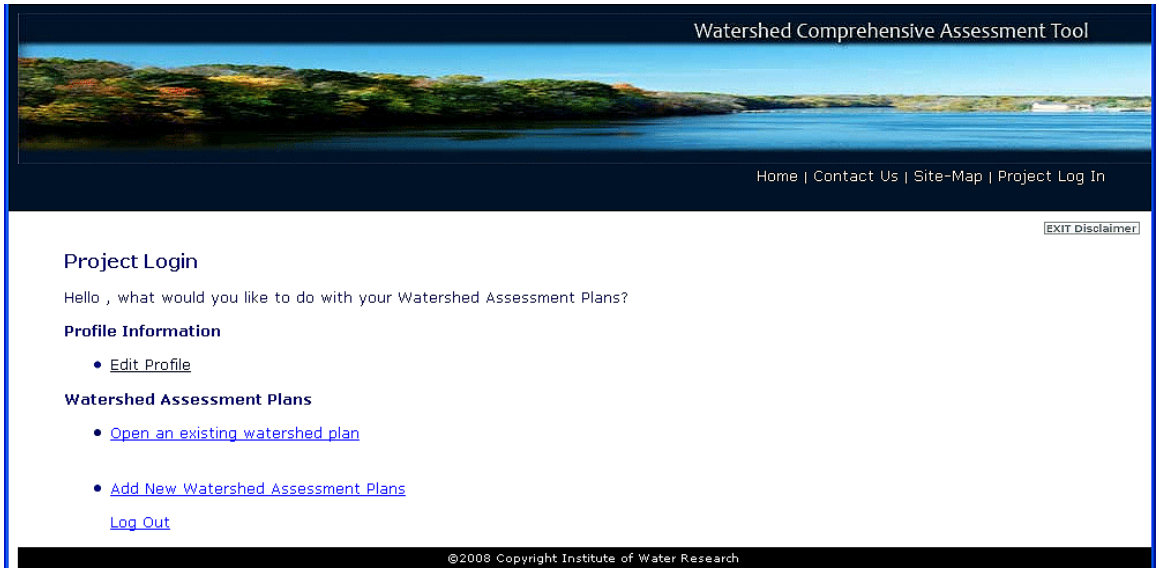


Figure 3.1 Project Log-In Homepage

information, they need to click the "review button" which will then take them back to the Project Log-In homepage. Now the user can click on the hyperlink labeled, "Open an existing watershed plan." which will take them once again to the Watershed Plan Creation Page. This time the user will see the name of their new watershed plan. To begin adding information to their watershed plan, the user will need to click on the name of their watershed, which is now hyperlinked.

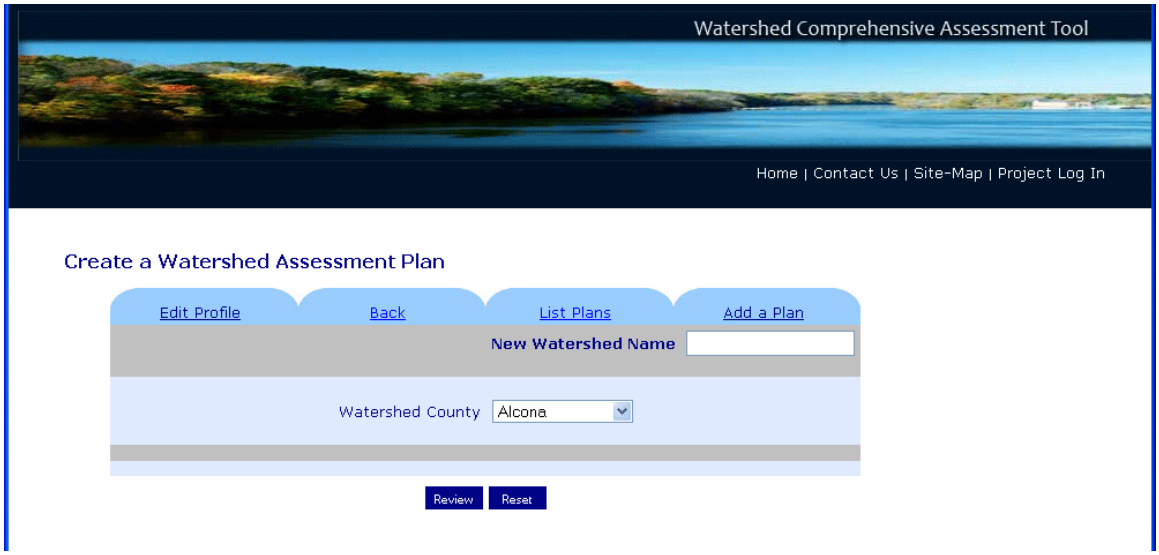


Figure 3.2 Project Log-In Watershed Plan Creation Page

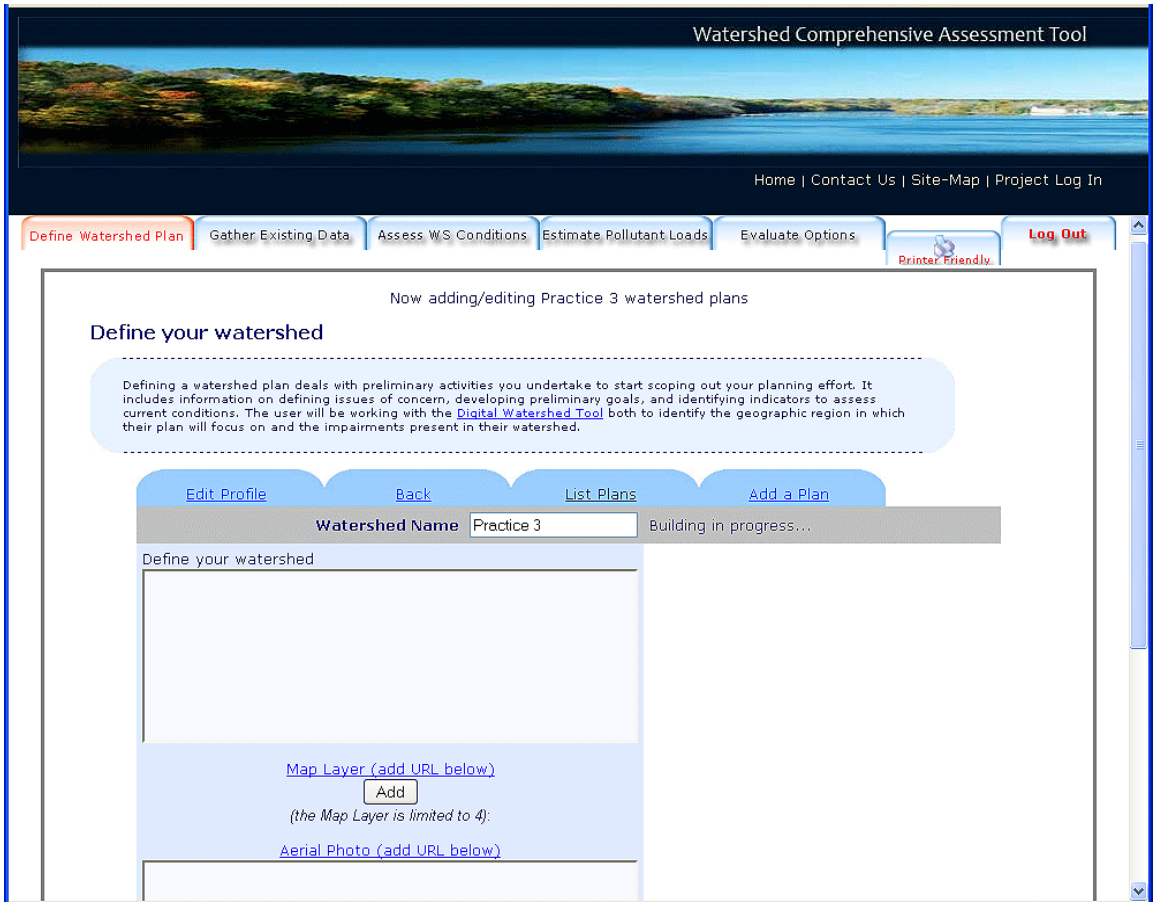


Figure 3.3 Project Log-In Watershed Plan Notes Page

They will then be taken to the Watershed Plan Notes Page (**See Figure 3.3**). The top section of this page lists each step of the WCAT system. (The name of each step matches the name of each tab in the WCAT system.) It also includes a button for printing and a button to log out. The step that the user is currently working on will be highlighted in red. The center of the page will contain a description of that step, an area to write notes, and an area to save map images. The top most box, in the center of the page, is the area reserved for note taking. As the user works through the WCAT system, they will be generating maps through the Digital Watershed Tool.

Within the DW system, there is a tool called, "Fetch Map Images." This tool will generate a map copy of whatever is currently being displayed in the DW map interface. This copy opens up in a new window with a unique URL code. In order for the user to save this map within the Project Log-In, they will need to copy the unique URL code and then paste the code within the map code area of the Watershed Plan Notes Page. (The map code area of the Watershed Plan Notes Page is the second box down in the center of the page. To make this box visible, the user will need to click the "Add button." The user can add up to 4 different unique URL codes here.) If the user is adding a map image from Digital Watershed that also contains an aerial photo, two boxes will appear when clicking the "Fetch Map Images" tool in Digital Watershed. The user will need to copy the unique URL code from the window that contains the aerial photo layer and paste it in the third box of the Watershed Plan Notes Page. When the user is finished adding notes and map URL codes, they will need to click on the blue button labeled "Review." Once the user clicks this button, any notes and mini versions of the added maps will show up on the right side of the

webpage. If the user made a mistake or would like to add additional notes and maps, they can make any necessary changes just like before. When the user is finished working on a particular step, they can click on the name of the next tab that they would like to work on. The user will follow the same outline for each step of the WCAT system. At any time, the user has the option to print out the notes and map images that they are working on. On the top of the webpage, in the far right corner, there is a button labeled "Printer Friendly" When the user clicks this button a new window will load up displaying the notes and map images in chronological order for each step of the WCAT system. When the user is finished working on their watershed plan, they can click the "Log Out" button located on the top right side of the page. The user will be then be brought back to the Home Page of the WCAT website.

We feel that the foundation of the Project Log-In portion of the WCAT system has been solidly and intuitively developed. As mentioned, the Project Log-In feature was not an original project task requirement. We felt that this feature could serve as a compliment to the EPA's Watershed Plan Builder. The Project Log-In feature gives the user the option to save notes and maps so that they can print them off and incorporate the information into the Watershed Plan Builder outline. This will ensure that the user will truly have a comprehensive report.

We did receive several comments on the Project Log-In feature from our WCAT advisory group. Several members felt that the copying and pasting portion of the Project Log-In put too much responsibility on the user for it to be viable. In other words, the advisory group felt that this process opens the door for user error and another method should be implemented if possible. Currently, this is the best method for capturing and saving images from our Digital Watershed system. Over the next few months we will try and figure out an alternative method for capturing and saving map images. It has been discussed that with the proper coding, the process of copying and pasting the map URL's could be automated, thereby decreasing the chance for user error. However, this will take some time to investigate and put into action.

4.2 Social Tools & BMPs to Improve Water Quality

As previously mentioned in **Section 2.7.2** of this report, we spent quite a bit of time researching and exploring websites that could provide us with solid examples of social tools and BMP's to improve water quality. We now have this information and it's just a matter of incorporating it into the WCAT system. Currently on the WCAT website there is a tab labeled "Social Tools/BMP's." This tab will contain the Social Tools and BMP's examples and links to websites with this information. We would like to link these websites to our WCAT system in a way that continues to follow our current design scheme.

There will be four expandable headings within this tab that covers the following main topics; The importance of BMP's/Social tools and how they can be used to improve water quality; PDF's/documents/links that demonstrate common examples of master plans, zoning rules, setbacks, and ordinances to improve water quality; Examples/Discussion of past successful projects that utilize BMP's/social tools to improve water quality and; Methods and practices that individuals can incorporate at home to improve water quality. Just like before, there will be tasks for the WCAT user to work through for each of these sections. This method ensures that the user will be exposed to solid examples of BMP's and social tools used to improve water quality.

As we begin to make these proposed changes, we may decide to add additional content and headings to this section. We hope to get more feedback over the next few months from other MSU faculty members who are familiar with BMP's and social tools to improve water quality. We also plan to continue to use the WCAT advisory group to evaluate the changes to this section of the WCAT system. We will begin adding content to this section of the WCAT system in the coming months.

4.3 Future GIS Data Layer Improvements and Tutorial Added to Digital Watershed.

The WCAT advisory group made several great suggestions to help improve our Digital Watershed tool, which is the platform base of the WCAT system. These suggestions have to deal specifically with the GIS data layers of the DW system and its user friendliness. The following paragraph discusses the improvements and additions that we would like to make to the Digital Watershed Tool based on the feedback that we received from the WCAT advisory group.

4.3.1 Land Use 2001 Data Layer

Currently in Digital Watershed we have a data layer called, "Land Use 2001". This data was downloaded from the Multi-Resolution Land Characteristics Consortium (MRLC). The MRLC is a group of federal agencies who began collaborating in 1993, pooling resources to assemble satellite imagery for the lower 48 United States. They developed a comprehensive database called the National Land Cover Datasets, mapping 21 types of land cover that seamlessly covers the U.S. The MRLC website is located at the following address: http://www.mrlc.gov/index.php The MRLC provides land cover data for 1992 and 2001. The National Land Cover Database 2001 is a Landsat based land cover database with several independent data layers. Primary components in the database include; Normalized imagery for three time periods per path/row; Ancillary data including 30m DEM, slope, aspect and a positional index; Per-pixel estimates of percent imperviousness and percent tree canopy; 21 classes of land cover data derived from imagery, ancillary data and derivatives using a decision tree; Classification rules, confidence estimates and metadata from the land cover classification.

The land cover data that we currently use in our Digital Watershed system is the 2001 data set. We did some processing work on this data set before incorporating the data into the DW system. The "Land Use 2001" data layer in DW displays the following land cover types: Water, Developed (Low to Medium), Developed (High Intensity) Barren Land (Rock/Sand), Forest, Shrub, Grassland, Pasture/Hay, Cultivated Crops, Wetlands, and No Data. Currently, the "Land Use 2001" data layer in DW only covers the Great Lakes Basin. We would like to download the 2001 land cover data set for the whole United States and incorporate the data into DW over the next few months. For more information on the 2001 land cover data please read the following PDF document: http://www.asprs.org/publications/pers/2007journal/april/highlight.pdf.

4.3.2 Land Cover 2001 Impervious Surface Data Layer

As mentioned, the 2001 land cover data set has the capability to display per-pixel estimates of percent imperviousness. The impervious surface data classifies each pixel into 101 possible values (0%-100%). Low percentage impervious is in light gray with increasing values depicted in darker grey and the highest value in pink and red. White areas have no impervious surface. The 2001 impervious land cover data set is available for download at the national scale. Several members of the advisory group felt that we need more data sets in Digital Watershed that deal with urban impacts. Impervious surfaces are a major contributor to non-point source pollution. It would be very beneficial for a WCAT user to be able to see which areas of their watershed contain the highest percentage of impervious surfaces. We would like to download this data on a national scale and incorporate it into Digital Watershed over the next few months.

4.3.3 Wetlands Inventory Data Layer

Several members of the WCAT advisory group suggested that we add a wetlands data layer to Digital Watershed. As previously mentioned in the Recommendations from Advisory Group

Section 3.0 of this report, the wetlands data layer that we currently have in Digital Watershed is only available for Michigan. We would like to add a wetlands data layer to DW that covers the whole United States. The U.S. Fish and Wildlife Service National Wetlands Inventory was the first solution that came to mind.

The U.S. Fish and Wildlife Service is the principle Federal agency that provides information to the public on the extent and status of the Nation's wetlands. Their website is located at the following address: http://www.fws.gov/wetlands/. The U.S. FWS has developed a series of topical geo-spatial maps to show wetlands and deepwater habitat and is available for download. This data covers the lower 48 states of the U.S. The name of this data set is the USFWS_WMS_CONUS_Wetlands layer and the Meta data is available at the following address: http://www.fws.gov/wetlands/data/metadata/wetland_polys.htm. Since the FWS no longer accommodates custom downloads, we will have to download the data one state at a time. Since this is the case, it may take a bit longer to incorporate this data into our Digital Watershed tool. We would like to download this data and incorporate it into our DW system in the near future.

4.3.4 Digital Watershed Tutorial

Several members of the WCAT advisory group were a bit confused when working with the Digital Watershed Tool for the first time. They specifically had trouble working with the data layers and felt that the GIS toolbox needed to be explained in more detail. For quite some time now, our organization has talked about setting up a comprehensive tutorial for the DW tool. With the upcoming launch of the WCAT system, we feel that it is now imperative that we put this discussion into action. We would like to design a tutorial that covers three main concepts of the system; The GIS Toolbox, the map data layers, and the map interface. Within this detailed description, we will walk the user through the system beginning with the homepage of Digital Watershed. To compliment this detailed walkthrough, we would like to have a Frequently Asked Questions page that addresses the most common issues face by Digital Watershed users. If a particular question is not covered on this page, we will provide a virtual "submission box" that will allow users to send us their questions and comments. The identity of the user who is asking the question will remain anonymous to avoid any possible complications. We hope to complete this comprehensive tutorial in the coming months.

5.0 Closing Statements & Conclusion

There is great need for accurate geospatial data to develop effective watershed management plans. Although many online data sources offer web-services that freely distribute this data, it is difficult for a user to access, view and analyze watershed-scale geospatial data without extensive GIS capabilities, even though it is a vital step to identify critical areas or pollution sources in a watershed. The Watershed CAT, as described in this report, fills this gap in watershed management by assembling a variety of data viewers and web-based tools to analyze watershed data more efficiently and with more detail. Combining these web-based tools/data viewers with the guidance of the EPA Watershed Plan Builder and the EPA Watershed Handbook will enable users of the WCAT system to develop a complete and more comprehensive watershed plan document. As we look further down the road, our organization plans to implement a pro-active management strategy. This strategy of continuous product evaluation will ensure the success of the WCAT system well into the future. The input and feedback we receive from our advisory group and the users of the WCAT system will help us to fulfill this highly adaptive strategy.

6.0 Appendix

User Needs Survey for WCAT

Purpose for this survey:

The Institute of Water Research at Michigan State University has been funded by the U.S. EPA to develop a web-based tool called, "Watershed Comprehensive Assessment Tool" (WCAT) that will synthesize existing web-based tools that can be used in the development of a watershed management plan. Although there are many tools already available online, there has been no coordinated effort to place these tools in the context of the watershed planning process. The primary goal of the WCAT is to facilitate the seamless use of web-based watershed management tools by watershed managers. This survey will provide our organization with valuable information from an average user's point of view, and will help us to make sure that our system is as informative and user friendly as possible. Please take a generous amount of time to complete this survey. Your input and time spent on this survey is much appreciated.

Background and purpose for the WCAT system:

With the publication of its 2008 Handbook for Developing Watershed Plans to Restore and Protect Our Waters (referred to as the EPA Watershed Handbook), the EPA has taken a critical step in promoting the development and implementation of effective watershed plans to protect water quality. This handbook describes science-based, watershed management methods and techniques to improve and protect water quality. These methods and techniques require extensive amounts of data and sophisticated decision support tools to analyze data and measure the results of actions. Knowing how to acquire relevant data and how to use appropriate analytical tools can be a formidable and labor intensive task. The need for structure and guidance when tackling this task is clear. The WCAT directly addresses this need.

The WCAT is designed to provide A Web-based, multifunctional, scalable watershed data analysis and decision support system to support the development and implementation of effective watershed management plans. This framework of GIS based watershed information and analytical tools will connect landscape dynamics with stressors, pollutant types, water quality, and water body monitoring. The WCAT system will provide a foundation for understanding the complexity of watershed functions and human behavioral impacts on water quality. It will provide a sustainable framework for a national watershed data and analysis system, and will be deployed on the Web to support and facilitate watershed organizations work to develop and implement effective watershed plans and achieve water quality objectives across the United States. Once the WCAT is complete, users will have access to "one stop shopping" for essential GIS-based watershed data and decision support tools to support watershed planning and implementation functions.

Please answer the following questions so that we can learn more about your user background.

1. Have you ever used a GIS system or tool? If so, please briefly explain.

2. On a scale of 1-10, with 1 being the lowest, please rate your level of experience with GIS systems/tools?

3. On a scale of 1-10, with 1 being the lowest, please rate your knowledge level/experience with respect to watershed management? Please explain.

4. In 2-3 sentences, tell us a bit more about your educational background. Please mention any prior experience/knowledge/training that is related to watershed management and GIS systems/tools.

For each of the following questions, please select the most appropriate rating based on your experience with the Steps portion of the Watershed Comprehensive Assessment Tool. The rating system is on a 1-10 scale.

With respect to the Explore WCAT Section
Thorough presentation and organization of information:
Word content was easy to read/understand:
Rationale for watershed planning:
The purpose of the WCAT is understood:
The introduction of the WCAT system tools was thorough and informative:
Comments:

With respect to the Define Watershed Plan Section
Thorough presentation and organization of information:
Word content was easy to read/understand:
Ease of following step instructions:
Explanation of step instructions:
Ease of use when working with the Digital Watershed system:
Comments:

With respect to the Gather Existing Data Section
Thorough presentation and organization of information:

Word content was easy to read/understand:
Ease of following step instructions:
Explanation of step instructions:
Ease of use when working with the Digital Watershed system:
Comments:

With respect to the Assess Watershed Conditions Section
Thorough presentation and organization of information:
Word content was easy to read/understand:
Ease of following step instructions:
Explanation of step instructions:
Ease of use when working with the Digital Watershed system:
Comments:

With respect to the Estimate Pollutant Loads Section
Thorough presentation and organization of information:
Word content was easy to read/understand:
Ease of following step instructions:
Explanation of step instructions:
Ease of use when working with the L-THIA tool:
Ease of use when working with the HIT tool:
Comments:

With respect to the Evaluate Options Section
Presentation and organization of information was thorough and complete:
Word content was easy to read/understand:
Ease of following step instructions:
Explanation of step instructions:
Ease of use when working with the HIT system:
Comments:

For each of the following questions, please select the most appropriate rating based on your personal experience with the Digital Watershed portion of the WCAT System. Also, please briefly explain why you chose the rating that you did.

1. The IWR's Digital Watershed is the platform base of the WCAT system. It is important that the DW tool be easily understood and as user friendly as possible. On a scale of 1-10,

with 1 being the lowest, please rate the Digital Watershed tool user friendliness. Please explain.

2. The GIS Toolbox of the Digital Watershed allows the user to manipulate the data layers of the map. On a scale of 1-10, with one being the lowest, please rate your level of difficulty when working with the tools of the GIS Toolbox. Please explain.

3. The data layers of the DW system provide many types of watershed information. On a scale of 1-10, with one being the lowest, please rate the data layers with respect to the following attributes. Please explain.

Ease of use:
Ability to understand the information presented:
Names of data layers appropriate (i.e. you can tell what type of information will be displayed based solely on the name of the data layer.):
Links to the meta-data (background info about the data layer) are informative:

4. If there was anything about the Digital Watershed tool that you felt needed improvement or if you have any other comments about the tool, please do so here.

For each of the following questions, please select the most appropriate rating based on your experience with the Webpage design of the Watershed Comprehensive Assessment Tool. The rating system is on a 1-10 scale, with 1 being the lowest. After selecting a rating for each statement, please explain why you chose the rating that you did.

The overall design/structure/layout of the WCAT website is visually appealing to the eye:
Rating and Explanation

The WCAT website utilizes a font color scheme that compliments the overall layout and is easy to see:
Rating and Explanation

The format or layout for each step of the WCAT is easy to follow. (i.e. you don't get lost when working through the content for each step.):
Rating and Explanation

The headings for each step of the WCAT are clearly visible and appropriately labeled:
Rating and Explanation

All hyperlinks work correctly and are up to date:
Rating and Explanation

C. 4 Water Neutral Footprint: The Nature Conservancy/Coca-Cola

Project Overview

Introduction

In support of Coca-Cola's and The Nature Conservancy's desire to protect Michigan's Paw Paw River and remain water neutral, the Institute of Water Research (IWR) at Michigan State University developed a suite of maps and modeled outputs that display optimal locations for protection and improvement of water quality and quantity in the Paw Paw River watershed.

Previous work by Michigan TNC staff and Michigan State University partners has resulted in a tool to quantify the impacts of groundwater pumping and surface land use on a groundwater aquifer. This framework allows for groundwater recharge (replenishment) to be calculated through spatial land use changes (e.g. conversion of conventional tillage to no-till, conversion of agricultural land to grassland or wetland restoration). Here we propose to apply this tool to the Paw Paw River Watershed, with the specific outcome of more efficiently targeting our outreach efforts to farmers, for the benefit of water quantity and quality within the watershed.

The optimization maps are the product of three tool outputs, 1) Michigan's Water Withdrawal Assessment Tool (WWAT), 2) High Impact Targeting (HIT) tool, and 3) Soil and Water Assessment Tool (SWAT). The idea behind the optimization maps is to individually identify and map areas of particular interest within the watershed such as: areas at risk of high sediment loadings, areas containing agricultural row crops, sensitive areas for water withdrawal, and groundwater recharge by soil groups. Once these areas were modeled and identified, they were assigned weighting within a 30x30 meter grid cell. The weightings were summarized to provide rankings for priority locations.

Tool Methods, Procedures, and Results

<u>High Impact Targeting Tool</u>

Description

The Web-accessible High-Impact Targeting—or HIT—system is a new tool that is designed to focus limited conservation resources on the most serious erosion and pollution problems. The HIT system can be used to identify—and target—the specific areas in agricultural fields that cause the greatest volumes of sediments deposited in waterways and adversely impact water quality and aquatic habitat. The intent is to get 'the biggest bang for the buck' by maximizing the beneficial impacts from the installation of new conservation practices on the highest-risk sediment yield areas. HIT relies on advanced geographical information systems (GIS) technology and innovative applications of computer modeling. The HIT system provides data on sediment delivery and agricultural erosion presented in map formats, tables, and other graphic formats. HIT is an interactive system so users can choose the appropriate scale to visualize the GIS data on high-risk areas that are of the greatest interest to them. Users can either compare risk areas in their local watersheds or zoom down to field level and see specific farms with color-coded high risk areas.

IWR generated HIT models for the Paw Paw River Watershed. The model outputs yielded erosion and sediment loading estimates for the watershed and its sub-basins, in addition to risk

maps identifying locations (at a 30x30 meter grid resolution) within agricultural fields. IWR then utilized the HIT outputs, in conjunction with the results from SWAT and the Water Withdrawal Assessment Tool, to generate priority maps for the Paw Paw that identified the optimum locations for land cover change that would foster increased ground water recharge and improve water quality.

Methods and Procedures

In generating a HIT model, IWR assembled the necessary data to run HIT's two underlying models, the Revised Universal Soil Loss Equation (RUSLE) and the Spatially Explicit Delivery Model (SEDMOD). These data include: digital elevation models (DEMs), land cover, SSURGO soil surveys, climate data, stream locations, and crop/tillage practices. IWR utilized the Paw Paw Watershed boundary extracted from the NRCS Watershed Boundary Dataset.

We downloaded 1 Arc-second DEMs from the USGS NED website (http://ned.usgs.gov) and clipped them by the Paw Paw Watershed boundary to a yield a study-area DEM (30-meter resolution) layer.

We next downloaded NRCS SSURGO soil surveys of each county that intersected the watershed from the USDA soil data mart (http://soildatamart.nrcs.usda.gov). We then extracted 'Kffact' (rock-free K factor data) attributes from the database and linked them to the SSURGO GIS layer. We used a buffered watershed boundary to clip the polygon SSURGO layer and converted it to a GRID (raster) dataset. We then clipped K-factor grid by a mask of the DEM layer, ensuring that the K-factor grid cells were coincident with all other input grids. This process was repeated for SSURGO's Percent Clay attribute, and the resulting Percent Clay grid was used as an input for SEDMOD's calculation of delivery ratio.

Next, we downloaded stream data from the United States Geological Survey's (USGS) National Hydrography Dataset (NHD – medium resolution, nhd.gov), to burn stream location into the DEM, ensuring that the models would recognize stream locations. This process entailed raising all DEM cells not coincident with stream locations by 30 meters, forcing SEDMOD to recognize the watershed's drainage network (as opposed to a DEM derived artificial network). We then filled all spurious sinks in the DEM to enforce a full drainage network to the watershed outlet.

Generating spatially explicit C-factor data for RUSLE calculations was the most labor-intensive step in the modeling process. We linked C-factor data to the 2001 National Land Cover Dataset (NLCD; mrlc.gov). First, we identified C-factor values for most of the NLCD classes from literature and on-line reports (http://www.ganet.org/dnr/environ/techguide_files/wpb/tenn_bio_tmdl.pdf). These sources provided C values for all but the agricultural grid cells in the NLCD, the land cover class for which C factor values are most pertinent. We then exported tables from the National Crop Residue Surveys (http://www.ctic.purdue.edu/CTIC/CRM.html) into MSExcel for three separate years (2000, 2002, and 2004) for each county that intersected the watershed. These surveys provided detail on the amount of acres dedicated to a particular crop, and the amount of those acres dedicated to particular tillage practice. Studying the acreage amounts for the different crops over three years (primarily soy, corn, and wheat) enabled us to discern a likely crop rotation for each county. Next, we consulted a document created by Michigan Natural Resource Conservation Service (NRCS) which contained C-factor values, grouped by crop-management zone, for individual crops based on the previous year's planting. Using the crop-rotation we discerned earlier, we were able to plug C-factor values for each crop in a given year. For each of the three years, the C-factor values were weighted by percentage of acres used for a given crop, and percentage of acres under certain tillage practices. This generated annual C-factor values for each county, which were finally averaged over the three-year period to yield one C-factor value for the entire watershed. We incorporated the county-averaged C factor values into the agricultural cells

of the NLCD grid, while C factors pulled from literature for the other NLCD classes were incorporated into the remaining cells.

To calculate the RUSLE LS layer we followed the steps outlined by Bernie Engel of Purdue University at <http://abe.www.ecn.purdue.edu/~engelb/agen526/gisrusle/gisrusle.html>. We used an upslope threshold of 5 cells, as opposed to the 15 he recommended for a 10-meter resolution dataset.

Similar to the creation of the C-factor grid, we derived the Surface Roughness grid from the NLCD grid; but without the county-level analysis and aggregation. Land cover classes were re-classified according to Manning R values from Dr. T. Brikowski at UT-Dallas. His work is online at http://www.utdallas.edu/~brikowi/Teaching/Applied_Modeling/SurfaceWater/LectureNotes/Manning_Roughness/manning_roughness.html.

The Percent Clay, Surface Roughness, and burned/filled DEM grids were then placed in a separate ArcINFO workspace. The SEDMOD algorithm was employed within ArcGIS and produced the Delivery Ratio grid.

Next, we generated the Erosion grid. We multiplied the 'K-factor,' 'C-factor,' 'LS-factor,' and 'R-factor' grid together in ArcMap's Raster Calculator to yield a grid representing total annual erosion in tons/acre. However, the individual grid cells roughly covered 900 square meters, not an acre. Therefore the grid had to be divided by 4.497 (1 acre = 4,047 square meters, divided by 900 square meters) to determine the total annual amount of erosion per cell. This grid was then multiplied by the SEDMOD Delivery Ratio grid, and divided by 100 to get total annual sediment loading to streams for each cell.

Results

HIT estimated that 27,250 tons of sediment (out of 210,000 tons of erosion) reached the Paw Paw River and its tributaries annually, with the most at-risk areas in the west-central portion of the watershed (Figure 1). Figures 4 and 5 show the prioritization results for C soils and A soils respectively.

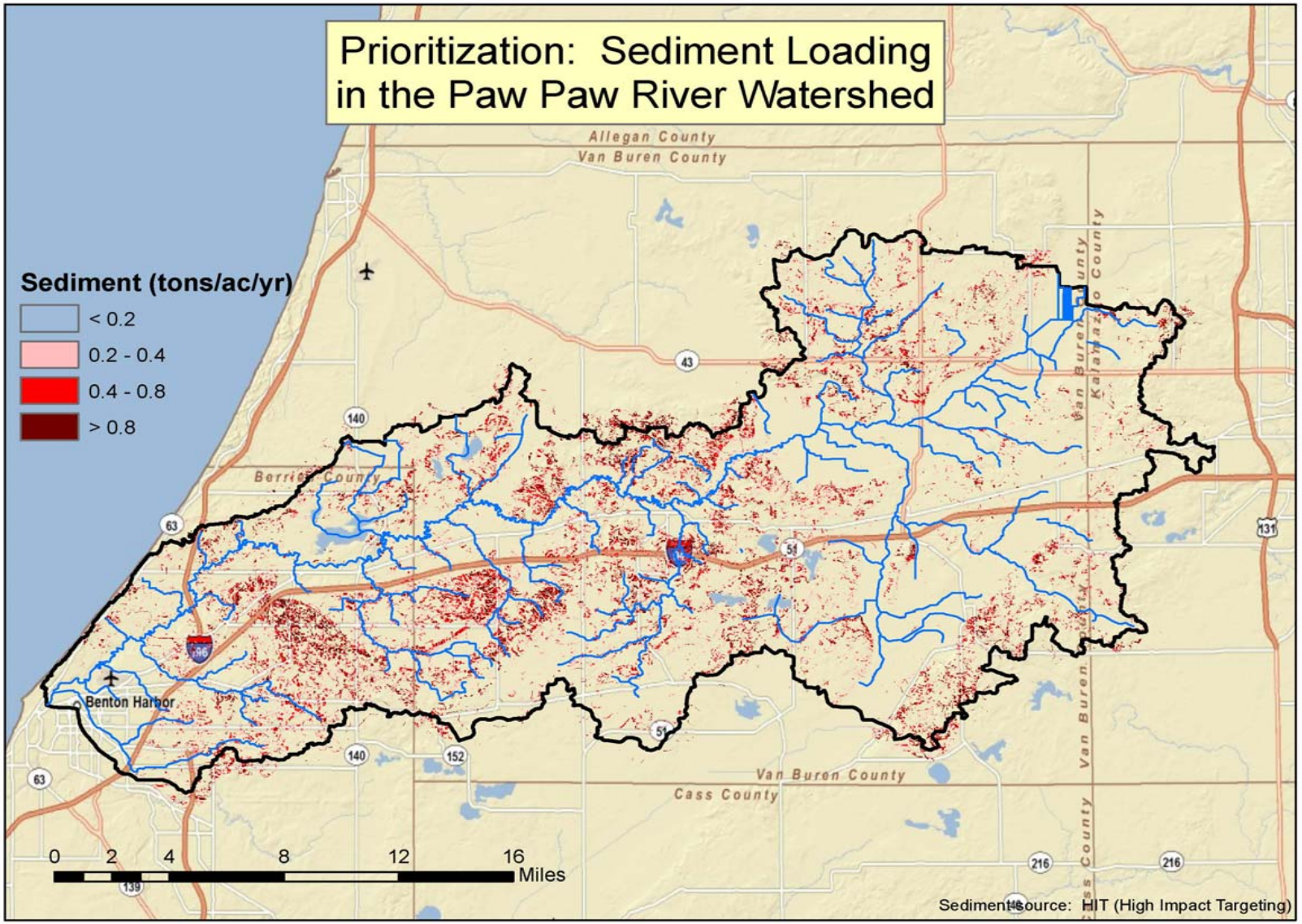

Prioritization: Sediment Loading in the Paw Paw River Watershed
Sediment (tons/ac/yr)
< 0.2
0.2 - 0.4
0.4 - 0.8
> 0.8
Allegan County
Van Buren County
Berrien County
Van Buren County
Kalamazoo County
Van Buren County
Cass County
Benton Harbor
0 2 4 8 12 16
Miles
Sediment source: HIT (High Impact Targeting)

Figure 1

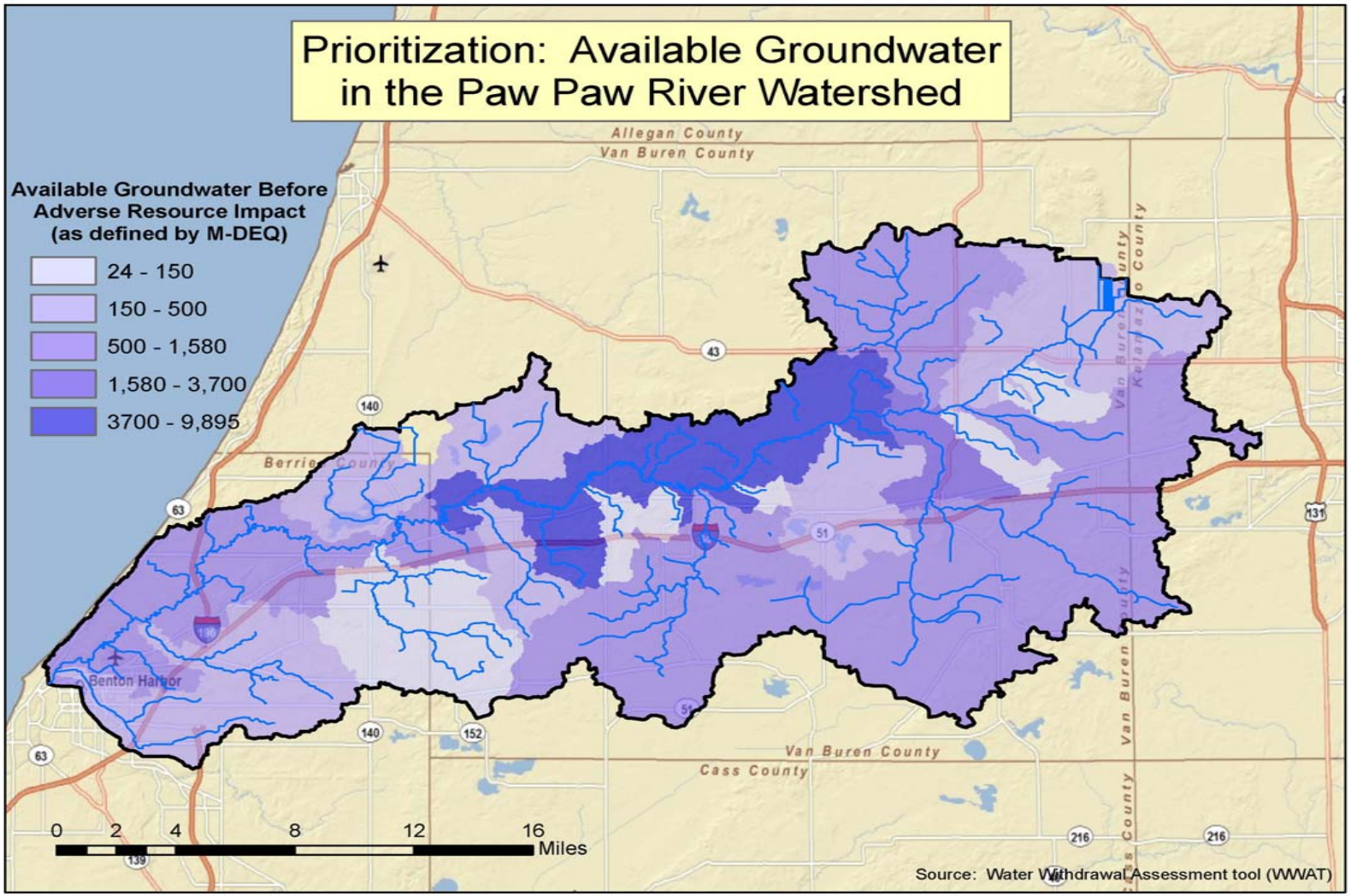

Prioritization: Available Groundwater in the Paw Paw River Watershed
Available Groundwater Before Adverse Resource Impact (as defined by M-DEQ)
24 - 150
150 - 500
500 - 1,580
1,580 - 3,700
3700 - 9,895
Allegan County
Van Buren County
Berrien County
Benton Harbor
Van Buren County
Cass County
0 2 4 8 12 16 Miles
Source: Water Withdrawal Assessment tool (WWAT)

Figure 2

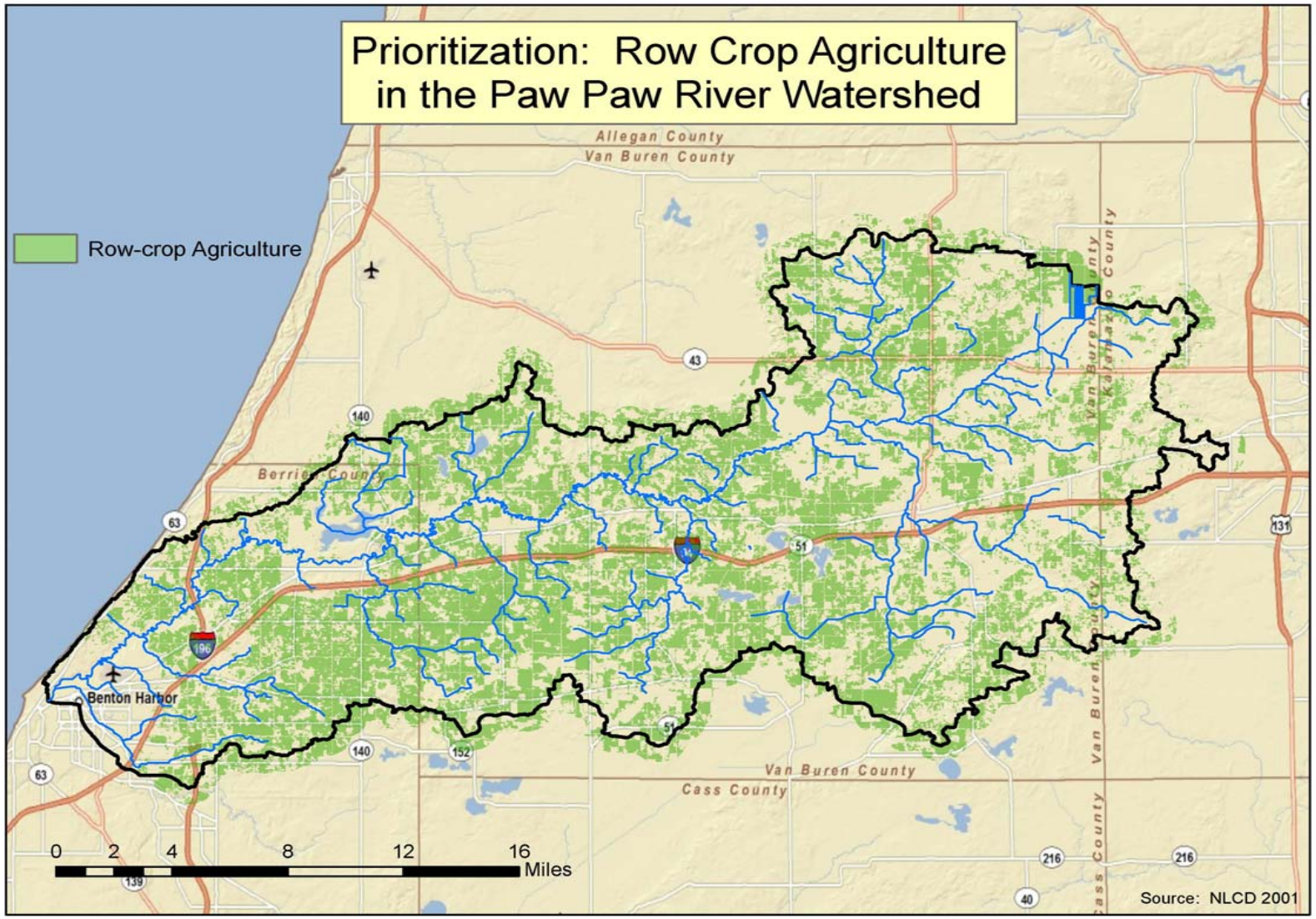

Prioritization: Row Crop Agriculture in the Paw Paw River Watershed
Row-crop Agriculture
Allegan County
Van Buren County
Berrien County
Van Buren County
Kalamazoo County
Van Buren County
Cass County
Van Buren County
Cass County
Benton Harbor
0 2 4 8 12 16 Miles
Source: NLCD 2001

Figure 3

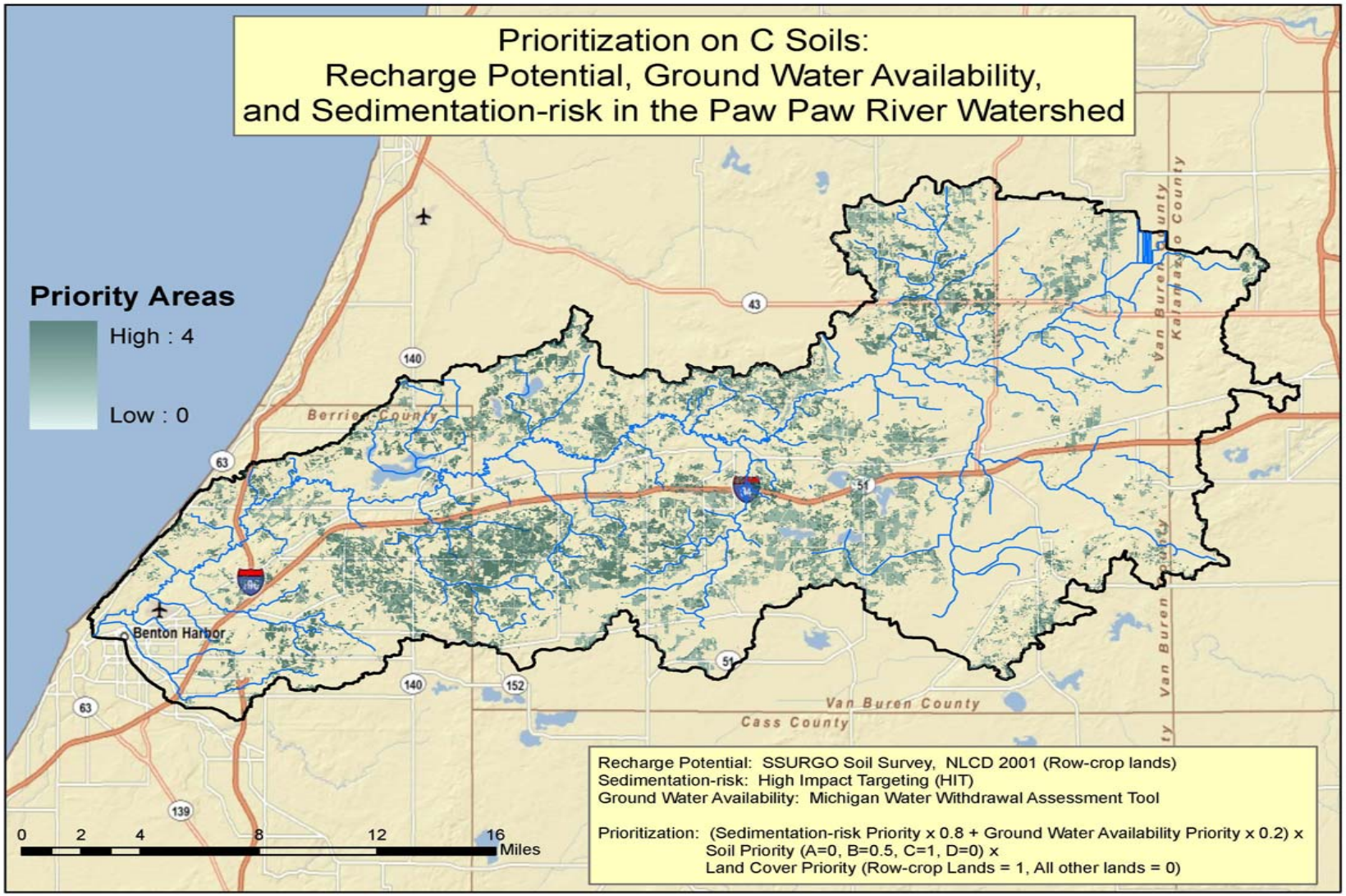

Prioritization on C Soils:
Recharge Potential, Ground Water Availability,
and Sedimentation-risk in the Paw Paw River Watershed
Priority Areas
High : 4
Low : 0
Berrien County
Benton Harbor
Van Buren County
Cass County
Kalamazoo County
Recharge Potential: SSURGO Soil Survey, NLCD 2001 (Row-crop lands)
Sedimentation-risk: High Impact Targeting (HIT)
Ground Water Availability: Michigan Water Withdrawal Assessment Tool
Prioritization: (Sedimentation-risk Priority x 0.8 + Ground Water Availability Priority x 0.2) x
Soil Priority (A=0, B=0.5, C=1, D=0) x
Land Cover Priority (Row-crop Lands = 1, All other lands = 0)
0 2 4 8 12 16
Miles

Figure 4

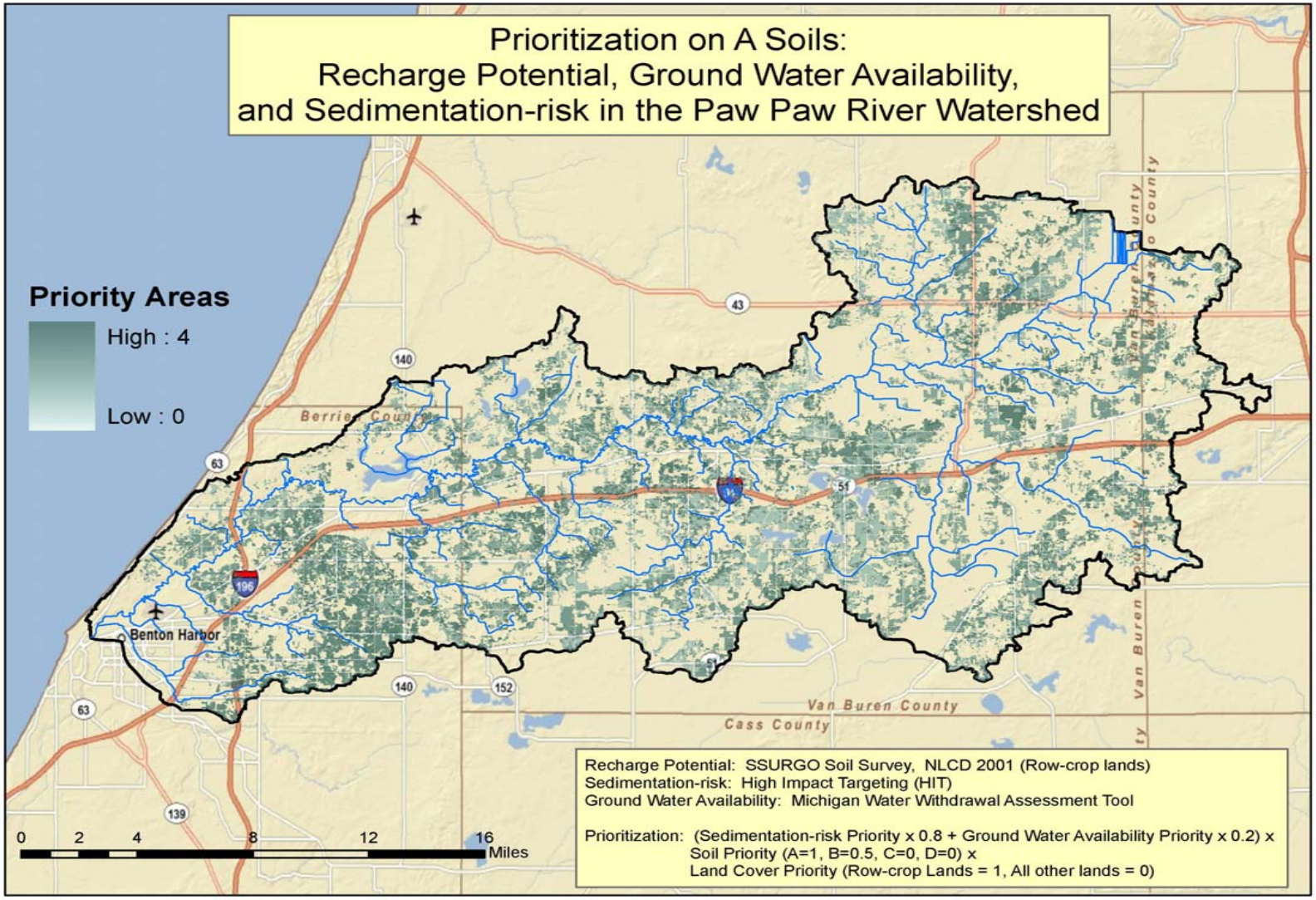

Prioritization on A Soils:
Recharge Potential, Ground Water Availability,
and Sedimentation-risk in the Paw Paw River Watershed
Priority Areas
High : 4
Low : 0
Berrien County
Benton Harbor
Van Buren County
Cass County
0 2 4 8 12 16 Miles
Recharge Potential: SSURGO Soil Survey, NLCD 2001 (Row-crop lands)
Sedimentation-risk: High Impact Targeting (HIT)
Ground Water Availability: Michigan Water Withdrawal Assessment Tool
Prioritization: (Sedimentation-risk Priority x 0.8 + Ground Water Availability Priority x 0.2) x
Soil Priority (A=1, B=0.5, C=0, D=0) x
Land Cover Priority (Row-crop Lands = 1, All other lands = 0)

Figure 5

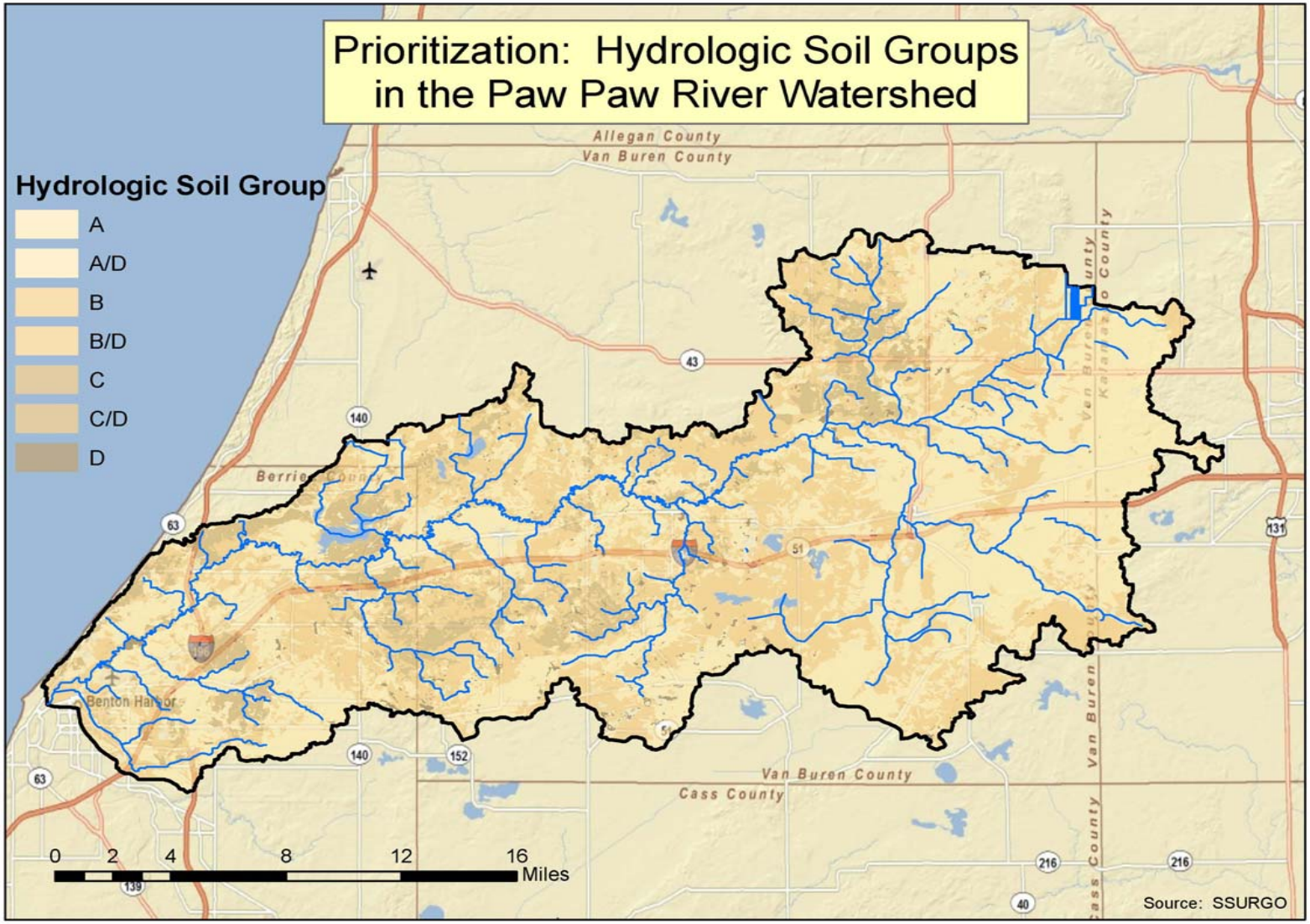

Prioritization: Hydrologic Soil Groups
in the Paw Paw River Watershed
Hydrologic Soil Group
A
A/D
B
B/D
C
C/D
D
Allegan County
Van Buren County
Van Buren County
Cass County
Benton Harbor
0 2 4 8 12 16
Miles
Source: SSURGO

Figure 6

Soil and Water Assessment Tool

Description

The Soil and Water Assessment Tool (SWAT) was developed by the U.S.D.A. Agricultural Research Service's Grassland, Soil and Water Research Lab in Temple Texas. The model was developed for the purpose of assisting water resources managers in predicting and assessing the impact of management on water, sediment and agricultural chemical yields in large, ungaged watersheds. The model is a continuous model capable of simulating many years of hydrologic period and operates on a daily time step. Recent additions allow for simulating surface runoff and infiltration using the Green and Ampt approach using rainfall data of any time increment and hourly channel routing. The SWAT model has eight major components: hydrology, weather, erosion and sedimentation, soil temperature, crop growth, nutrients, pesticides, and agricultural management. To simulate the spatial heterogeneity of land cover, topography, soil type and climate, the watershed is subdivided into a number of user delineated sub-basins. Each sub-basin is then further subdivided into individual Hydrologic Response Units (HRU) which is an individual combination of land use/cover/management, soil type and meteorological data. The daily or sub-daily water budget is computed for each HRU in the watershed. Daily surface runoff is calculated using the SCS curve number approach or hourly using the Green and Ampt method. Peak runoff rate is calculated using a modified Rational formula and the routing of in-channel flow between sub-basins is computed with Manning's equation and the Muskingum or Variable Storage Method. The meteorological input to the model consists of up to five parameters: rainfall (daily or sub-daily), daily max and min temperature, daily relative humidity, daily solar radiation, and average daily wind speed. The model is able to estimate values from missing data sets using a spatial database of values from National Weather Service stations across the U.S. and can compute potential evapotranspiration via a number of standard methods or utilize user supplied PET data.

Methods and Procedures

In this study, SWAT was used to simulate the hydrology of the Paw Paw River Watershed in Southwest Michigan. There were two specific goals of this modeling study 1) to estimate the hydrology water balance of the watershed under a current land use scenario and under a pre-settlement land use scenario and 2) create an estimate of groundwater recharge on the individual soils within the watershed under different potential land use categories and management practices.

Several datasets were required to model the hydrology of the watershed. Soils data were obtained from the USDA. The STATSGO dataset was used to model the overall hydrology of the watershed under both current and pre-settlement land uses. The SSURGO dataset was used to identify individual soil types that lie within the watershed and these soils were used in the second modeling approach.

Land use data was obtained from the Michigan Center for Geographic Information in the form of both gridded data and ESRI shapefiles. Under "current" land use the 2001 IFMAP GAP Lower Peninsula Land Cover dataset developed by the Michigan DNR was used. Land use classes identified by the MDNR data were converted to equivalent SWAT model land use classes. The 1978 Michigan Resource Information System 1800 land use data was used to simulate the pre-settlement data.

Weather data used for the modeling efforts were obtained through the Michigan Climate Office. Data was collected from the long-term National Weather Service station and Bloomingdale Michigan, north of the Paw Paw watershed. The model required daily rainfall, maximum and minimum temperature and solar data. The long-term dataset used in the modeling ranged from 1971 – 2008.

Results

The primary output of the SWAT modeling effort was estimates of percolation. In SWAT, percolation is water the infiltrates into the soil and moved down past the root zone. This water has the opportunity to then move into the shallow groundwater aquifer, feed stream baseflow or move deeper into the deep groundwater aquifer. The model estimates percolation for each combination of land use and soil type (HRU) identified in the watershed. Each of these values were averaged over the modeling time span from 1971 – 2008.

The same type of approach was taken in the second phase of modeling. Specific land use classes/management practices, along with each soil type within the watershed (where soils properties data were available), were simulated within SWAT to yield new estimates of percolation. The data were then combined for each land use/management practice and averaged within soil hydrologic group (HSG A, B, C, etc….). These data were then incorporated into the online groundwater recharge calculator.

Online Groundwater Recharge Calculator

Description

The online groundwater recharge calculator estimates the change in recharge to an aquifer based on land use/cover change and acres of land converted. The interface utilizes a map section and calculator section. The map section is built on Microsoft Bing Maps and displays the 12 digit HUC watershed boundaries, streams, and soil groups (Figure 7). The map interface works best with Mozilla FireFox. The user can zoom into parcel of land they are interested in and click the "Create New Parcel" button at the top map. The user can then single click on the corners of the property for which they wish to make land use/cover changes (double click when finished) (Figure 8). The map will automatically calculate the size the parcel and soil type(s), and then open the calculator interface.

In the calculator interface, the user can enter the current land use/cover and the proposed land use/cover. If the soil type from the selected parcel is a single soil type, and not comprised of multiple soils, the interface will select that soil group; if there are multiple soils groups, the user will have to choose a dominant type. Once these parameters are all chosen, the user clicks the "Calculate" button. This sends the parameters to a recharge look up table produced by the SWAT model. The results are displayed in graphical and numeric form displaying the change in groundwater recharge (Figure 9).

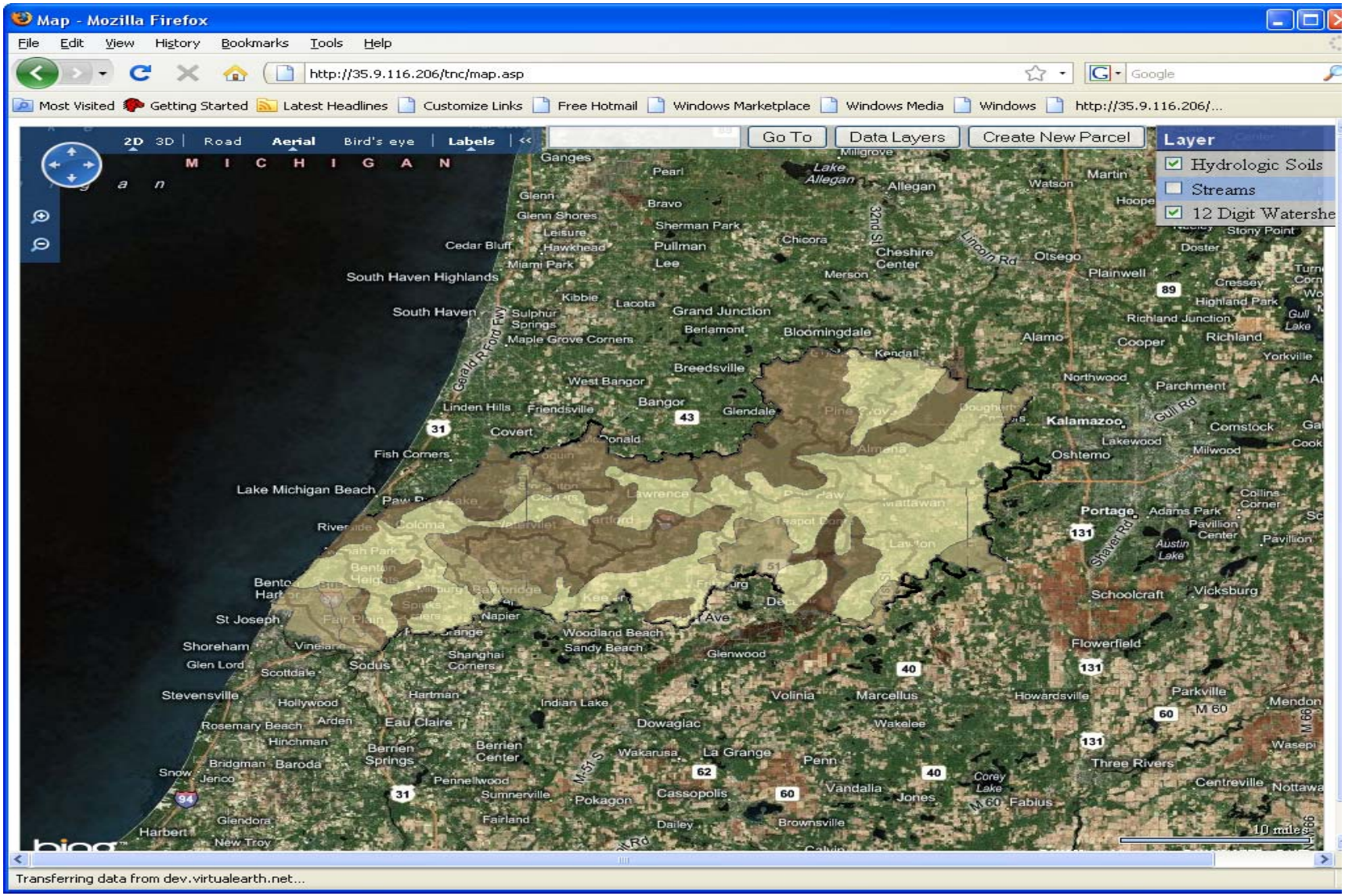

Map - Mozilla Firefox
File Edit View History Bookmarks Tools Help
http://35.9.116.206/tnc/map.asp
Most Visited Getting Started Latest Headlines Customize Links Free Hotmail Windows Marketplace Windows Media Windows http://35.9.116.206/...
2D 3D Road Aerial Bird's eye Labels
Go To
Data Layers
Create New Parcel
Layer
Hydrologic Soils
Streams
12 Digit Watershe
M I C H I G A N
South Haven Highlands
South Haven
Lake Michigan Beach
Kalamazoo
Portage
St Joseph
Schoolcraft
Vicksburg
Flowerfield
Three Rivers
Centreville
10 miles
Transferring data from dev.virtualearth.net...

Figure 7

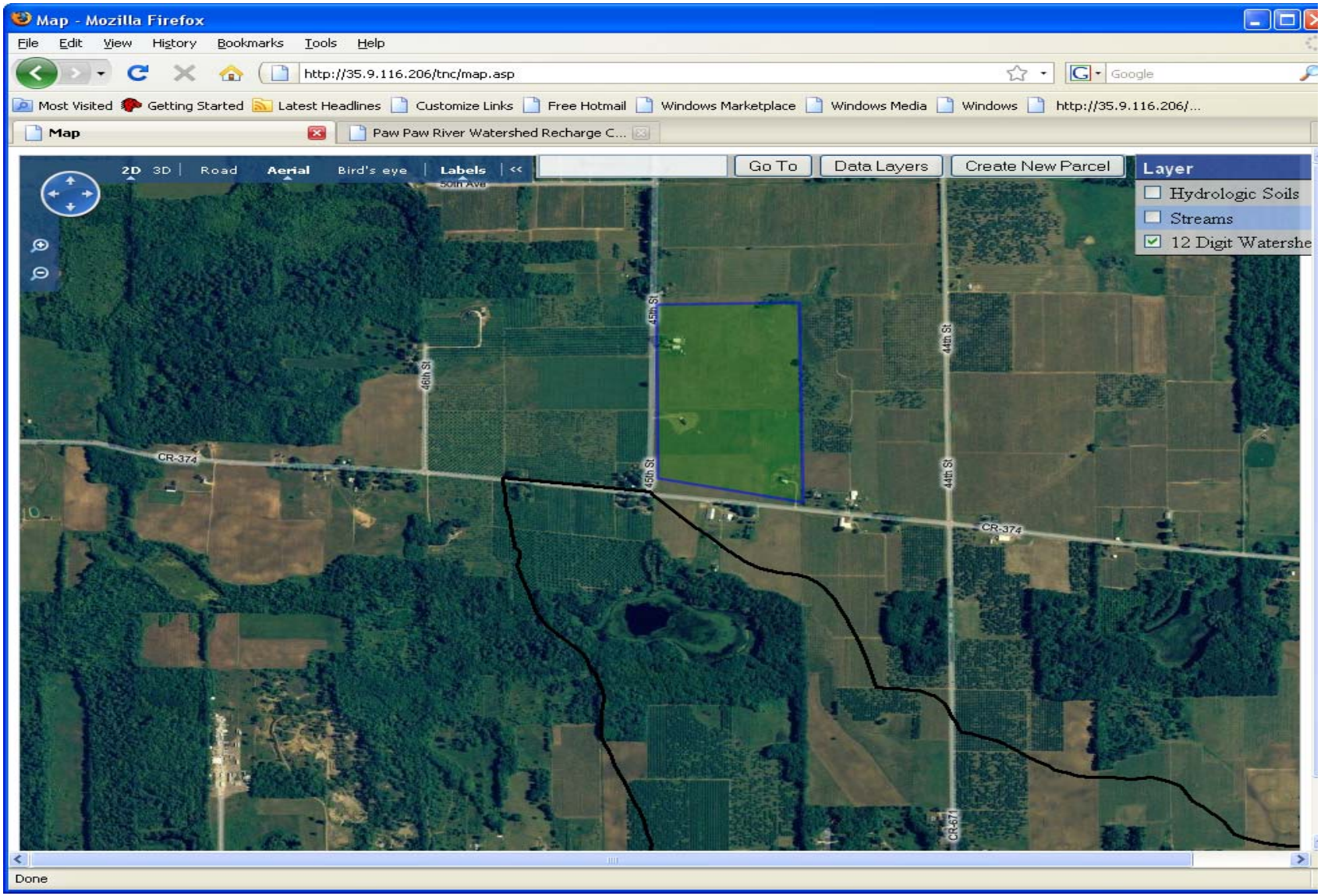

Map - Mozilla Firefox
File Edit View History Bookmarks Tools Help
http://35.9.116.206/tnc/map.asp
Most Visited Getting Started Latest Headlines Customize Links Free Hotmail Windows Marketplace Windows Media Windows http://35.9.116.206/...
Map
Paw Paw River Watershed Recharge C...
2D 3D Road Aerial Bird's eye Labels
Go To
Data Layers
Create New Parcel
Layer
Hydrologic Soils
Streams
12 Digit Watershe
CR-374
46th St
45th St
44th St
CR-371
Done

Figure 8

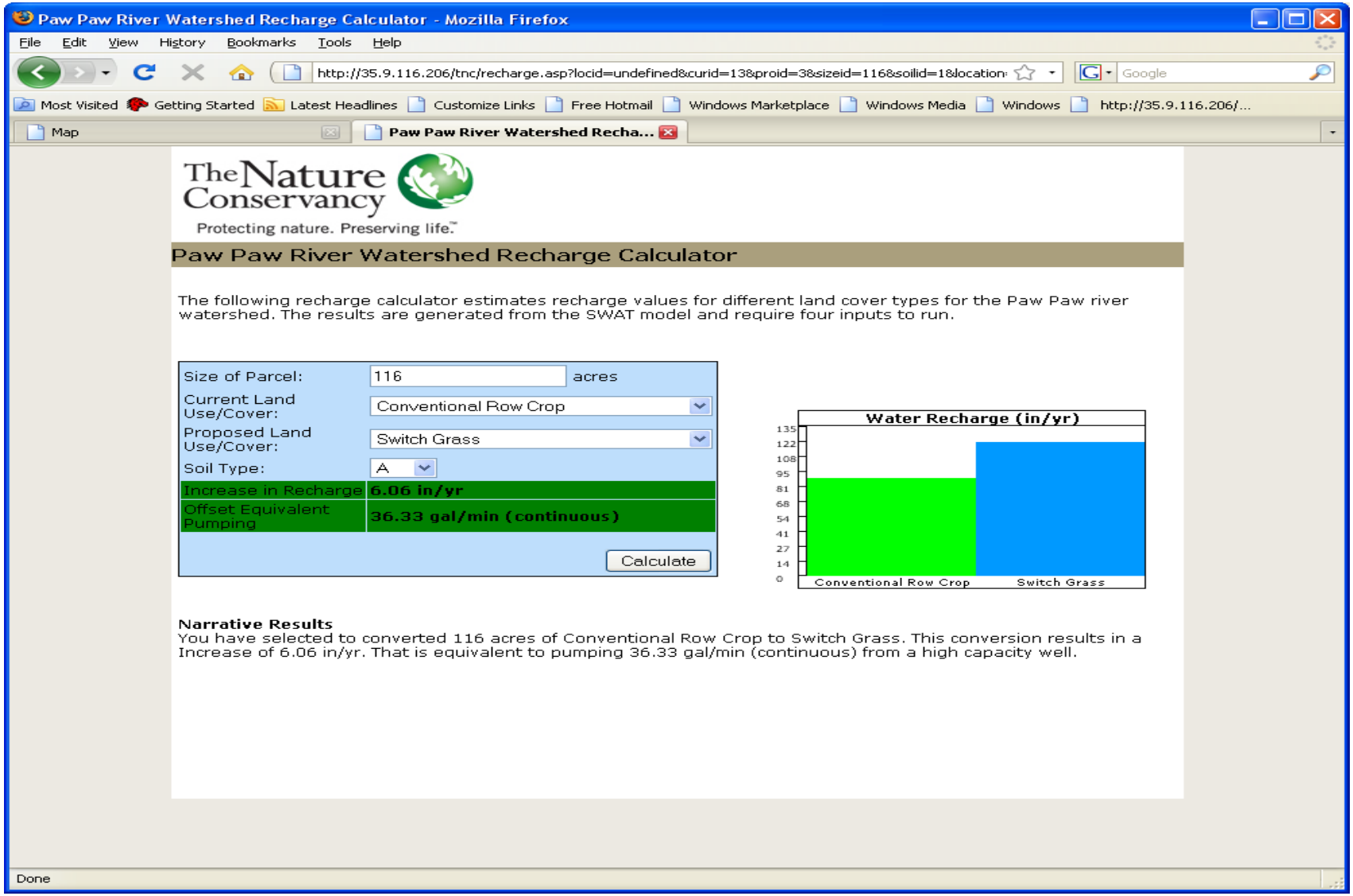

Paw Paw River Watershed Recharge Calculator - Mozilla Firefox
File Edit View History Bookmarks Tools Help
http://35.9.116.206/tnc/recharge.asp?locid=undefined&curid=13&proid=3&sizeid=116&soilid=1&location
Most Visited Getting Started Latest Headlines Customize Links Free Hotmail Windows Marketplace Windows Media Windows http://35.9.116.206/...
Map
Paw Paw River Watershed Recha...
The Nature Conservancy
Protecting nature. Preserving life.
Paw Paw River Watershed Recharge Calculator
The following recharge calculator estimates recharge values for different land cover types for the Paw Paw river watershed. The results are generated from the SWAT model and require four inputs to run.
Size of Parcel: 116 acres
Current Land Use/Cover: Conventional Row Crop
Proposed Land Use/Cover: Switch Grass
Soil Type: A
Increase in Recharge 6.06 in/yr
Offset Equivalent Pumping 36.33 gal/min (continuous)
Calculate
Water Recharge (in/yr)
135
122
108
95
81
68
54
41
27
14
0
Conventional Row Crop
Switch Grass
Narrative Results
You have selected to converted 116 acres of Conventional Row Crop to Switch Grass. This conversion results in a Increase of 6.06 in/yr. That is equivalent to pumping 36.33 gal/min (continuous) from a high capacity well.
Done

Figure 9

Water Withdrawal Assessment Tool

Description

The Water Withdrawal Assessment Tool (WWAT) was developed by IWR, Michigan Department of Natural Resources (MDNR), United States Geological Survey (USGS), and Michigan Department of Environmental Quality (MDEQ) to assess the effects of large quantity water withdrawals (those over 70 gallons/minute) on nearby streams. By combining an analytical ground water model, measured and estimated stream flows, and fish response curves, the tool is able to estimate the amount of baseflow diverted from the stream from pumping and whether the withdrawal is likely to have an adverse affect on the fish population in the nearby stream. The WWAT emphasizes the critical link between water quantity and stream ecosystem health.

Methods and Procedures

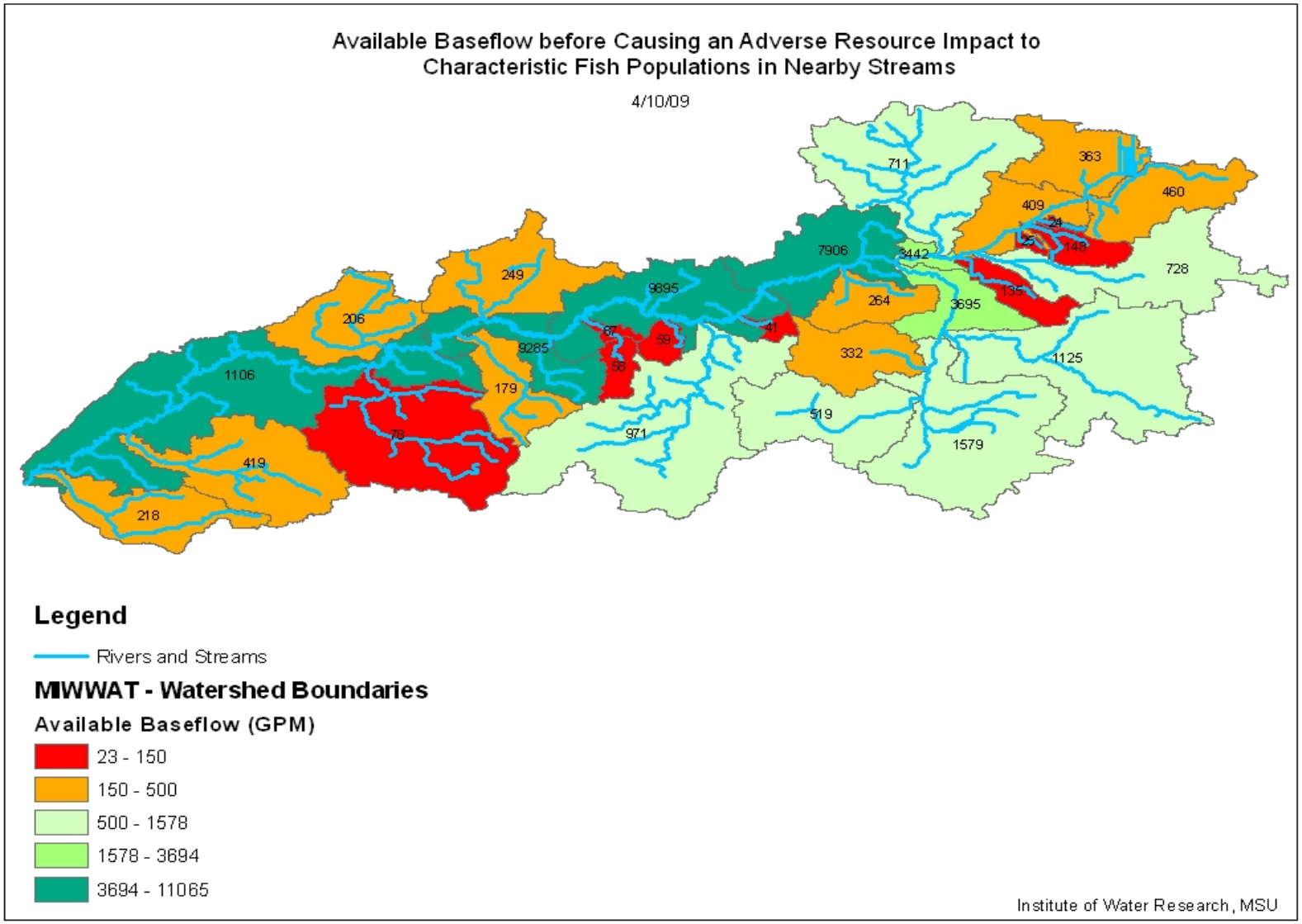
The WWAT has several components that work together to assess large quantity water withdrawals. For the purpose of this project, we focused on one of the components called the water availability map. This map is the result of 1) estimated index flow for the lowest summer flow month via regression modeling from stream gages, 2) fish response curves related to catchment area, baseflow yield, and July mean temperature. MDNR fisheries biologists have determined that variations in species abundance in rivers are most closely associated with the three factors identified in number two above.

Fish response curves were developed for 11 different stream types across the state including, large warm rivers, large cool rivers, large cold transitional river, small warm rivers, small cool rivers, small cold transitional rivers, small cold rivers, warm streams, cool streams, cold transitional streams, and cold streams. These fish curves indicate how fish will respond to temperature change in each of the stream types. The resulting responses produced four zones labeled A, B, C, and D. Adverse resource impacts generally occur when moving from zone C to zone D.

The available water map that was used to produce the optimization map for TNC used the C cutoff values. This is the available stream baseflow for a watershed that can be removed before having an adverse effect on the fish in the nearby stream. In general the less water available the more sensitive the streams in the watershed are to large quantity water withdrawals. IWR clipped theses watersheds and their values for modeling in the Paw Paw River watershed.

Results

The resulting map displays available baseflow across the Paw Paw River watershed. Areas colored red have between 23-150 GPM of baseflow available for pumping before likely causing an adverse resource impact (ARI). It is important to mention that these results are generated from an analytical model and do not represent the total water available for withdrawal. These numbers represent the amount of baseflow that could be diverted from a nearby stream via pumping before likely causing an ARI. Many factors influence how much baseflow is being diverted from a nearby stream, including, the depth of the well, distance from stream, surface vs groundwater withdrawal, and pumping schedule. These areas may be more sensitive to large water withdrawals due to their lower available baseflow as derived from initial screening of the Water Withdrawal Assessment Tool. It is recommend that these areas be monitored to limit large surface water withdrawals made directly from the stream or to request a “Site Specific Review” from the Michigan Department of Natural Resources and Environment if large withdrawals are to be made.


Available Baseflow before Causing an Adverse Resource Impact to
Characteristic Fish Populations in Nearby Streams
4/10/09
711
363
460
409
24
25
148
7906
3442
728
249
9895
135
264
3695
206
87
59
41
9285
332
1125
1106
58
179
519
78
971
1579
419
218
Legend
Rivers and Streams
MIWWAT - Watershed Boundaries
Available Baseflow (GPM)
23 - 150
150 - 500
500 - 1578
1578 - 3694
3694 - 11065
Institute of Water Research, MSU

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D. Social Dimensions

D. Social Indicators Data Management and Analysis System - SIDMA

Objective

Develop a web-based data analysis system to analyze and compare, map, store, and reveal trends related to water quality improvements through social indicators.

Progress Summary

During the fourth quarter of 2009, IWR has worked primarily on building the post-project survey response interface, updating the interface for viewing frequency and indicator data, and creating the interface to compare pre and post project response data. In addition, we have continued to make revisions to SIDMA based on ongoing feedback from the pilot projects and the regional social science team.

Completed Work

The development team is presently on schedule for constructing SIDMA. Table 1 illustrates work completed and work in progress. The table below is the newly revised set of tasks.

Task #	Action	Percent Complete
1.1	Examine social indicators for database incorporation	100
1.2	Incorporate user needs design requirements	100
1.3	Assess needs for supporting social indicators	100
2.1	Develop SQL database	99
2.2	Design web site schematics for information flow	100
2.4	Incorporate weighting and ranking produced by social indicator team	100
2.6	Create user access levels	100
2.7a	Develop Survey Builder Database for Urban	100
2.7b	Develop Survey Builder Interface for Urban	100
2.7c	Develop Survey Builder Database for Agricultural	100
2.7d	Develop Survey Builder Interface for Agricultural	100
2.7e	Develop Survey Response Input Interface	99
2.8	Develop Control Panel to Manage User Groups	95
3.1	Collect GIS layers	90
3.2	Develop mapping interface	100
4.1	User review and feedback	95 (ongoing task)
4.2	Complete modifications	95 (ongoing task)
5.0	Develop educational and outreach material	92
6.0	Final report	0
7.0	Incorporate feedback from states	70
8.0	Revise Questionnaires	60
9.0	Develop statistical calculations and graphing outputs	98
10.0	Incorporate Demographics into SIDMA map	60
11.0	Link project interface to map interface	25
12.0	Add 12 digit HUC boundaries to SIDMA map	60
13.0	Develop functions to import projects from GRTS	0

Table 1

Note: Tasks that are shaded (2.8) are from previous task list.

Post-Project Response Input Interface

The post-project response input interface allows users to input responses after the project has been completed or the plan implemented (Figure 1-2). It provides the same type of inputs as the pre-project interface so input responses can be easily compared.

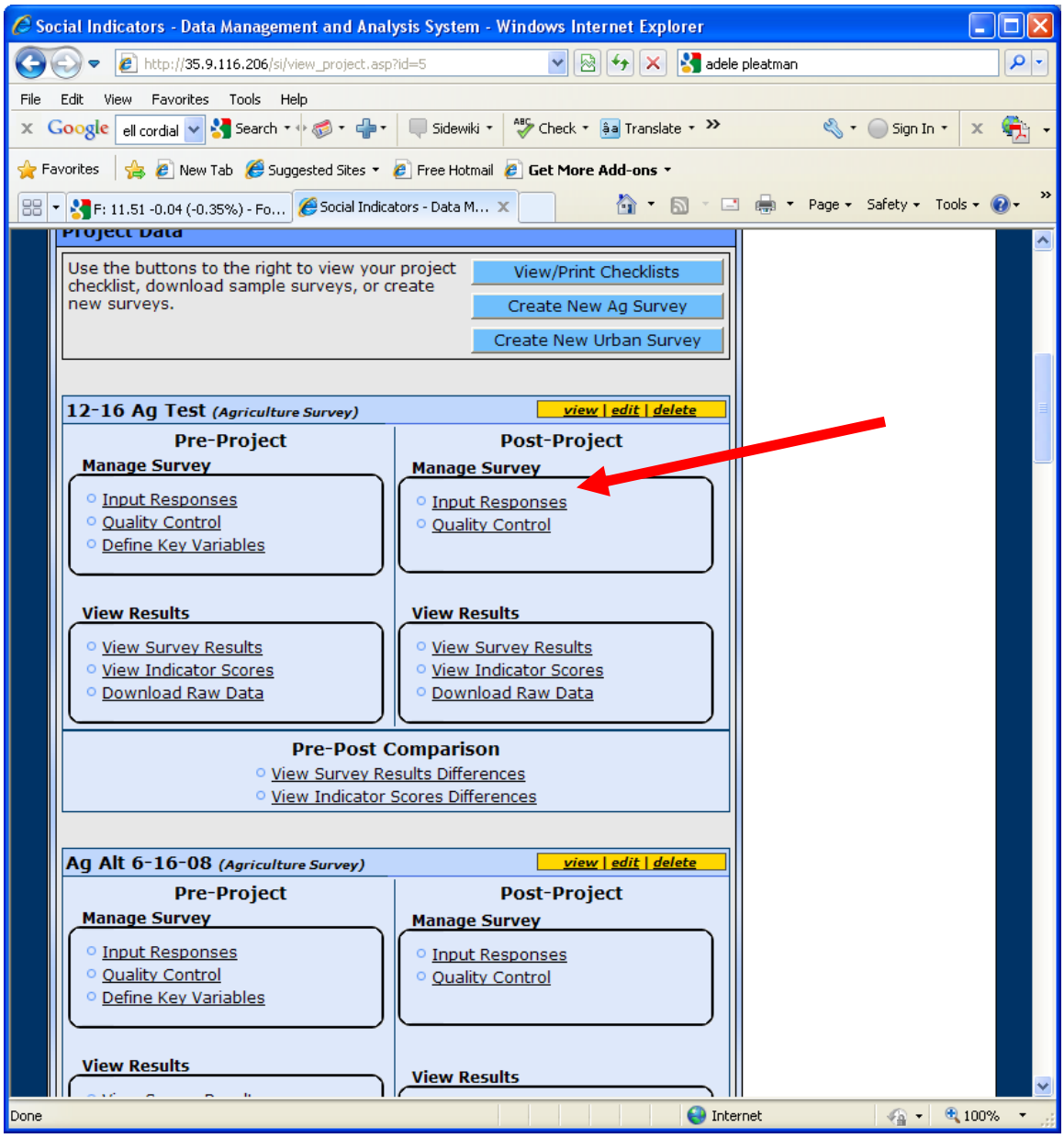


Figure 1

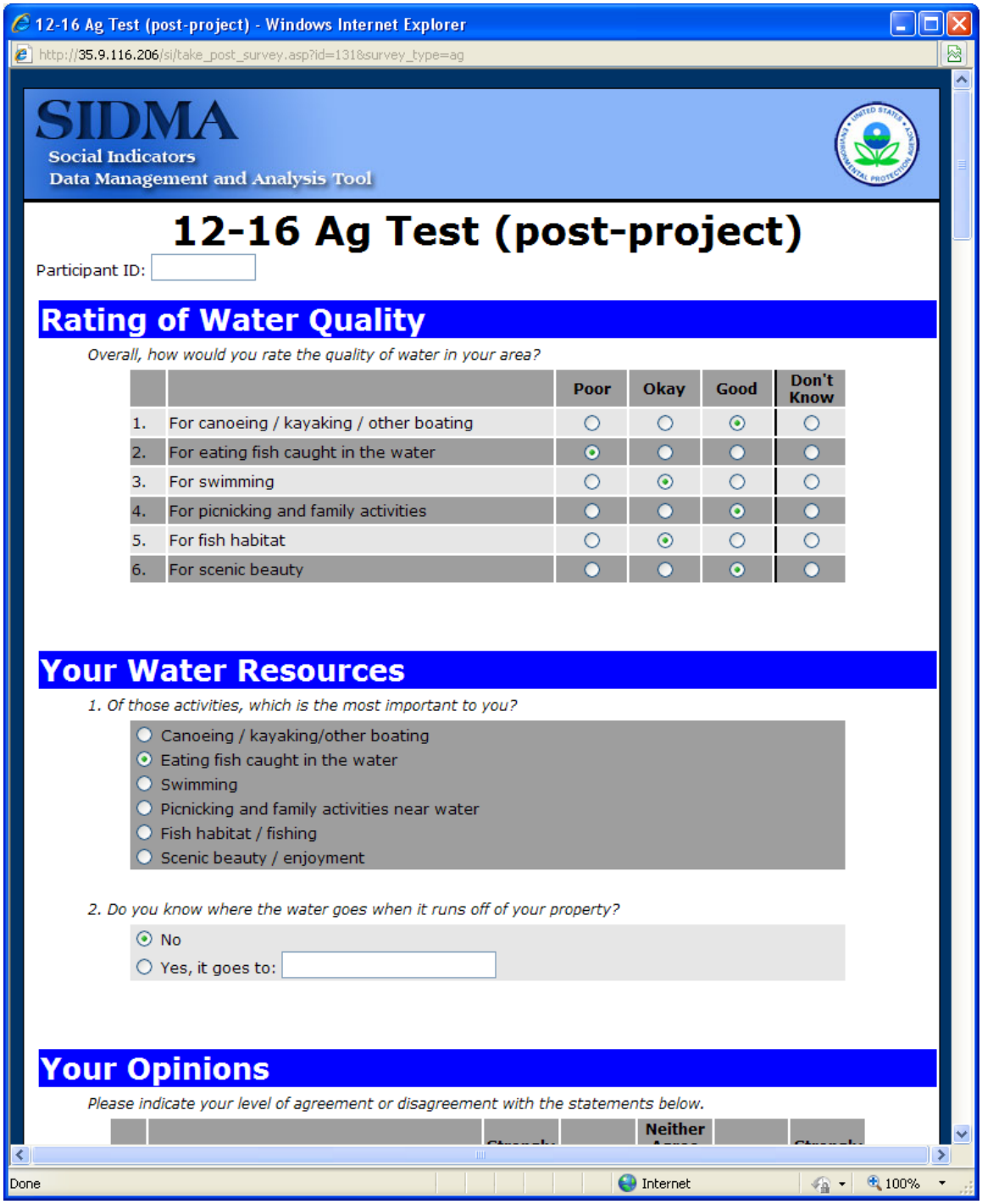

12-16 Ag Test (post-project) - Windows Internet Explorer
http://35.9.116.206/si/take_post_survey.asp?id=131&survey_type=ag
SIDMA
Social Indicators
Data Management and Analysis Tool
12-16 Ag Test (post-project)
Participant ID:
Rating of Water Quality
Overall, how would you rate the quality of water in your area?
Poor
Okay
Good
Don't Know
1. For canoeing / kayaking / other boating
2. For eating fish caught in the water
3. For swimming
4. For picnicking and family activities
5. For fish habitat
6. For scenic beauty
Your Water Resources
1. Of those activities, which is the most important to you?
Canoeing / kayaking/other boating
Eating fish caught in the water
Swimming
Picnicking and family activities near water
Fish habitat / fishing
Scenic beauty / enjoyment
2. Do you know where the water goes when it runs off of your property?
No
Yes, it goes to:
Your Opinions
Please indicate your level of agreement or disagreement with the statements below.
Neither
Done
Internet
100%

Figure 2

Pre and Post Project Comparisons

In addition to creating the new interface to input post-project responses, we developed an interface for pre and post project comparisons. After pre/post project information has been collected, the project manager can select the "View Survey Results Differences" link and open the calculated response (Figure 3).

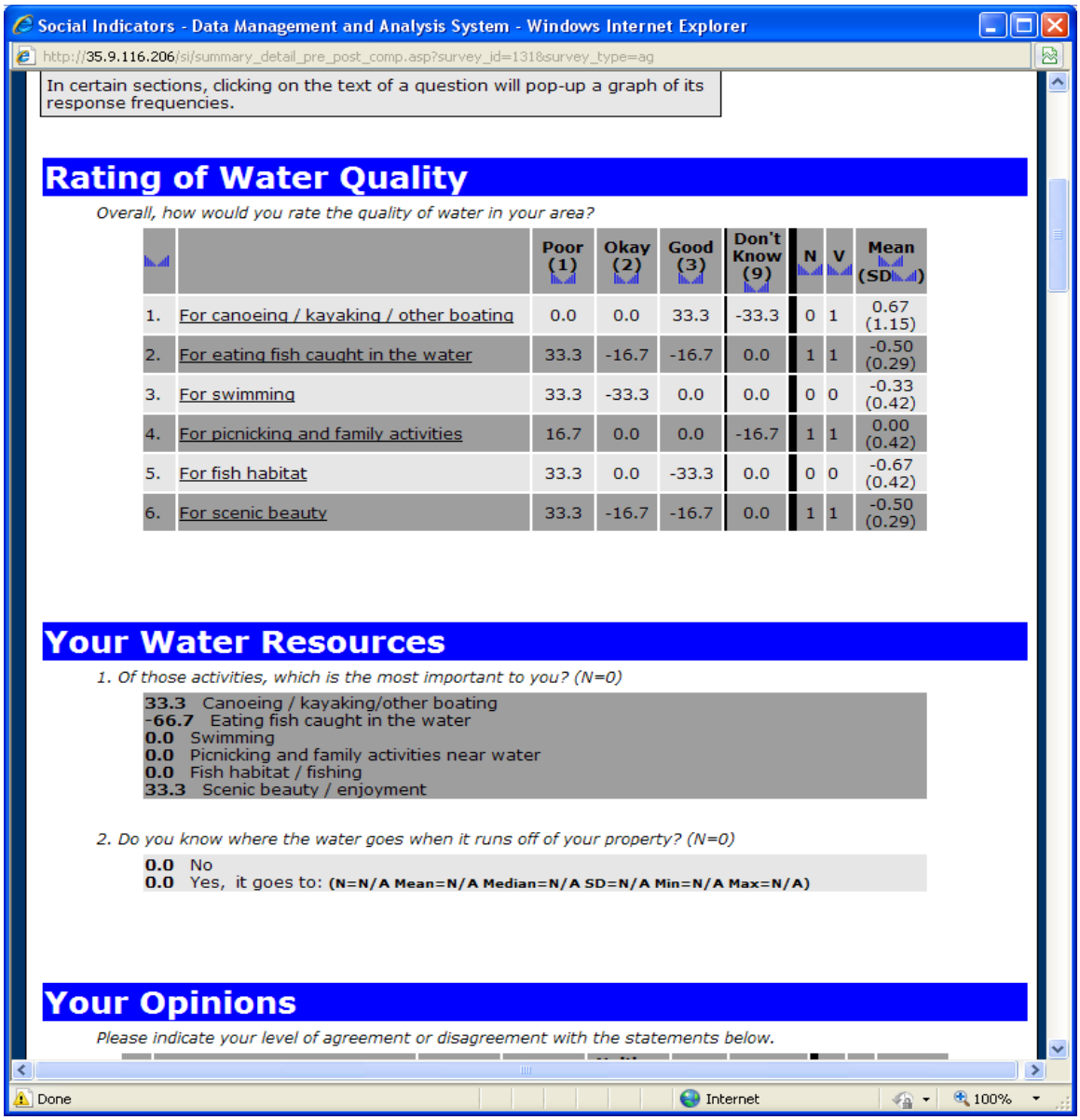


Figure 3

This interface displays the survey response differences for each response in the questionnaire and provides the mean and standard deviations. By selecting the questions the users can open a new window which contains the graphical representation of the response differences (Figure 4). This chart is an updated version from the previous chart, as is shows negative change that may occur for a given question.

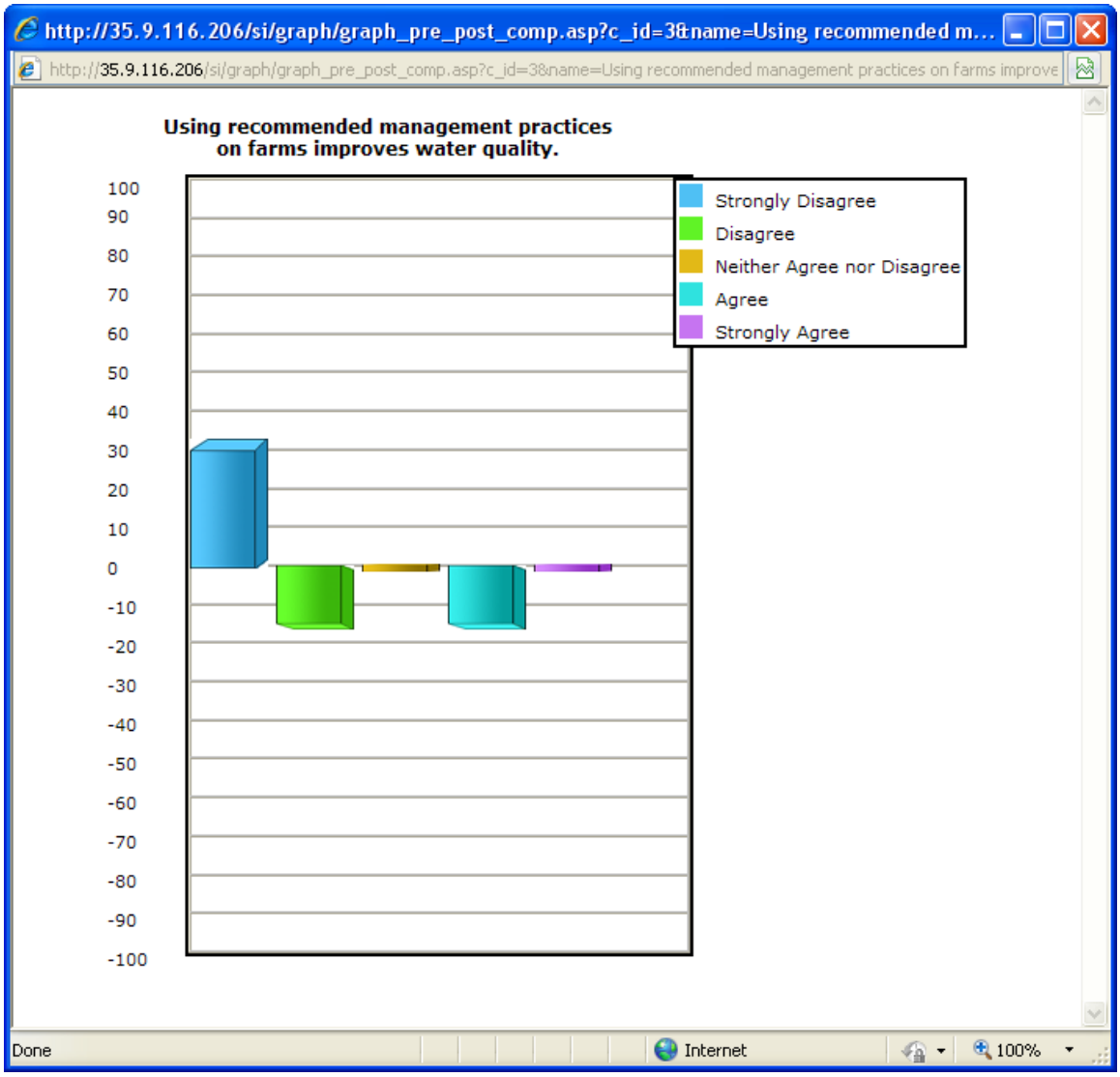
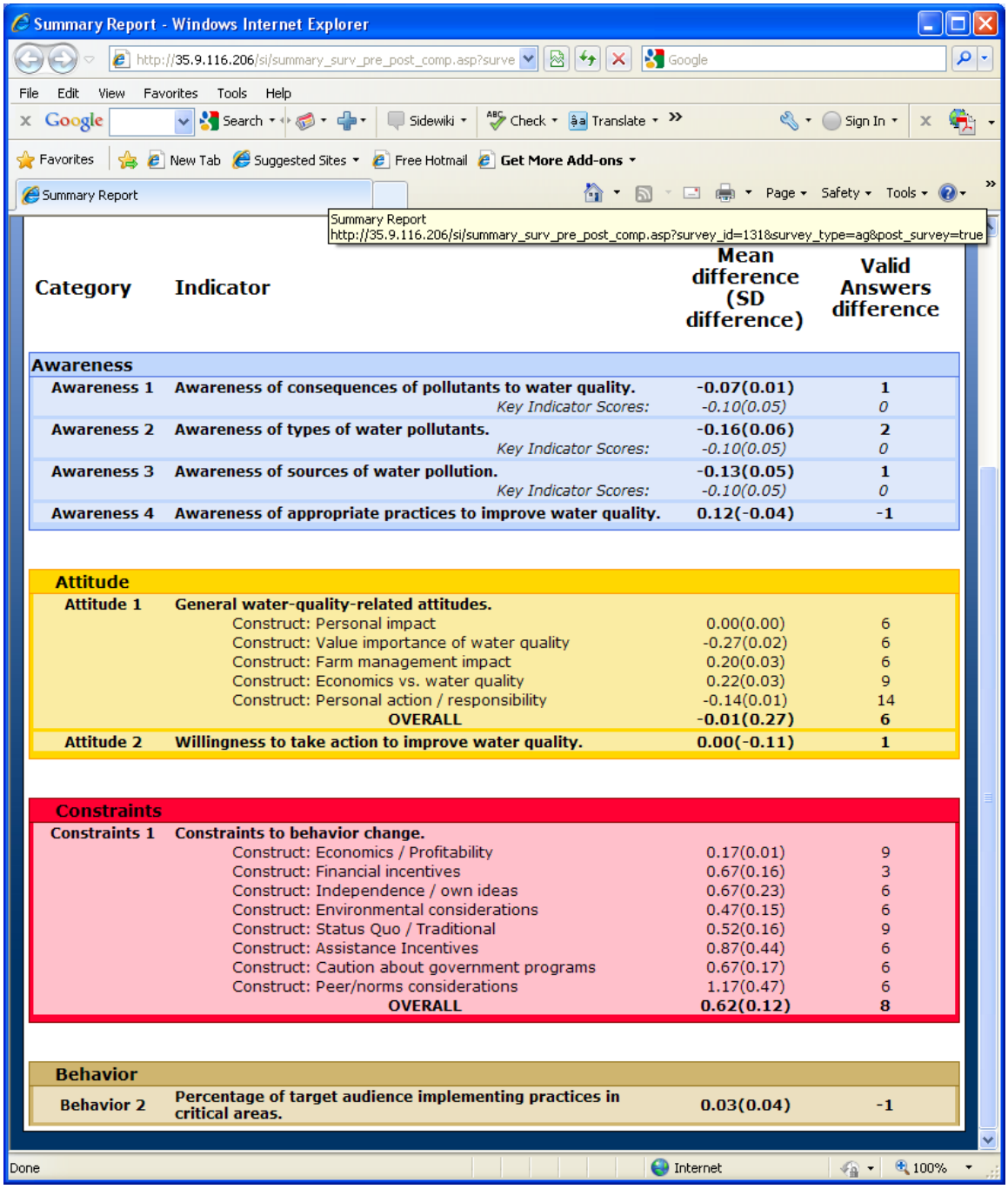


Figure 4

The user can also choose to view indicator score differences by selecting the "View Indicator Score Differences" as shown in Figure 1. This newly updated interface shows the differences between pre and post project indicator scores (Figure 5). If numbers are negative, it indicates response values were higher among the pre-project responses as compared to the post-project responses. This interface also displays mean and standard deviation differences.



Summary Report - Windows Internet Explorer

http://35.9.116.206/si/summary_surv_pre_post_comp.asp?survey_id=131&survey_type=ag&post_survey=true

Category	Indicator	Mean difference (SD difference)	Valid Answers difference
Awareness			
Awareness 1	**Awareness of consequences of pollutants to water quality.**	**-0.07(0.01)**	**1**
	Key Indicator Scores:	*-0.10(0.05)*	*0*
Awareness 2	**Awareness of types of water pollutants.**	**-0.16(0.06)**	**2**
	Key Indicator Scores:	*-0.10(0.05)*	*0*
Awareness 3	**Awareness of sources of water pollution.**	**-0.13(0.05)**	**1**
	Key Indicator Scores:	*-0.10(0.05)*	*0*
Awareness 4	**Awareness of appropriate practices to improve water quality.**	**0.12(-0.04)**	**-1**
Attitude			
Attitude 1	**General water-quality-related attitudes.**		
	Construct: Personal impact	0.00(0.00)	6
	Construct: Value importance of water quality	-0.27(0.02)	6
	Construct: Farm management impact	0.20(0.03)	6
	Construct: Economics vs. water quality	0.22(0.03)	9
	Construct: Personal action / responsibility	-0.14(0.01)	14
	OVERALL	**-0.01(0.27)**	**6**
Attitude 2	**Willingness to take action to improve water quality.**	**0.00(-0.11)**	**1**
Constraints			
Constraints 1	**Constraints to behavior change.**		
	Construct: Economics / Profitability	0.17(0.01)	9
	Construct: Financial incentives	0.67(0.16)	3
	Construct: Independence / own ideas	0.67(0.23)	6
	Construct: Environmental considerations	0.47(0.15)	6
	Construct: Status Quo / Traditional	0.52(0.16)	9
	Construct: Assistance Incentives	0.87(0.44)	6
	Construct: Caution about government programs	0.67(0.17)	6
	Construct: Peer/norms considerations	1.17(0.47)	6
	OVERALL	**0.62(0.12)**	**8**
Behavior			
Behavior 2	**Percentage of target audience implementing practices in critical areas.**	**0.03(0.04)**	**-1**

Figure 5

In addition to these changes, we have also made minor changes to the database and variable names in the survey as requested by the social science team and feedback from pilot projects.

Work In Progress

IWR has been preparing the GIS interface to pass specific demographics information identified by EPA into the project interface. We anticipate this to take place in the upcoming quarter. Another work in progress is the ongoing task of updating SIDMA based on the pilot projects feedback. We will continue this process as we move through the project.

Project Challenges

The biggest challenge of the fourth quarter was building the pre and post project comparisons in a way that will make them easily transferable to a new version of SIDMA that is being requested from the regional social science team.

Next Steps

IWR will work with the regional team to evaluate the new pre and post project interface that has been designed. In addition, we will begin building the capacity for SIDMA to automatically transfer demographics information from the map into the project data.

Development Location

The site can be viewed anytime at "http://35.9.116.206/si/index.asp." The interface is constantly changing throughout the development phase and some of the menu items may not be available at all times.

Travel Summary

The travel summary provides a description of travel costs accrued on the project account over the past quarter. A more detailed financial summary can be found in the Financial Summary Report provided by Michigan State University's Contracts and Grants.

No travel occurred during this quarter.

Budget and Finance

A detailed financial summary can be found in the Financial Summary Report provided by Michigan State University's Contracts and Grants.

Award No. G09AC00161 Developing the Water Withdrawal Assessment Tool

Basic Information

Title:	Award No. G09AC00161 Developing the Water Withdrawal Assessment Tool
Project Number:	2009MI161S
Start Date:	5/15/2009
End Date:	5/14/2010
Funding Source:	Supplemental
Congressional District:	8
Research Category:	Water Quality
Focus Category:	Water Quality, Water Quantity, Water Supply
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Principal Investigators:	Jon Bartholic, Jeremiah A Asher

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Prepared in cooperation with the
Michigan Department of Natural Resources

Ground-Water-Withdrawal Component of the Michigan Water-Withdrawal Screening Tool

Scientific Investigations Report 2009–5003

U.S. Department of the Interior
U.S. Geological Survey

Ground-Water-Withdrawal Component of the Michigan Water-Withdrawal Screening Tool

By Howard W. Reeves, David A. Hamilton, Paul W. Seelbach, and
A. Jeremiah Asher

Prepared in cooperation with the
Michigan Department of Natural Resources

Scientific Investigations Report 2009–5003

U.S. Department of the Interior
U.S. Geological Survey

U.S. Department of the Interior
KEN SALAZAR, Secretary

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Suzette M. Kimball, Acting Director

U.S. Geological Survey, Reston, Virginia: 2009

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Conversion Factors and Datum

Multiply	By	To obtain
	Length	
foot (ft)	0.3048	meter (m)
meter (m)	3.281	foot (ft)
mile (mi)	1.609	kilometer (km)
kilometer (km)	0.6214	mile (mi)
	Area	
square mile (mi^2)	259.0	hectare (ha)
square mile (mi^2)	2.590	square kilometer (km^2)
	Flow rate	
gallon per minute (gal/min)	3.785	liter per minute (L/min)
gallon per day (gal/d)	4.3×10^{-8}	cubic meter per second (m^3/s)
million gallons per day (Mgal/d)	0.04381	cubic meter per second (m^3/s)

Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83).

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Ground-Water-Withdrawal Component of the Michigan Water-Withdrawal Screening Tool

By Howard W. Reeves[1], David A. Hamilton[2], Paul W. Seelbach[3], and A. Jeremiah Asher[4]

Abstract

A water-withdrawal assessment process and Internet-based screening tool have been developed to evaluate proposed new or increased high-capacity water withdrawals in Michigan. Michigan legislation defines high capacity withdrawals as those capable of removing an average of 100,000 gallons per day for a consecutive 30-day period. This report describes the ground-water component of the screening tool, provides background information used to develop the screening tool, and documents how this component of the screening tool is implemented. The screening tool is based on application of an analytical model to estimate streamflow depletion by a proposed pumping well. The screening tool is designed to evaluate intermittent pumping, to account for the dynamics of stream-aquifer interaction, and to apportion streamflow depletion among neighboring streams. The tool is to be used for an initial screening of a proposed new or increased high-capacity withdrawal in order to identify withdrawals that may cause adverse resource impacts. The screening tool is not intended to be a site-specific design tool. Results of an example application of the screening tool in Kalamazoo County, Mich., are compared to streamflow depletion estimated by use of a regional ground-water-flow model to demonstrate its performance.

Introduction

The water-withdrawal assessment process mandated by State of Michigan Public Act 34 of 2006 (2006 PA 34) (Michigan State Legislature, 2006a) was proposed to "assist in determining whether the proposed [water] withdrawal may cause an adverse impact to the waters of the state or to the water-dependent natural resources of the state." The water-withdrawal assessment process was developed under the auspices of the Michigan Ground Water Conservation Advisory Council (GWCAC), which was formed though Public Act 148 of 2003 (2003 PA 148) (Michigan State Legislature, 2003) and revised by 2006 PA 34. In response to 2006 PA 34, the U.S. Geological Survey (USGS) entered into a cooperative agreement in 2006 with the Michigan Department of Natural Resources; the Michigan Department of Environmental Quality; the Institute for Fisheries Research, University of Michigan; and the Institute for Water Research, Michigan State University, to assist in developing the technical aspects of the water-withdrawal assessment process.

The 2006 PA 34 legislation presumed that, for the first 2 years of the act, wells deeper than 150 ft or further away than ¼-mi from trout streams did not create an adverse resource impact on a trout stream (Michigan State Legislature, 2006a). Wells within ¼-mi of a trout stream and less than 150 ft deep may have posed an adverse resource impact on the stream, but the legislation did not specify how this potential should be analyzed. This presumption expired in 2008, and the legislature replaced it with the water-withdrawal assessment process including an Internet-based screening tool (Public Act 185 of 2008 (2008 PA 184), Michigan State Legislature, 2008a). The water-withdrawal process identifies withdrawals likely to cause an adverse environmental impact on the waters of the State by assessing whether the withdrawal will affect the ability of a stream to support the characteristic fish population at a site (State of Michigan Ground Water Conservation Advisory Council, 2007).

Assessment Process and Screening Tool

The legislature and GWCAC envisioned a screening tool as part of the water-withdrawal assessment process. In this report, the term "assessment process" refers to the entire process used to assess a new or increased high-capacity withdrawal from surface water or ground water, including initial screening, site-specific review, and agency procedures. High capacity withdrawals are defined through legislation as those capable of removing an average of 100,000 gal/d for a

[1] U.S. Geological Survey.

[2] Michigan Department of Environmental Quality, Land and Water Management Division.

[3] Michigan Department of Natural Resources, Institute for Fisheries Research.

[4] Michigan State University, Institute for Water Research.

consecutive 30-day period (as defined in section 32701 of Public Act 33 of 2006 (2006 PA 33), Michigan State Legislature, 2006b). The screening tool is an Internet-accessible program used for an initial screening of a proposed new or increased high-capacity withdrawal. This screening tool identifies withdrawals that are not likely to cause an adverse resource impact upon any type of stream in the State and allows users proposing such withdrawals to proceed with the withdrawal after registering the use. Withdrawals identified as having potential to cause an adverse resource impact are expected to require additional agency review to determine their disposition (State of Michigan Ground Water Conservation Advisory Council, 2007). This tool is designed to focus regulatory resources on withdrawals that have greater potential to cause environmental harm. The screening tool uses a statewide database of aquifer types and properties in conjunction with a robust analytical equation to identify withdrawals not likely to cause an adverse environmental impact.

In this report, the component of the screening tool used to estimate the amount of streamflow reduction caused by a given ground-water withdrawal is presented and discussed. The complete screening tool, including ground-water and surface-water withdrawals and the decision rules used to evaluate withdrawals, will be documented in a separate report.

Streamflow Depletion by Pumping Wells

The key to understanding the potential impact of a pumping well on streamflow is to recognize the source of water to wells as described, for example, by Theis (1940), Bredehoeft and others (1982), Sophocleous (1997), Alley and others (1999), and Bredehoeft (2002). When a well is pumped, water is removed initially from storage in the aquifer, and the potentiometric level, or head, near the well is reduced. Once the head near the well is reduced, then flow is induced towards the well. Water is removed from storage, and the potentiometric level declines away from the pumping well, thereby creating a cone of depression around the well. This cone of depression continues to expand until the pumping can be balanced by (a) *an increase in recharge* to the system, induced by the lowering of the potentiometric level in the aquifer; (b) *a decrease in the discharge* from the system, resulting from the lowered potentiometric level in the system and decreased gradients in discharge areas; or (c) *a combination of increased recharge and decreased discharge* (Bredehoeft, 2002). The sum of increased recharge and decreased discharge is called capture (Lohman and others, 1972). If the well cannot capture enough water to balance pumping, water levels will continue to decline until pumping cannot continue at the initial rate. The capture of a pumping well does not depend on the initial recharge rate; rather, it depends on the change in recharge induced by the pumping well (Bredehoeft and others, 1982; Bredehoeft, 2002).

Ground-water pumping can capture streamflow in two ways for an initially gaining stream: (1) decreased discharge from the aquifer to the stream because of the lowered potentiometric gradient, and (2) induced infiltration from the stream to the aquifer because of a reversal in potentiometric gradient. In the second instance, the flow is from the stream toward the well, and the affected segment of the stream becomes a losing segment. The source of water to a pumping well changes with time from water released from storage to water captured because of decreased discharge or increased recharge, and this shift depends on the geometry of the system and aquifer properties (Bredehoeft, 2002). Appendix 1 offers an analysis of the various ways that the interaction between a pumping well and a stream have been quantified.

Purpose and Scope

The purpose of this report is to document the ground-water-withdrawal component of the Michigan water-withdrawal screening tool. In practice, the impact of wells on streams may not be limited to the ¼-mi buffer and 150 ft cutoff depth used in the original legislation so the ground-water component of the statewide assessment tool is designed to estimate streamflow depletion resulting from pumping a well without imposing arbitrary spatial constraints. The final screening tool also is designed to evaluate intermittent pumping and to account for the dynamics of stream-aquifer interaction so that ground-water withdrawals are not considered to be immediate from the stream at the pumping rate. Finally, the screening tool was designed to estimate the depletion from neighboring streams, not just from the stream closest to the proposed well.

In this report, the methods used to evaluate the impact of a new or increased ground-water withdrawal upon streamflow are described. Types of data required for the evaluation and the sources of data are provided. The distribution of streamflow depletion between neighboring streams is discussed in detail because the method used for this distribution was developed in this project. The screening tool was tested by comparison of results from it to streamflow depletion estimates generated with a numerical ground-water-flow model of Kalamazoo County, Mich. (Luukkonen and others, 2004), and these results are presented and discussed.

Study Approach

The ground-water component of the water-withdrawal screening tool was designed to account for the removal of water from storage and the resulting delay in the impact of new or increased pumping on streamflow. As a conservative approach, the only sources of water to the well in the screening tool are storage and streamflow depletion. For

the screening tool, recharge to the aquifer is assumed to be unaffected by the addition of a high-capacity well. Several other potential sources of water to the well are omitted in this approach, including decreased loss of ground water to vegetation capable of using shallow ground water, and changes in water exchange between adjacent aquifers through semiconfining layers. The pumping well also is assumed to not significantly affect the water level in the stream. Because stream elevation and recharge are assumed to be unaffected by the additional pumping, natural seasonal variation in the system (including variations in stream elevation and recharge) does not influence the estimation of streamflow depletion.

As stated by Bredehoeft (2002) and described in appendix 1, the only way to assess capture by a pumping well is by using either analytical or numerical approaches to model the system. In general, analytical models are applicable for simple geometries and uniform aquifer properties, whereas numerical models allow for more complicated systems. For simple systems, both approaches yield similar estimates. For more complicated systems, analytical solutions may not capture the complexity of the system. Numerical models can describe a more complicated system, but these models require more extensive site-specific data and analysis. The goal of this project was to devise a procedure applicable for statewide screening; therefore, an analytical model was selected to estimate streamflow depletion by a pumping well. Use of an analytical model yields a screening tool that is sufficiently accurate but requires minimal input data and user training.

Ground-Water-Withdrawal Component of Screening Tool

Upon review of the literature related to modeling streamflow depletion by pumping wells, the analytical model selected for the ground-water component of the water-withdrawal screening tool is an equation derived by Hunt (1999). This analytical model describes streamflow depletion by a pumping well for a partially penetrating stream in an infinite aquifer with streambed resistance between the stream and the aquifer. This analytical model is appropriate for Michigan streams, which typically do not fully penetrate the aquifers used for water supply, and it is sufficiently simple for statewide screening. This analytical model was implemented in a Fortran computer code (Reeves, 2008). In the final implementation of the screening tool, an Internet-accessible version of the analytical model was required. The essential elements of the analytical model were programmed in VBScript (Microsoft Corporation, 2007) for implementation in the Internet version. This report includes verification that the VBScript version of the analytical model yields solutions similar to those from the Fortran version documented by Reeves (2008).

To illustrate the aquifer properties required by the analytical model, the form of the model is a useful summary. Hunt (1999) derives the analytical model as

$$Q_s = Q_w \left[\operatorname{erfc}\left(\sqrt{\frac{Sd^2}{4Tt}} \right) - \exp\left(\frac{\lambda^2 t}{4ST} + \frac{\lambda d}{2T} \right) \operatorname{erfc}\left(\sqrt{\frac{\lambda^2 t}{4ST}} + \sqrt{\frac{Sd^2}{4Tt}} \right) \right], \qquad (1)$$

where

Q_s	is the rate of streamflow depletion (length cubed per unit time),
Q_w	is the pumping rate (length cubed per unit time),
erfc()	is the complementary error function (dimensionless),
exp()	is the exponential function (dimensionless),
d	is the distance from the well to the stream (length),
S	is the storage coefficient, or storativity, of the aquifer (dimensionless),
T	is the transmissivity of the aquifer (length squared per unit time),
t	is the time from the start of pumping, and
λ	is the streambed conductance term (length per unit time).

The major assumptions used to derive equation 1 (Hunt, 1999) are the following:

- Horizontal flow dominates any potential vertical flow; the Dupuit assumption is valid.
- The aquifer is homogeneous and isotropic and has constant saturated thickness.
- The aquifer is either confined or, if unconfined, change in hydraulic head in the aquifer is small compared to the saturated thickness.
- The stream is straight, infinitely long, and remains in hydraulic connection with the aquifer.
- The pumping does not change the stage of the stream.
- Recharge to the system is unchanged by pumping.
- The streambed may offer resistance to ground-water flow.
- There is no streambank storage.
- The pumping rate is constant.
- The aquifer extends to infinity.

Examination of equation 1 reveals that streamflow depletion depends on aquifer and streambed properties, the distance from the well to the stream, and time. In this model, streamflow depletion is described by a Darcy expression describing the flux between the stream and the aquifer (Hunt, 1999). The aquifer is assumed to remain in hydraulic contact with the stream, which means that the pumping well does not cause the hydraulic head in the aquifer to be lower than the streambed. See appendix 1 for more discussion of this assumption. To examine the sensitivity of streamflow depletion results on variations of input parameters, see Hunt (1999) and Reeves (2008).

The aquifer is assumed to be infinite, and, therefore, no additional data regarding the aquifer geometry are required by the model beyond the distance between the well and the stream. The remaining model input includes transmissivity, streambed conductance, storage coefficient, pumping rate, and time desired for the evaluation. As described in Reeves (2008), the analytical model was implemented in the computer code STRMDEPL08, which was used for development of the screening tool, with the option to simulate time-varying pumping rates.

Input of Constant and Time-Varying Pumping Rates

The impact of time-varying pumping is estimated in the screening tool because removal of water from storage may reduce the streamflow depletion. The streamflow depletion caused by time-varying pumping may be much lower than the pumping rate, and the estimated depletion caused by time-varying pumping often continues in time even while the pump is off. For analysis of streamflow depletion resulting from a constant pumping rate, the user must input the pumping rate. The duration of pumping in the screening tool is set to 1,825 days (5 years). For time-varying pumping, the user must not only provide the pumping rate but also a pumping schedule. Appendix 1 provides more discussion regarding the affect of time-varying pumping rates.

The interface to the screening tool prompts the user for more information if the user indicates a ground-water withdrawal with time-varying pumping. The user must enter the months when the well will be pumped, the well capacity, the days per week that the well will be pumped during those months, and the hours per day pumped. If the hours pumped per day are less than 24, the well capacity is prorated to yield a daily pumping rate. The days per week and months of pumping are then evaluated to determine the number of times that the pumping rate is changed. A superposition in time technique is used to account for time-varying pumping in the screening tool. Assuming that only streamflow depletion caused by a new or increased use is of interest, the equation for superposition used to evaluate time-varying pumping may be written as

$$Q_s(t_i) = \sum_{k=1}^{i} \Delta Q_k(t_k) R(\Delta t_k) \,, \qquad (2)$$

where

$Q_s(t_i)$ is the streamflow depletion at time interval i (length cubed per unit time),

$\Delta Q_k(t_k)$ is the change in pumping rate during the interval k (length cubed per unit time),

$R(\Delta t_k)$ is the ratio of streamflow depletion to pumping rate given by equation 1 for time interval k (length cubed per unit time),

t_i is the length of time from the beginning of the pumping analysis to the time of interest,

Δt_k is $t_i - t_k$, the difference in time between the time of interest and the time when the pumping rate changed for interval k,

i is the number of times when the pumping rate changes (dimensionless), and

k is the time interval number (dimensionless).

Streamflow depletion is estimated for every time when the pumping rate changes and at the end of the 5-year evaluation period. The maximum streamflow depletion from each of these estimations is identified in the screening tool and used to evaluate the potential impact of the proposed pumping.

Aquifer Properties Required for the Water-Withdrawal Screening Tool

The analytical model used for the water-withdrawal screening tool, equation 1, requires aquifer transmissivity, streambed conductance, and aquifer storage coefficient. One of the assumptions is that the aquifer is homogeneous. Aquifers in Michigan, however, are typically heterogeneous. For the screening-level evaluation, an estimated transmissivity and storage coefficient were assigned to watersheds and used in the screening tool. A safety factor was assigned in the screening tool to allow for more site-specific evaluation of withdrawals that may lead to adverse environmental impact. The procedures used to assign aquifer properties to watersheds for the water-withdrawal screening tool are presented in this section.

For the statewide water-withdrawal screening tool, the most consistent source of aquifer properties was assembled recently into the Michigan Ground Water Inventory and Map (GWIM) database (Michigan Department of Environmental Quality, 2005). The GWIM database includes estimates for aquifer transmissivity mapped to a 1-km by 1-km (3,281 ft by 3,281 ft) grid across the State for glacial deposits and bedrock aquifers. Constant values for aquifer storage coefficient were assumed in the GWIM analysis for illustration of potential well-to-well impacts. These values were different for the glacial deposits and bedrock aquifers, but the values for both types were indicative of leaky (semiconfined) systems.

The range of storage coefficients observed in aquifer tests in Michigan is discussed later in this report. The GWIM database information was used to assign transmissivity, streambed conductance, and storage coefficient in the screening tool.

Definition of Valley Segments

The surface-water spatial framework used for the ground-water component of the water-withdrawal screening tool was built on the classification of Michigan stream arcs into ecological valley segments (Seelbach and others, 2006; Brenden and others, 2008; Zorn and others, 2009). Each valley segment is a contiguous length of stream with relatively homogeneous hydraulic, hydrologic, and ecologic characteristics. The catchment area, which is the surface watershed drainage area, for each valley segment was defined by combining the surface catchments of the approximately 30,000 individual stream arcs in the 1:100,000-scale National Hydrography Dataset (NHD) as processed in the Great Lakes Regional Aquatic Gap project (Morrison and others, 2003; Brenden and others, 2006). The final framework consists of approximately 10,000 valley segments. The reduction in streamflow caused by a ground-water withdrawal is assigned to the downstream point of the valley-segment catchment. To apply the water-withdrawal screening tool, aquifer properties were required for each unique valley segment.

Assignment of Aquifer Properties for Glacial Deposits to Valley Segments

Three aquifer properties are required by the analytical model: transmissivity, streambed conductance, and storage coefficient. Values for these properties were estimated from information in the GWIM database (Michigan Department of Environmental Quality, 2005). In this database, transmissivity of glacial deposits is mapped to a grid for the entire State of Michigan. The median transmissivity for the grid cells within each valley segment catchment is assigned to the valley segment and used in the screening model. The median was selected as the representative statistic instead of the arithmetic mean because the median is less influenced by extremely low or high transmissivity estimates in the database and therefore may be the more reasonable statistic for screening-level estimation.

The streambed conductance used in equation 1 may be written as

$$\lambda = \frac{(K_v w)}{b}, \qquad (3)$$

where

K_v is the vertical hydraulic conductivity of the aquifer (length per unit time),

w is the stream width (length), and

b is the distance from the bottom of the stream to the top of the well screen or open interval of a bedrock well (length).

The distance from the bottom of the stream to the top of the well screen or open interval, b, is provided as the well depth by the user. For the statewide screening, the stream width was estimated by use of a regression equation developed to relate stream width to drainage area of a stream segment (T.G. Zorn, Michigan Department of Natural Resources, written commun., 2007):

$$w = 3.28 * (10 \hat{} ((0.522358 * \log(da * 1.6093 \hat{} 2)) - 0.18786)), \qquad (4)$$

where

da is the drainage area of the catchment (square miles) and

w is width (feet).

An estimate of the vertical hydraulic conductivity of the aquifer was computed by dividing the median transmissivity by the average thickness of aquifer material for each valley-segment catchment. This thickness was estimated by interpolating the thickness used for the wells in the GWIM transmissivity-estimation procedure to a 3,281 ft by 3,281 ft grid over the State and then computing the mean estimated thickness for the grid cells within each valley-segment catchment. To avoid dividing by zero in areas where glacial deposits are thin, a minimum value of 5 ft was assigned.

Equation 2 allows the streambed conductance used in the screening tool to vary with the depth to the top of the well screen entered by the user. A factor of 1/10 is included in the estimated streambed conductance to account for the anticipated anisotropy of aquifers in Michigan. This factor is reasonable for aquifers without clay units and probably underestimates the anisotropy in areas where clay layers are present (Todd and Mays, 2005). Anisotropy in hydraulic conductivity describes the tendency for the aquifer material to have less resistance to flow in the horizontal direction than the vertical direction primarily because of layering of the system: underestimation of this factor is conservative in the estimate of streamflow depletion by a pumping well. Because the user may request site-specific review of a proposed withdrawal if the screening tool identifies it as having greater potential for causing adverse environmental impact, this conservative factor was appropriate. The final expression for streambed conductance used in the screening tool is

$$\lambda = \frac{\left((T / B')w / 10\right)}{b}, \qquad (5)$$

where

B' is the estimated mean thickness of glacial deposits for the valley-segment catchment (length) and

b is the input value of depth to the top of the well screen or open interval of the well (length).

The final aquifer property is storage coefficient. In the analysis for the GWIM, constant values for storage coefficient were used: 0.0016 for glacial deposits and 0.0004 for bedrock aquifers. These values were determined by use of the geometric means of reported storage coefficients from aquifer tests reviewed by the State. For the screening tool, the value for the glacial deposits was believed to be too small, resulting in overprediction of the streamflow depletion from wells in unconfined or leaky aquifers. The storage coefficients reported for aquifer tests in glacial deposits vary over four orders of magnitude and do not correlate well with location in the State, surficial geology, or depth. Relation of storage coefficient with depth is illustrated in figure 1. On the statewide scale, it has not been possible to reliably identify areas of Michigan dominated by confined, leaky, or unconfined conditions. Use of the geometric mean, or a smaller value typical of a confined aquifer, may lead to a potentially contradictory situation where the assumption is made in the screening tool that the aquifer behaves as confined but also in good hydraulic contact with headwater streams. Conversely, assuming that an unconfined specific yield represents statewide conditions is not conservative, especially for time-varying pumping estimates. To give a conservative estimate that is consistent with the observed uncertainty in the estimated storage coefficients across the state, a constant value of 0.01, which is representative of a leaky aquifer, was used in the screening tool.

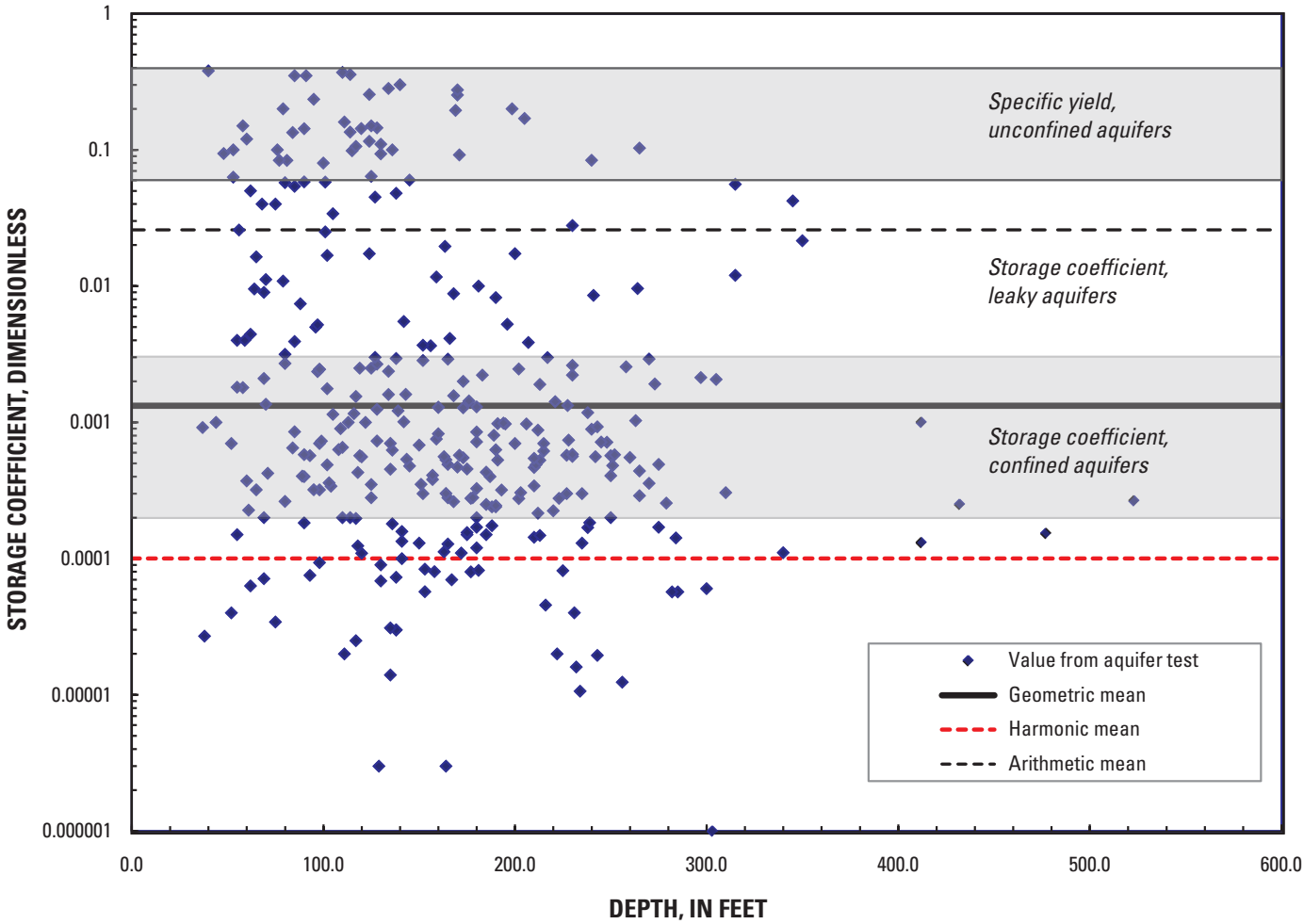
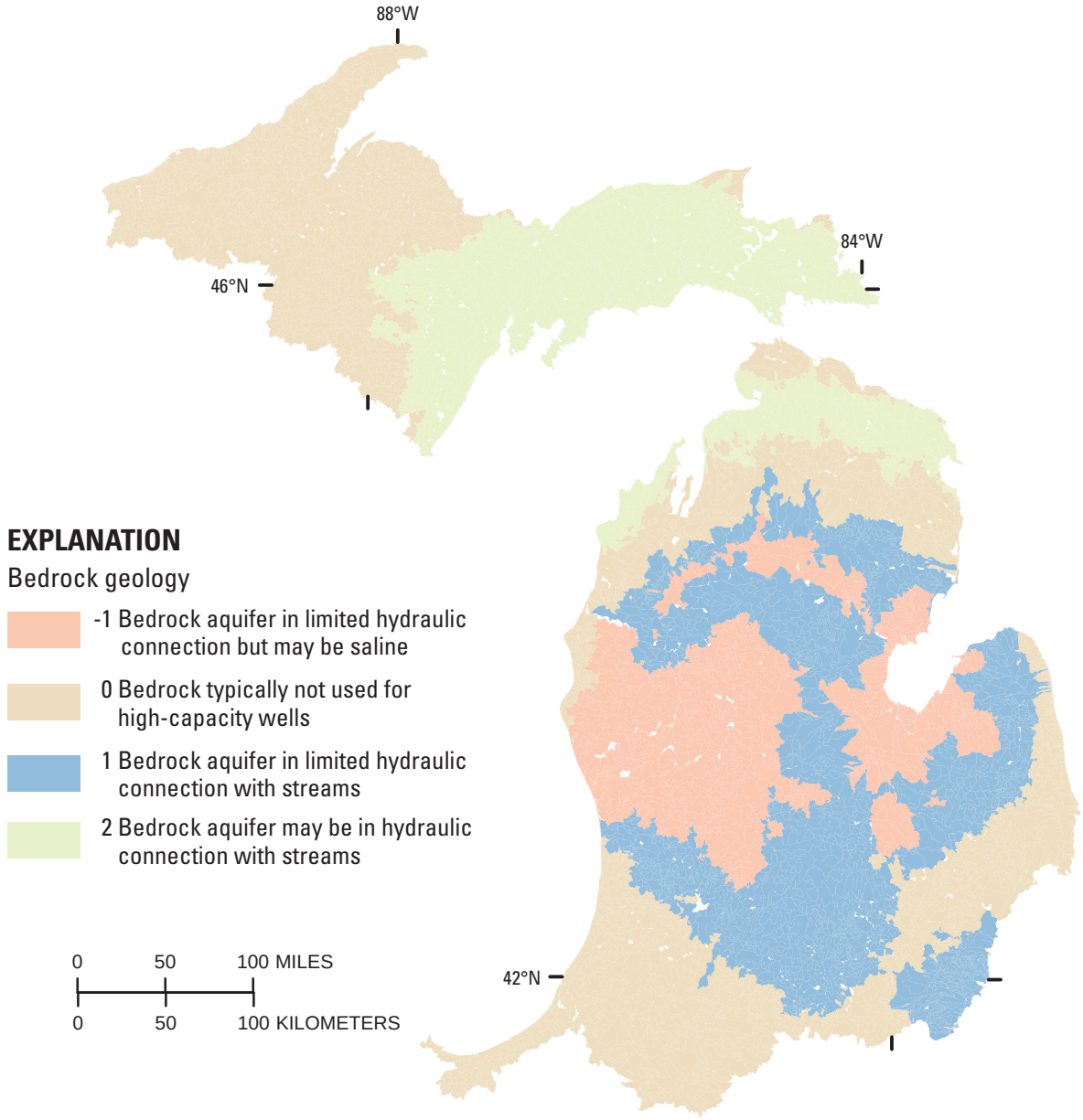


Figure 1. Reported aquifer storage coefficients for wells completed in glacial deposits from aquifer tests reviewed by the State of Michigan as a function of depth; arithmetic, geometric, and harmonic means also are shown. Shaded zones show typical ranges of specific yield and storage coefficient (for a 100 foot aquifer) for unconsolidated materials (Domenico and Schwartz, 1990).

Assignment of Bedrock Aquifer Properties to Valley Segments

Bedrock aquifers are used in parts of Michigan, and in some areas of the State these bedrock aquifers are separated from overlying streams by thick glacial deposits containing layers of material with low hydraulic conductivity, such as silt or clay. In these areas, the hydraulic connection between these aquifers and nearby streams is limited. In other areas, there may be a greater hydraulic connection between the bedrock aquifer and overlying streams. Saline water may be present in some areas of the major bedrock aquifers, and it may occur at depth under a freshwater zone or through the entire thickness of the bedrock aquifer. Finally, in some areas of the State, bedrock aquifers are not suitable for high-capacity wells. To account for these different potential conditions in the screening tool, the bedrock aquifers were grouped into four categories (fig. 2). The categories and response given by the water-withdrawal screening tool are summarized in table 1.



Bedrock geology from Michigan Department of Environmental Quality, 1987

Figure 2. Four bedrock categories used in the water-withdrawal screening tool for Michigan.

Table 1. Bedrock categories and response by water-withdrawal screening tool to proposed bedrock well in each category.

Bedrock category	Description of bedrock hydraulic conditions	Response from water-withdrawal screening tool
-1	Bedrock aquifers typically in only limited hydraulic connection with streams but in areas where ground water in the bedrock aquifer is potentially saline based on a regional assessment (Westjohn and Weaver, 1996). Note that in some areas, saline water may occur at depth below a freshwater zone, and in other areas, saline water may be present throughout the entire bedrock thickness.	The proposed well passes the screen and the user is informed to register the use as required by statues. Because in some areas identified as saline (Westjohn and Weaver, 1996) bedrock wells may produce potable water and saline water becomes an issue only for deeper bedrock wells, this flag is not used in the current version (January 2008) of the screening tool. The information is retained in the underlying database in case this information is desired in future versions. The user is warned in all uses of the screening tool that the tool is not intended as a design tool and that the evaluation does not guarantee ground-water quantity or quality.
0	Bedrock typically not used for high-capacity wells because the dominant bedrock unit in the area is not a productive aquifer. For example, this category is used for areas in the state underlain by the Coldwater Shale.	The user is informed through a pop-up message that bedrock aquifers in this area are generally not used for high-capacity wells. The screening tool uses aquifer properties from the glacial deposits to evaluate the potential streamflow depletion for the proposed well.
1	Bedrock aquifers typically in only limited hydraulic connection with streams, especially smaller streams.	The proposed well passes the screen, and the user is informed to register the use as required by statues.
2	Bedrock aquifer may have hydraulic connection with streams.	The proposed withdrawal is evaluated by use of bedrock properties from the Ground-Water Inventory and Map database that were processed in the same way as the properties for the glacial deposits. The streambed conductance between the bedrock aquifer and the stream is estimated by use of the properties of the glacial deposits overlying the bedrock. The assigned storage coefficient is 0.0004, as used in the Ground-Water Inventory and Map.

Definition of Great Lake Shoreline Catchments

Many small valley-segment catchments were defined adjacent to one of the Great Lakes. If the valley segment in a catchment adjacent to a Great Lake did not contain a stream or was smaller than approximately 3 to 6 mi^2, then the valley-segment catchment was designated as a shoreline catchment. No limitation on depletion was set from these shoreline catchments because pumping was assumed to come from the lake and not adversely impact a stream. Entities proposing withdrawals greater than 2 Mgal/d, however, are required to obtain a water-withdrawal permit (Public Act 180 of 2008 (2008 PA 180), Michigan State Legislature, 2008b), and the potential ecological impact of such withdrawals may be assessed in the permitting process.

Distribution of Streamflow Depletion Among Valley Segments in Neighboring Catchments

Unlike direct surface-water withdrawal, ground-water withdrawals are thought to potentially affect valley segments in neighboring catchments. The analytical solution, however, estimates streamflow depletion only between the well and a single stream. Nine different methods to apportion streamflow depletion among neighboring valley segments were evaluated. Details regarding this evalution are presented in appendix 2. The simplest approach is to estimate streamflow depletion only for the valley segment draining the catchment containing the well. This simple approach, however, performed the worst compared to the results from a numerical ground-water-flow model. On the basis of the analysis, an inverse distance method was selected for the screening tool because (1) it produces a reasonable overall pattern of streamflow depletion compared to a numerical ground-water-flow model, (2) it is the most straightforward to implement in the Internet-based screening tool, and (3) it has some theoretical basis in steady-state analysis (Wilson, 1993). The weighting used for this distribution method may be written as

$$f_i = \frac{\frac{1}{d_i}}{\sum_{j=1,n} \frac{1}{d_j}}, \tag{6}$$

where

f_i is the fraction of the captured water attributed to valley segment i,

n is the number of adjacent valley-segment catchments, and

d_i is the distance from the proposed well to the closest point on the valley segment within catchment *i*.

Demonstration of Analytical Model and Distribution Approach

The ground-water-flow model for the area around Kalamazoo County, Mich. (Luukkonen and others, 2004) was used to test the nine distribution methods discussed in appendix 2 and to demonstrate the performance of the analytical model used in the screening tool. The ground-water-flow model is a finite-difference (MODFLOW) simulation model with 6 layers, 154 rows, and 162 columns. The smallest grid spacing in the model is 660 ft by 660 ft. Valley-segment catchments in the interior of the model that have this finest grid spacing were used in the methods testing. The model used for the test case includes approximately 90 existing wells, and streamflow depletion caused by the addition of a new well to different parts of the model is examined. To illustrate the applicability of the analytical model and distribution approach to field problems, a transient simulation with seasonally varying recharge and pumping rates was used as the test case. Luukkonen and others (2004) presented the results for a 9-year transient simulation; but, in this work, the length of the simulation was reduced to 5 years to reduce computer run time (fig. 3). The simulation illustrates seasonal pumping and recharge. This simulation is used in the demonstration to illustrate that the analytical model given by equation 1 is not affected by time-varying areal recharge as long as the areal recharge is independent of the imposed pumping. Because areal recharge in the numerical model is specified and does not depend on the pumping imposed on the system, the numerical model is consistent with the assumptions made in the analytical model. For many cases in Michigan, pumping will not induce increased recharge, and this assumption is valid at least on a screening level.

A method to illustrate streamflow capture by pumping wells (Leake and Reeves, 2008) was used to examine the spatial distribution of streamflow capture from the valley segments. In this method, hypothetical wells are added to the MODFLOW model sequentially on a grid of cells (fig. 4).

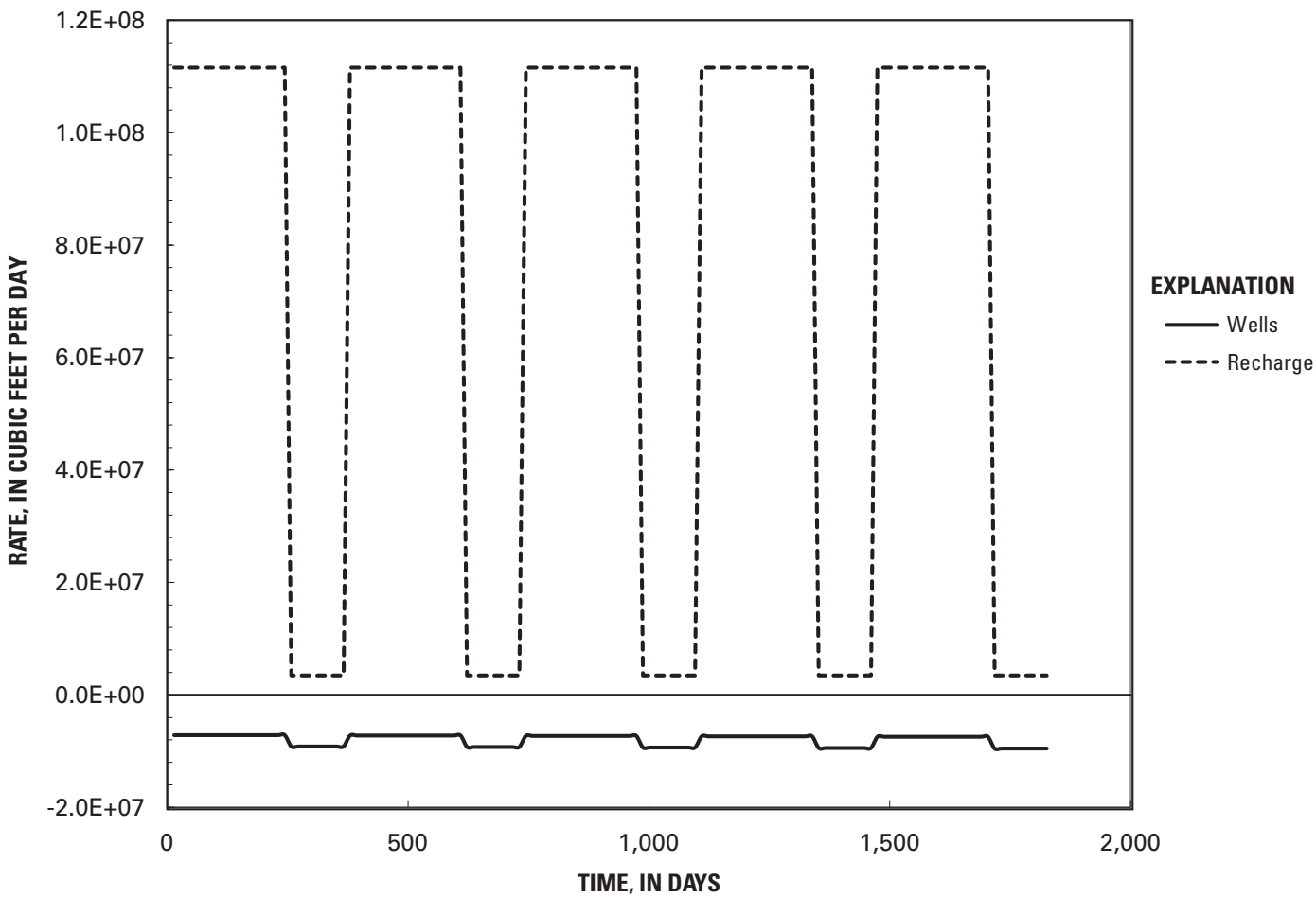


Figure 3. Recharge and pumping rates used in the base simulations with the Kalamazoo regional ground-water-flow model (Luukkonen and others, 2004).

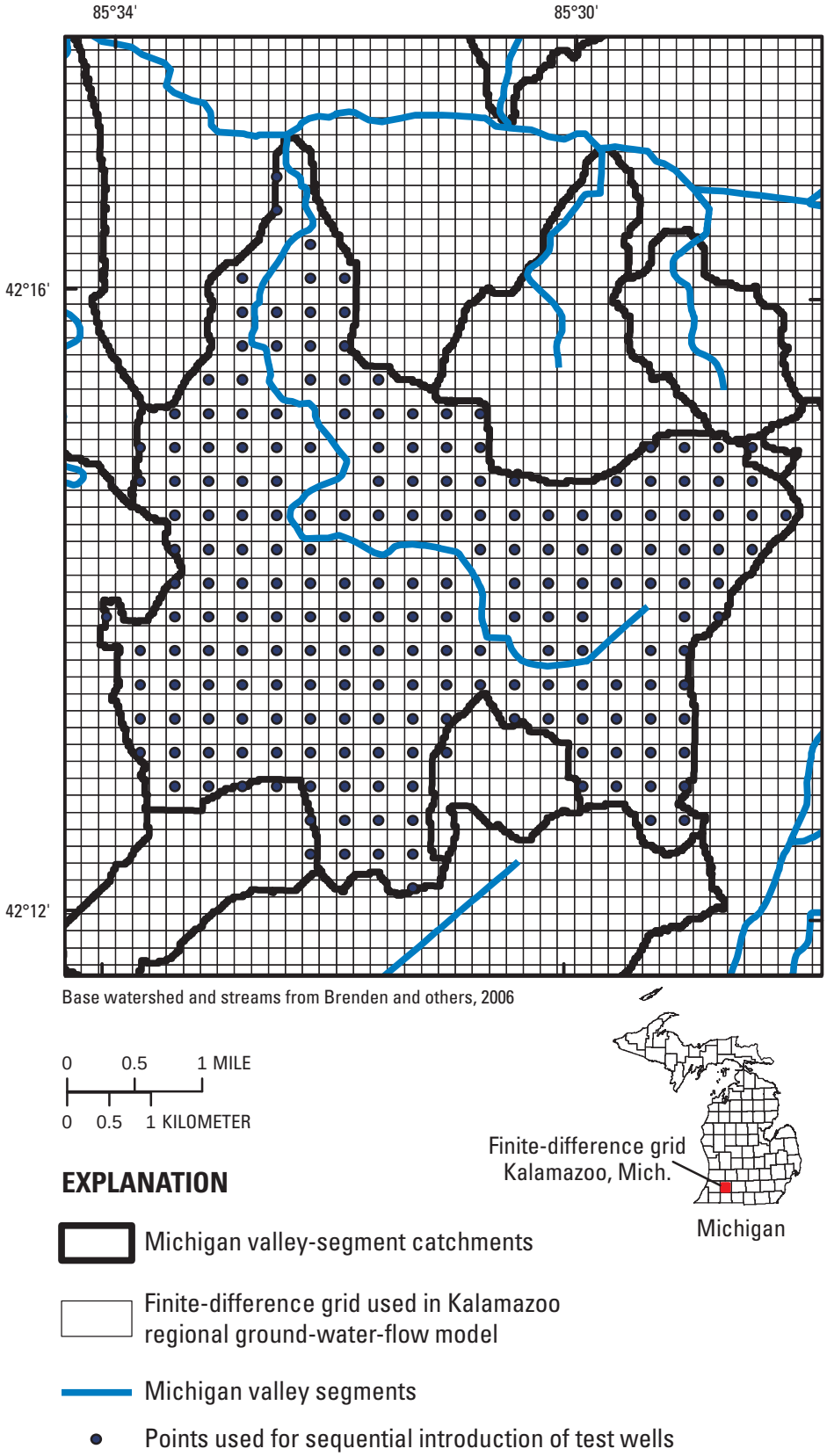


Figure 4. A grid of points used to compare the analytical model and different distribution methods to MODFLOW results from the Kalamazoo regional ground-water-flow model (Luukkonen and others, 2004).

One well is added to a specified cell, and the new simulation is computed. The results from this new simulation are subtracted from base-model results to determine the capture and change in storage caused by the new well. The process is repeated with one new well at a time, generating a grid of results that may be mapped. The fluxes to individual river cells representing the valley segments from the statewide data framework were computed. These fluxes were recorded by use of a river observation file (Hill and others, 2000) to designate the finite-difference cells assigned as river cells to the appropriate valley segments. The river flux output from the system with the new well for each designated valley segment was subtracted from the valley-segment flux computed with the original model to yield the streamflow depletion due to the new well as simulated with the MODFLOW model. Values for streamflow depletion as a percentage of pumping rate for the grid of wells shown in figure 4, which were placed in layer 3 of the model, are shown in figure 5. The two methods, MODFLOW and the analytical model, produce similar results for wells introduced into the test valley-segment catchment. The maximum depletion for wells introduced near the valley segment within the catchment is between 70 and 80 percent, and the minimum depletion near the boundary of the catchment is less than 10 percent (See appendix 2 for more detailed discussion of the methods to distribute streamflow depletion among neighboring valley segments).

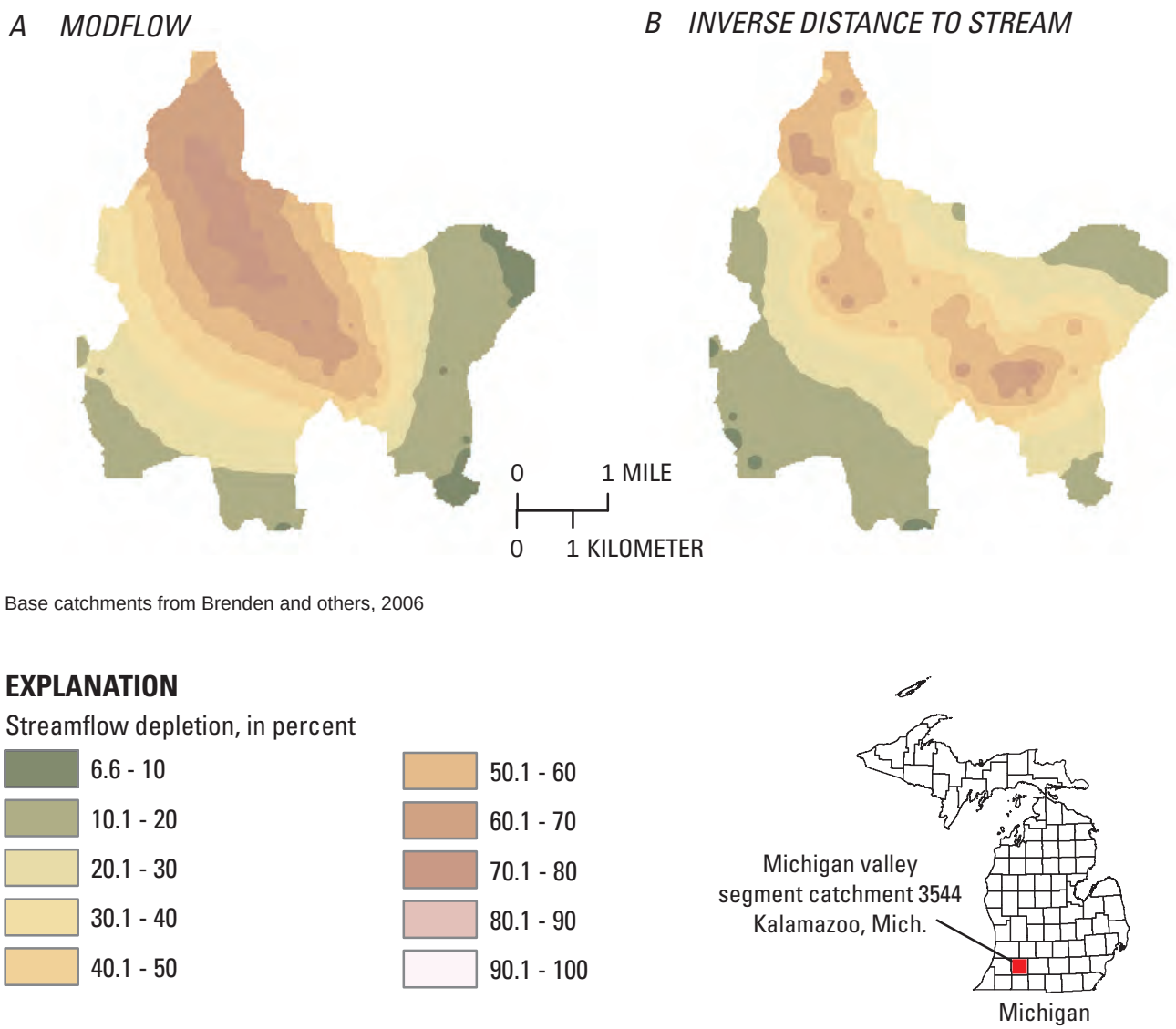


Figure 5. Estimated streamflow depletion from valley segment 3544 as a percentage of pumping rate after 5 years of pumping. *A*, results from a sequential introduction of test wells in the MODFLOW ground-water-flow model for Kalamazoo County, Mich. *B*, results from analytical model with inverse distance to stream distribution of streamflow depletion.

Limitations of Testing

The MODFLOW simulation model for the Kalamazoo area provides a convenient way to test the analytical model and distribution methods. The ground-water-flow model, however, is a regional simplification of the flow system, and neither the MODFLOW model nor the analytical model may accurately estimate the true impact of a specific well on a specific stream in the area. Site-specific investigation would be required for such an estimate. The MODFLOW model resolution of the stream network and well distribution also affects the estimates. The smallest grid size in the ground-water-flow model is 660 ft by 660 ft, and this becomes the shortest distance between the well and the stream that can be tested with the MODFLOW model. If a test point is placed in the same cell as a valley segment, the effective distance between the well and the stream is zero in the MODFLOW model. For the test grid (fig. 4), no wells were placed in valley-segment cells. The distances used for the analytical model are from geoprocessing of the data-framework files. These distances are more accurate than those used in the MODFLOW model, and some mismatch between MODFLOW results and the analytical estimates is expected because of these distance differences. In addition, the aquifer characteristics used in the MODFLOW model are different from those used in the analytical model. The transmissivity, storage coefficient, and streamflow-conductance values used in the analytical model in the test were estimated from the statewide databases, as described earlier in this report. The values used in the MODFLOW model, however, were the calibrated values from Luukkonen and others (2004). Different input values were used to more fully test the approach for the screening tool described previously. The reasonable match between the MODFLOW results and the analytical-model results supports the use of the analytical model, the use of the estimated aquifer properties derived from the GWIM database, and the use of the inverse-distance weighting scheme to distribute streamflow depletion among neighboring valley-segment catchments.

The aquifer and surface-water network in Kalamazoo County is not necessarily representative of conditions across all of Michigan. In addition to this quantitative test, a series of qualitative ad hoc tests were performed by applying the analytical model to locations of high-capacity wells in every county of the state. The ad hoc tests relied on the experience of the testing team to assess whether the results appeared to be reasonable, and no major problems were identified through this testing.

Summary of the Ground-Water Component of the Water-Withdrawal Screening Tool

The water-withdrawal screening tool was designed to be accessed through the Internet. This access required the integration of several technologies. The screening tool essentially implements the analytical model and inverse-distance weighting distribution method described in the previous sections but with different computer software than used in the testing and development. A brief list of steps may help illustrate the ground-water component of the screening tool. The overarching technology is an ArcIMS Web site (Environmental Systems Research Institute, Inc. (ESRI), 2004) that provides a map interface to the screening tool for the user. The following is the sequence of steps for a typical screening-tool session:

1. When the user enters the location for a new withdrawal, a server running ArcView with Avenue Scripts (for example, Razavi and Warwick, 1999) determines the valley segment containing the proposed well.

2. The user specifies whether the proposed well is in glacial deposits or bedrock. If bedrock, then the bedrock type for the valley-segment catchment is identified.

3. A GIS data file is accessed to gather the aquifer properties assigned to the valley-segment catchment and to determine whether the valley-segment catchment is identified as a Great Lake shoreline catchment.

4. The neighboring valley segments are identified.

5. The distances from the proposed well to the nearest valley segment in each of the valley-segment catchments are computed.

6. VBScripts are used to run the Hunt (1999) analytical model (equation 1) for each of the valley segments using the aquifer properties for the valley-segment catchment containing the well and the distances computed in step 5. If the user specifies time-varying pumping, then superposition (equation 2) is used to compute the maximum streamflow depletion during the 5-year evaluation period. For steady pumping, the solution is evaluated after 5 years of pumping.

7. VBScripts are used to distribute the streamflow depletion between the neighboring valley segments using inverse distance weighting (equation 6).

8. Additional scripts are used to collect this information, compare the results to streamflow estimates, and apply screening rules to provide feedback to the user.

Example Screening and Confirmation of Water-Withdrawal Screening-Tool Results

The tests of the analytical model presented in this report were generated by use of Python scripts and the Fortran-based STRMDEPL08 program (Reeves, 2008). The STRMDEPL08 program was used to evaluate the Hunt (1999) analytical model (equation 1). Examples were run in this manner as batch tests for the technical subcommittee of the GWCAC. Because the STRMDEPL08 program has been documented by Reeves (2008), it serves as a standard for comparison of the Internet-based water-withdrawal screening tool. In this final section, results from the water-withdrawal screening tool using the sequence of ArcIMS, VBScript, and Avenue scripts listed above are shown to match results from STRMDEPL08 with inverse-distance weighting applied to distribute withdrawal among neighboring valley segments.

For this demonstration, an example in the northern part of the Lower Peninsula of Michigan (fig. 6) was evaluated with the water-withdrawal screening tool. The latitude and

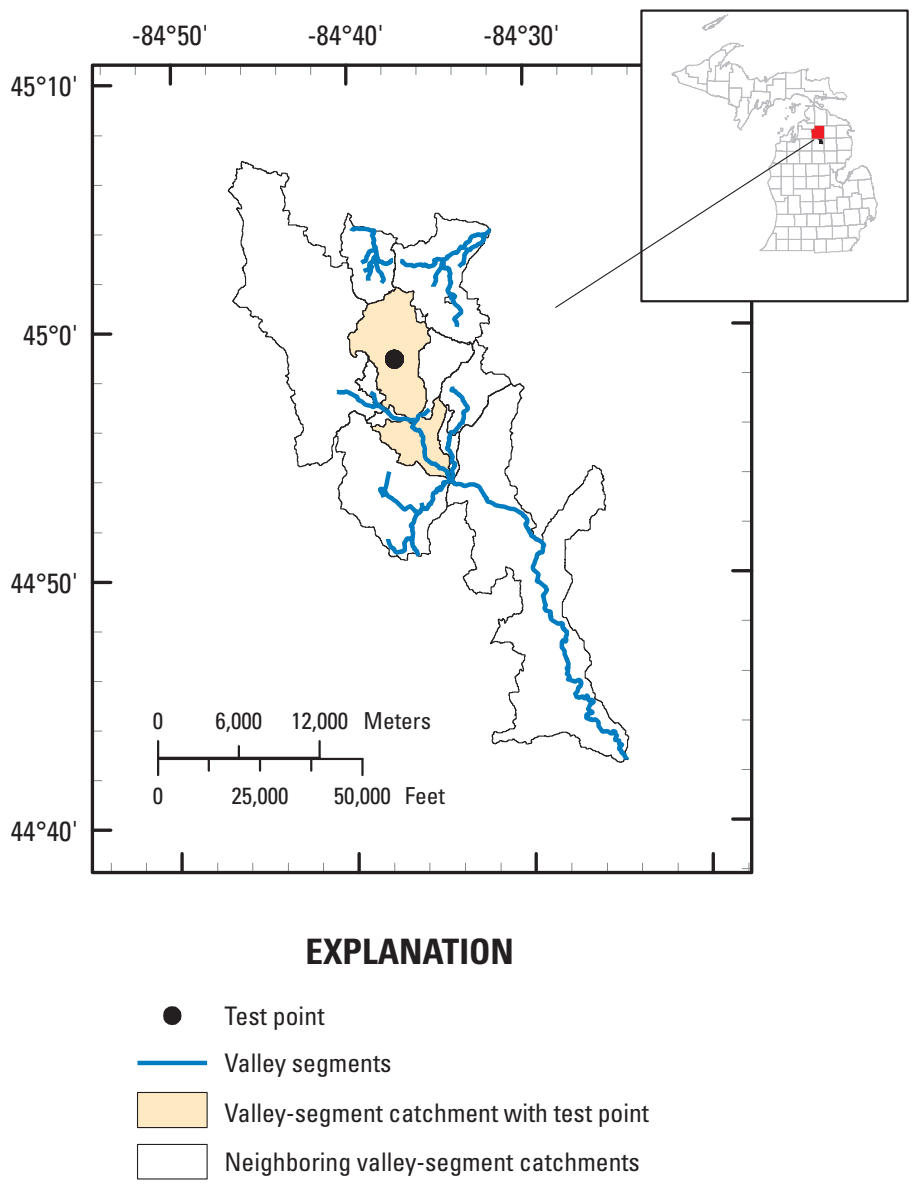


Figure 6. Example test point, valley-segment catchment containing the point, and neighboring valley-segment catchments.

longitude of the point were input to the Python scripts used for the screening-tool development. The point, the valley-segment catchment containing the point, the neighboring valley-segment catchments, and the neighboring valley segments identified by the Internet-based suite of programs and the Python scripts were identical. The percent removal from each of the valley segments and the total removal given a well at a depth of 80 ft and a continuous pumping rate of 70 gal/min generated by the STRMDEPL08 program (Reeves, 2008) and the water-withdrawal screening tool were nearly identical (table 2). The differences between the STRMDEPL08 and water-withdrawal screening tool may be attributed to slight differences in the estimated distances between the proposed well and valley segments, most likely caused by round-off in the latitudes and longitudes used to locate the point.

Table 2. Compilation of estimates for an example test point using the Michigan water-withdrawal screening tool and the set of batch programs used in screening-tool development and testing.

[The number of digits used does not signify precision of estimates but is reported to show the difference between the two sets of calculations]

Valley segment identification	Distance to example well, feet		Removal from valley segment, percent		Analytical removal, gallons per minute		Estimated removal from valley segment, gallons per minute	
	Screening tool	Batch	Screening tool	Batch	Screening tool	Batch	Screening tool	Batch
8	14,802	14,798.9	9.89	9.89	52.02	52.02	5.15	5.15
9	12,609.2	12,609.6	11.61	11.61	54.30	54.30	6.31	6.30
11	15,750.5	15,745.0	9.30	9.30	51.05	51.03	4.75	4.74
27	22,567.6	22,562.4	6.49	6.49	44.24	44.25	2.87	2.87
9741	27,565.2	27,561.4	5.31	5.31	39.52	39.49	2.10	2.10
10532	33,059.5	33,052.5	4.43	4.43	34.62	34.60	1.53	1.53
11967	14,846.3	14,844.0	9.86	9.86	51.98	51.97	5.13	5.13
12515	17,042.5	17,033.9	8.59	8.59	49.73	49.73	4.27	4.27
12573	11,959.5	11,960.4	12.24	12.24	54.98	54.98	6.73	6.73
12941	19,070.8	19,063.4	7.68	7.68	47.69	47.71	3.66	3.66
13925	10,028.9	10,030.6	14.60	14.59	57.01	57.00	8.32	8.32

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Appendix 1. Background and Literature Review on Streamflow Depletion Modeling

Streamflow depletion has been modeled with various analytical and numerical models. The conceptual model underlying each approach may be used to distinguish and classify the analytical and numerical models. Five conceptual models and extensions are discussed to provide an overview of the relevant literature on streamflow depletion by wells.

Fully Penetrating Stream With No Streambed Resistance

The first conceptual model discussed in this report was used to derive a solution by Theis (1941) that was later recast in the now more familiar form by Glover and Balmer (1954). This model is for a stream that fully penetrates the aquifer. There is no resistance to flow offered by the streambed. The domain is homogeneous and extends to infinity away from the stream. The stream is infinite, and the interaction between the pumped aquifer and the entire stream length is considered. There is no flow across the bottom of the aquifer. Flow is horizontal (Dupuit approximation) and, if the aquifer is unconfined, then drawdown in the aquifer is small compared to the saturated thickness such that the system may be modeled with constant transmissivity (fig. 1–1*A*). Glover (1974) presents a solution to the problem that provides an estimate of streamflow depletion for an arbitrary length of the stream.

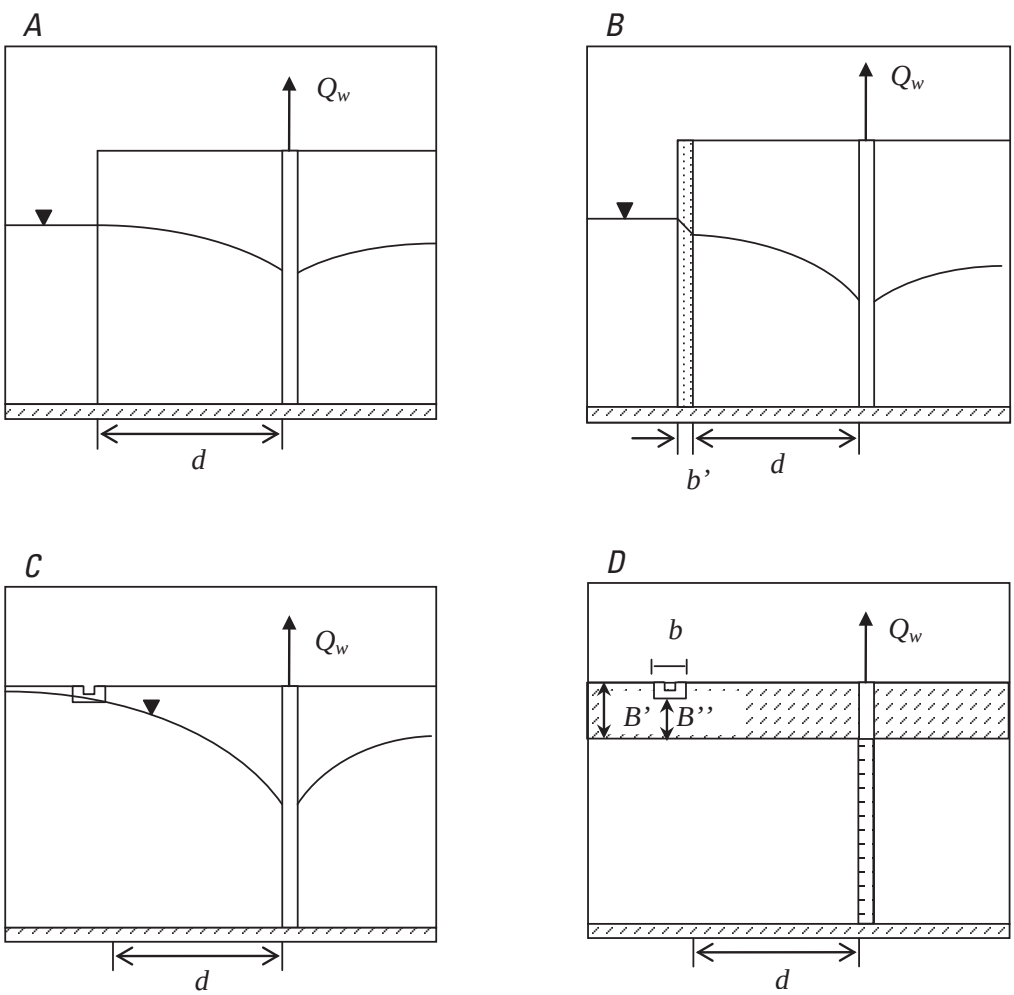

Figure 1–1. Alternate conceptual models for streamflow depletion by a pumping well. (*A*, Fully penetrating stream with no streambed resistance. *B*, Fully penetrating stream with streambed resistance. *C*, Partially penetrating stream with streambed resistance. *D*, Partially penetrating stream in semiconfining layer with pumping from underlying semiconfined aquifer. In the figure, d is the distance from the well to the stream, Q_w is the pumping rate from the well, b' is the thickness of the streambed, B' is the distance from the land surface to the top of the leaky aquifer, B'' is the distance from the bottom of the stream to the top of the leaky aquifer, and b is the width of the stream (Modified from Reeves, 2008)).

The Theis (1941) and Glover and Balmer (1954) solutions are transient but consider only a constant pumping rate. Jenkins (1968) and Wallace and others (1990) describe how to use superposition to extend the Glover and Balmer (1954) solution for intermittent or cyclic pumping rates. Jenkins (1968) introduces the concept of the streamflow depletion factor (*sdf*) that is used by several subsequent authors (for example, Burns, 1983). Jenkins (1968) focuses on the use of superposition to solve intermittent pumping problems and demonstrates that streamflow depletion continues for some time even after pumping has been stopped. Wallace and others (1990) examine the time required for the system to attain a dynamic steady state and the conditions under which a cycle-average pumping rate could be used in the estimation of streamflow depletion by cyclic pumping. Under certain conditions, discussed in the paper, the use of the cycle-average pumping rate to analyze streamflow depletion severely underestimates the peak depletion rates; therefore, an analysis with the true cyclic pumping rates is preferable. Barlow (2000) wrote a computer program to compute the Glover and Balmer (1954) solution for intermittent pumping, using the techniques described by Jenkins (1968).

In contrast to the transient solutions, Newsom and Wilson (1988) and Wilson (1993) present steady-state solutions to this problem. For all the solutions discussed for this conceptual model, the total streamflow depletion is the pumping rate because there are no other sources of water to allow the system to reach steady state other than capture from the stream. The Glover (1974) solution and the Newsom and Wilson (1988) or Wilson (1993) solutions can be used to estimate the amount of streamflow depletion in a prescribed length of the stream reach. As this length becomes large, the streamflow depletion from the specified stream reach approaches the pumping rate. The papers by Newsom and Wilson (1988) and Wilson (1993) illustrate the importance of regional ground-water flow on the solution. The analysis in the papers also distinguishes between streamflow capture by interception of ground water that would have been discharged from the aquifer as base flow and streamflow capture by induction of stream water into the aquifer. Wilson (1993) also provides analysis for a well between two streams with vertical recharge and for an aquifer with both a stream and a barrier boundary.

Distinguishing between capture from decreased base flow to the stream and induced infiltration from the stream may be important for water-quality analysis if the water-quality characteristics of the stream and the aquifer are different. The steady-state solutions may be used to analyze the infiltration rate of poor-quality surface water to a supply well or the discharge rate of contaminated ground water to a stream despite the installation of an extraction well. The critical pumping rate required to induce infiltration from the stream is shown to be a function of the angle between the ambient flow direction and the stream (Newsom and Wilson, 1988). If the ambient flow rate is perpendicular to the streambed, which is the typical situation, the critical flow rate is calculated as follows (Newsom and Wilson, 1988; Wilson, 1993):

$$Q_c = \pi d q_a , \qquad (1\text{–}1)$$

where

Q_c is the critical pumping rate, d is the distance between the well and the stream, and

q_a is the ambient flow rate of ground water to the stream per unit length of stream.

This last term is the specific discharge from the aquifer to the stream integrated by the thickness of the aquifer, and it has units of length squared per unit time (Newsom and Wilson, 1988). Newsom and Wilson (1988) present results that show that this critical pumping rate increases by approximately 10 percent at an approximate angle between the ambient flow and the streambed of 29 degrees. The critical pumping rate is increased for angles between 0 and approximately 55 degrees and decreases between 55 degrees and 90 degrees. For flow parallel to the streambed (90-degree angle between ambient flow and the streambed), the critical pumping rate is approximately 40 percent of the value given above.

Chen (2003) combines transient analysis and the questions posed by Newsom and Wilson (1988) and Wilson (1993) to present a transient investigation of induced infiltration from the stream and decreased base flow to the stream. In particular, Chen (2003) derives the critical time required to induce infiltration from the stream as

$$t_c = -\frac{d^2 S}{4T \ln(\pi q_a d / Q)} , \qquad (1\text{-}2)$$

where

t_c is the critical time when infiltration from the stream to the aquifer is induced,

T is the aquifer transmissivity (length squared per unit time),

S is the aquifer storage coefficient (dimensionless), and

Q is the pumping rate of the well (length cubed per unit time).

Chen (2003) also discusses the residual impact of pumping on streamflow after pumping has ceased. As noted by other transient analysis (for example, Jenkins, 1968; Wallace and others, 1990), streamflow depletion continues after pumping has stopped until, under this conceptual model, the total volume removed as streamflow depletion is the same as the volume of water removed from the aquifer by the intermittent pumping.

Fully Penetrating Stream With Streambed Resistance

Hantush (1965) presented the solution for the second conceptual model that includes streambed resistance as illustrated in figure 1–1*B*. The resistance in the streambed is described by

a streambed leakance or retardation coefficient, $L = (Kb'/K')$, where K is the hydraulic conductivity of the aquifer, K' is the hydraulic conductivity of the streambed, and b' is the thickness of the streambed[1]. The streambed leakance term causes the interaction between the pumping well and the stream to be delayed. As discussed for the previous conceptual model, because there are no other sources of water for the well to capture, the streamflow depletion is the pumping rate at steady state. The Hantush (1965) solution is a transient solution for a constant pumping rate, and the superposition techniques described by Jenkins (1968) can be applied to this solution. Barlow (2000) includes the Hantush (1965) solution in the computer program cited above as an input option selected by the user.

Many solutions that consider streambed resistance also incorporate partial penetration of the streambed into the aquifer, and these solutions will be discussed in the next section. Three papers that evaluated analytical solutions and identified shortcomings with various conceptual models are now reviewed to emphasize the difference between the conceptual models and associated analytical solutions. Spaulding and Khaleel (1991) and Sophocleous and others (1995) analyzed the analytical solutions by Glover and Balmer (1954), Jacob (1950) (discussed in the next section), Hantush (1965), and Glover (1974) and provide results illustrating the importance of streambed resistance and partial penetration of the streambed into the aquifer. See figure 1–1*C* for an illustration of a partially penetrating streambed. Spaulding and Khaleel (1991) used a finite-element ground-water-flow model from the literature and Sophocleous and others (1995) used the finite-difference-based model MODFLOW (Harbaugh and others, 2000) to test the various analytical solutions for different conceptual models. Both papers conclude that streambed resistance and partial penetration of the streambed into the aquifer are important to the solution and that conceptual models that do not account for these factors may severely overestimate the streamflow depletion rate at a given time. Conrad and Beljin (1996) also used MODFLOW to investigate various assumptions inherent in the Wilson (1993) solution. These authors also investigated the impact of streambed resistance and partial penetration by the stream. In addition, they present tests exploring the impact of vertical anisotropy in the aquifer and of considering typical variations in stream levels on the simulation of the aquifer system. All of these papers show that partial penetration of the streambed into the aquifer and incorporation of streambed resistance are important features that should be included in the analysis of streamflow depletion.

Partially Penetrating Stream With Streambed Resistance

Hunt (1999) generalizes the problem more by considering a partially penetrating stream in a fully confined or unconfined aquifer. The rest of the assumptions used for the previous cases still hold: horizontal flow following the Dupuit approximation, small changes in saturated thickness for the unconfined case, and a homogeneous aquifer. In this case, the aquifer has infinite extent and the stream width and depth are small compared to the aquifer thickness, such that the stream may be modeled as a line (zero width). Hunt (1999) includes the resistance through a streambed using Darcy's Law, $Q = \lambda (H-h)$, where λ is a streambed-conductance term that must incorporate the hydraulic conductivity of the streambed, geometry of the streambed, and streambed thickness; H is the elevation of the water level in the stream; and h is the head in the aquifer at the streambed. As discussed by Hunt (1999), and emphasized by Rushton (1999), the head in the aquifer is assumed to remain in the streambed in this solution. (Solutions considering the case where the head in the aquifer drops below the streambed are discussed later.) This solution considers the impact of pumping on the head in the aquifer on the opposite side of the stream from the pumping well (fig. 1–1*C*). The solution yields the time-dependent response of the aquifer and for streamflow depletion to steady pumping from a well. Hunt (1999) shows how the solution presented approaches the Glover and Balmer (1954) solution as λ approaches infinity and the Hantush (1965) solution if λ is replaced by $2T/L$. Hunt (1999) points out that Hantush (1965) suggested that the distance from the stream to the well, d, in the solution may be varied to account for partial penetration of the stream (see also Jacob, 1950; and Spaulding and Khaleel, 1991) and that this suggestion appears to be incorrect. Evidently, the Hantush (1965) solution for the semi-infinite domain and fully penetrating stream may be used for the infinite domain and partially penetrating stream by appropriate correction to the retardation coefficient, L, using $L = 2T/\lambda$.

The notion that partial penetration of the streambed into the aquifer may be modeled by varying the distance from the well to the stream in the solution is not unique to Hantush (1965). Jacob (1950) suggested that the distance from the well to the stream may be varied in the Glover and Balmer (1954) solution to account for both streambed resistance and partial penetration of the streambed (Spaulding and Khaleel, 1991). To facilitate comparison of the analytical solutions, Spaulding and Khaleel (1991) used a three-dimensional analytical solution to derive a set of curves defining the effective distance from the well to the stream for different degrees of partial penetration for use in either the Glover and Balmer (1954) or Hantush (1965) solutions. Darama (2001) used this set of curves along with techniques from Wallace and others (1990) to examine cyclic pumping in the case of partially penetrating streambed with streambed resistance. Darama (2001) echoed the conclusions of Spaulding and Khaleel (1991) and Sophocleous and others (1995) that partial penetration of the streambed and streambed resistance are important factors in the solution that should be considered in the conceptual model.

Singh (2003) presents an alternate solution for a partially penetrating stream by adding an equivalent resistance length to the Hantush (1965) retardation coefficient to account for

[1] Streambed resistance in the paper by Hunt (1999) is L, but Hantush (1965) denotes this coefficient by a.

partial penetration. In this way the solution addresses both streambed resistance and partial penetration. An expression to approximate the additional resistance length that depends on the thickness of the aquifer and the stream width is provided. Singh (2003) also discusses the use of superposition to account for intermittent pumping. The geometry of the conceptual model is not discussed by Singh (2003), and the Hunt (1999) solution is not cited. Because of the relation between the Hantush (1965) and Hunt (1999) solutions, and because the Singh (2003) solution is an extension of the Hantush (1965) solution, there must be a relation between the Singh (2003) and Hunt (1999) solutions. This relation implies that the Singh (2003) solution could be used for the conceptual model shown in figures 1–1*B* or 1–1*C*. An analysis to relate the Hantush (1965) retardation coefficient, the streambed-conductance term used by Hunt (1999), and the resistance length added due to partial penetration in the Singh (2003) would be interesting but beyond the scope of this review.

Another approach to this conceptual model was offered by Zlotnik and Huang (1999), who derived an analytical solution by breaking the problem domain into two regions. The first region is the aquifer below the partially penetrating stream, and the second region is the adjacent semi-infinite aquifer. The solution is derived by simultaneously solving the equations for the two regions that are coupled by the boundary condition at the interface between the two regions. The solution is given as a Laplace Transform and is awkward to evaluate. A simplified version of the solution in which the storage coefficient in the region below the streambed is ignored yields a simpler solution that has a similar form to many of the other analytical solutions discussed. One advantage of this solution is that the stream has finite width in contrast to the solution presented by Hunt (1999) that models the stream as a line.

Butler and others (2001) extend the earlier work by Zlotnik and Huang (1999) and compare results of this analytical model to results from the solution presented by Hunt (1999) and to numerical results generated from MODFLOW. This analysis again emphasizes the importance of considering both partially penetrating streambed and streambed resistance when simulating the interaction between a pumping well and a stream. The authors noted that the model by Hunt (1999), which does not account for stream width, yields essentially the same result as a finite-width solution if the well is more than five stream-widths away from the stream. Comparison with the numerical model allowed the evaluation of the assumption that the aquifer is infinite in extent away from the stream. This analysis suggested that the aquifer width has to be hundreds of stream widths in extent before the analytical solution yields similar results as the numerical solution.

A solution for a finite-width stream also was given by Fox and others (2002). The nature of the solution and an alternate explanation for convergence problems identified by Fox and others (2002) is presented in the discussion by Hunt (2004). The difference between the finite-width solution (Fox and others, 2002) and line-width solution (Hunt, 1999) was investigated for a range of conditions. The difference depends on the distance from the well to the stream and the simulation time. When the well is more than 50 stream widths from the stream, the difference between the two solutions is less than 1 percent. In contrast to the findings of Butler and others (2001), the lower limit reported by Fox and others (2002) for agreement between the solutions is 25 stream widths. When the well is closer than 15 stream widths away from the stream, the maximum error between the solutions under the worst-case conditions is stated to be as great as 10 percent.

Di Matteo and Dragoni (2005a, 2005b) used MODFLOW to investigate partial penetration of the streambed into the aquifer and the impact of regional gradients on the solution. The importance of regional gradients for fully penetrating streams also was illustrated by Newsom and Wilson (1988), Wilson (1993), and Chen (2003). Di Matteo and Dragoni (2005a) present an interesting approach wherein MODFLOW was used to generate streamflow-depletion estimates, and then these estimates were fit by a nonlinear function in terms of the aquifer parameters and stream geometry. This empirical relation was then tested for a variety of conditions to illustrate the importance of anisotropy, partial penetration of the streambed, and the overlap between the bottom of the streambed and top of the well casing. This is the only paper that explicitly considers this overlap in the analysis.

Steady-state solutions to the partially penetrating streambed are presented by Ernst (1979) and Bakker and Anderson (2003). Ernst (1979) uses image-well theory to derive expressions for drawdown and streamflow depletion, but this paper appears to be largely forgotten because it is not often cited in the literature. Bakker and Anderson (2003) also use image-well theory and allow for a hydraulic gradient in the stream and for ambient flow in the aquifer at an arbitrary angle to the streambed. The solution is very interesting in that it illustrates the impact of pumping a well on the opposite side of the stream as solved by Hunt (1999) and schematically illustrated in figure 1–1*C*. In the special case of no hydraulic gradient in either the stream or in the aquifer (no ambient flow), the solution reduces to a steady-state evaluation of the solution by Hunt (1999). The Bakker and Anderson (2003) solution is similar in concept to that of Newsom and Wilson (1988) and Wilson (1993) except that it considers partial penetration of the streambed. The partial penetration of the streambed into the aquifer complicates matters and leads to a solution written in terms of complex potentials. As in the case of the earlier steady-state solutions, this solution is useful to delineate ultimate capture zones for wells and to distinguish between captured base flow and induced infiltration from the stream to the aquifer.

Partially Penetrating Stream With Drawdown in the Aquifer Below the Streambed

Several papers in the literature have discussed the importance of unsaturated flow in the analysis of the interaction of a stream and an aquifer when the head in the aquifer falls below

the streambed and the stream becomes disconnected from the water table (perched). In all of the solutions presented earlier in this review, the head in the aquifer must remain within the streambed. In cases where the resistance to flow in either the aquifer or the streambed is large enough, the head in the aquifer may drop below the streambed in response to pumping. Classically, when the head in the aquifer falls below the streambed, the rate of streamflow depletion becomes constant and independent of the pumping rate. The rate of streamflow depletion depends on the water level in the stream, the elevation of the streambed, and the hydraulic characteristics of the streambed (as modeled in MODFLOW, for example (Harbaugh and others, 2000); see also the discussion by Rushton, 1999). Soil properties under unsaturated flow conditions, however, lead to more complicated behavior, and the rate of streamflow depletion also depends on the degree of saturation of the aquifer material below the streambed, the saturation-capillary pressure characteristics of the aquifer material, and the distance between the streambed and the water table.

Peterson and Zhang (2000) use a numerical model for unsaturated flow to demonstrate that the capillary pressure that develops below a perched stream may become an important consideration to the estimate of streamflow depletion. Solutions that use the classic approach described above may significantly underestimate the streamflow-depletion rate because they do not consider the flow from the stream to the aquifer caused by capillary-pressure differences and described by unsaturated flow theory.

Osman and Bruen (2002) recognized this problem and proposed a modified algorithm for losing streams for MODFLOW that includes a term to account for unsaturated flow. These authors compared the results of the modified MODFLOW model to a full unsaturated-flow model. They report that the modified approach performed much better than the classic MODFLOW approach compared to the unsaturated-flow model for the water-table configuration under a perched stream and for the estimated streamflow depletion. Bruen and Osman (2004) used Monte Carlo experiments to investigate the importance of unsaturated flow below perched streams and the heterogeneity of the underlying aquifer. They report that explicit consideration of aquifer heterogeneity compared to modeling with average properties increases in importance in the estimate of streamflow depletion when the water table is well below the streambed.

Fox and Durnford (2003) modify the Hunt (1999) solution to allow part of the stream to become perched. The segment of the stream that is perched delivers water to the unsaturated zone at a rate determined by the unsaturated properties of the aquifer, as described by the previous papers. Empirical testing allowed Fox and Durnford (2003) to generate an analytical-solution procedure. The authors showed that if the stream becomes perched, the drawdown is greater and streamflow depletion is less than that predicted by use of the Hunt (1999) solution, which does not allow the stream to become perched.

Streamflow Depletion in the Presence of Other Water Sources

The only water source for capture by the well to attain a steady state for all of the solutions presented thus far is the stream. The capture is either captured discharge from the aquifer that would have reached the stream or induced infiltration from the stream to the aquifer. The differences between the solutions are the rate that the system reaches steady state and the configuration of drawdown in the aquifer, such as whether the solution predicts drawdown on the side of the stream opposite from the pumping well. Other sources of water, however, may exist in some practical situations, and the estimate that ultimately streamflow depletion equals the pumping rate will not hold in these situations. Several papers present and analyze various other water sources (figs. 1–1*D* and 1–2).

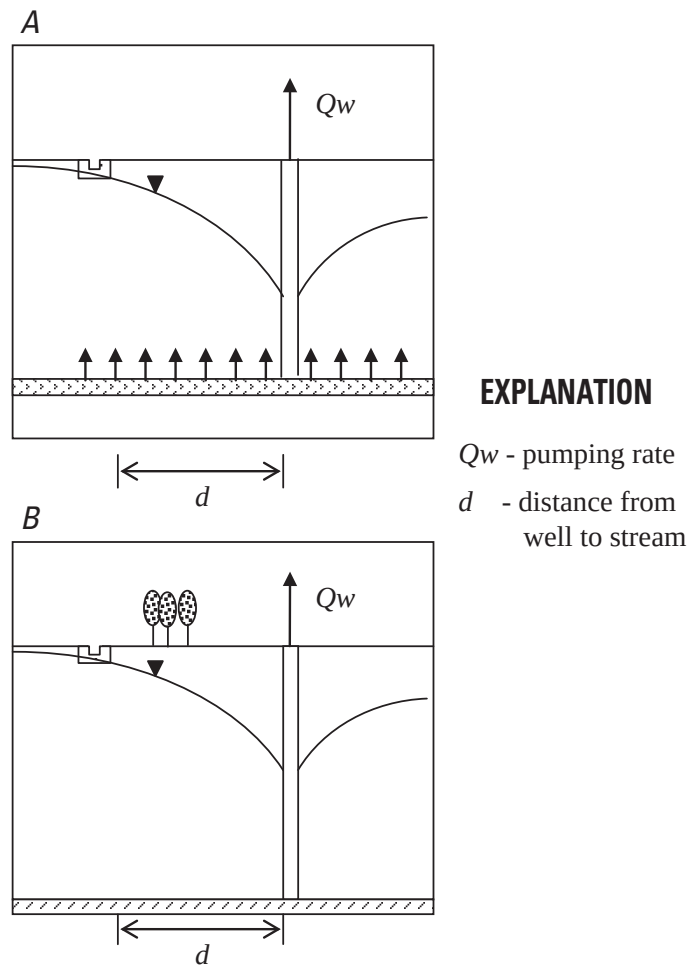

Figure 1–2. Alternate sources of water for capture by a well near a stream. *A*, Stream in an aquifer that overlies a regional aquifer with potentially different hydraulic properties. *B*, Stream in an aquifer system where pumping may interact with plants and change evapotranspiration losses from the system.

Hunt (2003a) presents an analysis for a stream in an semiconfining unit that overlies a leaky aquifer with a well (fig. 1–1*D*). Water may be released from storage from both the leaky aquifer and the semiconfining unit. The water released from storage from the semiconfining unit is the additional water source in this solution. The solution exhibits delayed-yield behavior: after an initial fairly rapid response to pumping, usually considered the result of the expansion of water and compression of the matrix, the response curve flattens for a time and then sharpens once again. The flattening of the response curve in this case is a result of the additional water source yielding water to the well without requiring additional drawdown in the aquifer. It is the only analytical solution to pumping a well near a stream that can fit this type of response by an aquifer. After long periods of time, as the system approaches a steady state, and the streamflow depletion will again equal the pumping rate. Release of water from storage from the semiconfining unit further delays the steady state such that the streamflow depletion may be less than the pumping rate for practical problems and time frames. In this conceptual model, the water in storage in the semiconfining unit is not recharged; therefore, the semiconfining unit cannot provide a long-term source of water to allow the system to reach steady state. This solution is used by several authors to analyze field data that exhibit delayed yield (Hunt, 2003b; Kollet and Zlotnik, 2003, 2005; Fox, 2004; and Lough, 2005).

Zlotnik (2004) solves a conceptual model that provides for a long-term source of water and generates a solution where the streamflow depletion rate is not necessarily the pumping rate at steady state. The conceptual model describes a stream in a shallow aquifer that overlies a deeper regional aquifer (fig. 1–2*A*). The shallow and regional aquifers may be separated by a confining or semiconfining unit. The regional aquifer presumably receives recharge that is independent of the stream and shallow aquifer and is modeled as maintaining a constant peizometric head. The conceptual model used for this analytical solution does not consider streambed resistance or partial penetration of the streambed into the shallow aquifer. The key result is that the streamflow depletion rate is dependent on the hydraulic properties of the shallow aquifer and the unit separating the shallow and regional aquifers. The paper also presents analysis of different boundary conditions for the shallow aquifer and summarizes test cases illustrating this type of behavior in the field.

Two papers investigated in interaction between pumping a well near a stream and changes in evapotranspiration losses from the aquifer (fig. 1–2*B*). Darama (2004) used analytical models, and Chen and Shu (2006) used the numerical model MODFLOW. Both of these papers illustrate how ground water may be captured by a reduction of evapotranspiration loss as the head in the aquifer is lowered by pumping. This evapotranspiration capture decreases the streamflow capture required for the system to reach steady state. Chen and Shu (2006) summarize two important points regarding this situation that depend on whether the issue is streamflow depletion in response to pumping or streamflow recovery in response to reductions in pumping. The first point is that the water captured by a reduction in evapotranspiration rate causes the streamflow depletion to be less than the pumping rate. The second point is that if pumping rates are reduced to help maintain streamflow, then the potential increase in evapotranspiration rates as the head in the aquifer is increased causes the increase in streamflow to be less than the reduction in pumping rate.

Application and Analysis of Streamflow-Depletion Models

Several articles and reports have been written that apply or analyze streamflow-depletion models. For this review, they are classified into two areas: application of the techniques to field problems and use of streamflow-depletion models for water-resources management. Most of the papers already cited provide application of the methods and discussion of the results. The papers in this section use the previous solutions or numerical methods that have already been summarized.

Application to Field Problems

Christensen (2000) demonstrated how the Hunt (1999) solution could be used to estimate streamflow-depletion parameters from aquifer-test data. This paper provides a detailed derivation of the inverse method and a discussion of the uncertainties associated with this type of analysis. The paper does not give an example of an application of the techniques to field data but refers to work that was later published by Nyholm and others (2002, 2003). Nyholm and others (2002) analyze two aquifer tests for wells located 60 m (200 ft) from a stream in a glacial outwash plain in Denmark. As discussed, the authors state that the conditions required to use the analytical solution by Hunt (1999) do not hold for these particular aquifer tests and use MODFLOW to simulate the tests. The inverse modeling code MODFLOWP (Hill, 1992) was used in this case (although MODFLOW–2000 should be able to produce similar results). The paper is notable in the analysis of the MODFLOWP information and related statistical tools and in the detailed discussion of this analysis. More detail regarding the tests and analysis of the test results, including the analysis of application of the Hunt (1999) solution, is offered by Nyholm and others (2003).

Hunt and others (2001) present an analysis of a field experiment that estimated the aquifer transmissivity and storage coefficient and the streambed-conductance factor by application of the Hunt (1999) solution to field data. (See also the discussion of the paper by Kollet and Zlotnik, 2002.) Hunt and others (2001) demonstrate the techniques used to estimate the aquifer and streambed properties.

Hunt (2003b) presents a short paper comparing application his 1999 model and his 2003 model to data from a field experiment. The brief paper demonstrates that the newer solution exhibiting delayed yield fits the field data better than the

earlier solution, which does not include semiconfined conditions (Hunt, 1999). The newer solution fits over the entire time of the test and yields reasonable values for the aquifer characteristics.

Kollet and Zlotnik (2003) describe a detailed aquifer test near a stream with clusters of piezometers between a pumping well and a stream. They analyzed the data with both the Hunt (1999) and the Butler and others (2001) approaches. The authors argue that Butler and others' approach (2001) allows for a better fit of model parameters to the measured data because this model was better able to capture different hydrogeology at the site. Lough (2005) offers a different analysis of the data using the Hunt (2003a) model for a leaky aquifer exhibiting delayed yield and states that this approach better fits the entire response at the observation wells than does the late-time portion used by Kollet and Zlotnik (2003). Kollet and Zlonik (2005) reply that the aquifer is not leaky and suggest that the Hunt (1999; 2003a) analytical solutions do not fit the experimental data well because the assumption of horizontal flow (Dupuit assumption) is violated near the stream, as shown in the observation well data.

Chen and Chen (2003a) present another case study applying the Hunt (1999) solution to field data to estimate streamflow depletion parameters. The authors also present an ad hoc sensitivity analysis of the Hunt (1999) solution and an evaluation of the reliability of estimates for hypothetical cases. This paper received two comments in the literature stating that it did not recognize earlier work by Christensen (2000) or the application by Nyholm and others (2002). (See Christensen, 2005; Chen and Chen, 2005a.) Kollet (2005) argues that the Hunt (1999) solution was inappropriate for this field test and that Chen and Chen (2003a) did not adequately discuss the differences between their results and previously published work (see Chen and Chen, 2005b).

Fox (2004) presents another case study and compares the result of fitting the Hunt (1999), Butler and others (2001), Fox and others (2002), and Hunt (2003a) solutions to field data. In this case, the data again show a delayed-yield response, and the solution by Hunt (2003a) is claimed to fit the drawdown data the best (other fits are not shown). All of the methods were stated to adequately fit the late-time data obtained in the field, and the transmissivity values reported using each of the solutions were reasonable.

Use of Streamflow-Depletion Models for Water-Resources Management

The STRMDEPL program was first documented in a report describing the application of a precipitation-runoff model for the impact of water withdrawals on streamflow by Zarriello and Ries (2000). This implementation of the analytical solutions for streamflow depletion from wells was subsequently used in several other USGS studies in New England. Representative of these are two other precipitation-runoff models (Zarriello and Bent, 2004; Barbaro and Zarriello, 2007) and a detailed water-use and water-availability analysis (Barlow, 2003). In all four of these studies, STRMDEPL (Barlow, 2000) was used to estimate daily streamflow depletion based on daily pumping records from municipal wells. Streamflow depletion is delayed in time and attenuated compared with pumping records, and the analytical solution allowed the precipitation-runoff models to be appropriately calibrated to the pumping records.

A series of papers analyzed the proportion of streamflow depletion from induced infiltration from the stream to the aquifer and from captured discharge that would have reached the stream as base flow under different pumping or aquifer conditions (Chen, 2001; Chen and Yin, 2001; Chen and Shu, 2002; Chen and Chen, 2003b; and Chen and Yin, 2004). These papers, in addition to those by Newsom and Wilson (1988), Wilson (1993), and Bakker and Anderson (2003), may be used to assess water-quality issues arising from induced infiltration from the stream to an aquifer.

Chen and Yin (2001) and Chen and Shu (2002) use MODFLOW to study induced infiltration of stream water to an aquifer stressed by seasonally pumped wells. Chen and Shu (2002) emphasize streamflow depletion and the analysis of the depletion that continues after pumping is stopped. Chen (2001) uses particle tracking and a simple analytical model (Theis solution with an image well) to examine the capture zone of a well. Chen and Chen (2003b) use MODFLOW and particle tracking to assess the impact of anisotropy on the induced infiltration of stream water. Chen and Yin (2004) use the Hunt (1999) solution and apply the concepts illustrated by Wilson (1993) to identify the reach of stream where induced infiltration from the stream to the aquifer occurs. The ratio of capture by induced infiltration to total capture is presented for various conditions, and comparison of the analytical model results to numerical results generated with MODFLOW are presented. As discussed, distinguishing between induced infiltration and base-flow reduction is more important in water-quality analysis than in streamflow-depletion analysis because the total streamflow depletion is the same regardless of the partitioning between these mechanisms.

The Environment Agency, which manages water resources in England and Wales, evaluated potential ways to assess ground-water pumping on streamflow. The "Impact of Groundwater Abstractions on River Flows (IGARF I)" program was discussed by Kirk and Herbert (2002) and in technical reports by the Environment Agency (for example, Parkin and others, 2002).

Case studies examining whether reductions in pumping will change river flows form the core of a paper by Rushton (2002). The major message of this paper is that natural systems are more complicated than those described by most models and that careful hydrogeologic investigation and data collection are required to estimate whether ground-water pumping affects river flow at a given site. Rushton (2002) shows how the timing of recharge events, high and low flows, and seasonal changes in ground-water levels determine the response of the river to reductions in pumping when the river

is at low flow. In some cases, Rushton argues, the pumping wells are virtually disconnected from the river during low flow and reductions in pumping may have only a marginal benefit on river flows.

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Appendix 2. Distribution of Withdrawal Between Neighboring Watersheds

A major aspect of the screening tool is the distribution of pumping between several neighboring valley segments. The simplest approach to estimate the impact of a proposed well on the stream network is to treat the withdrawal as a surface-water withdrawal and assume that the streamflow depletion due to pumping is immediate in time and entirely on the valley segment that drains the catchment containing the well. Use of the Hunt (1999) analytical model relaxes one of these assumptions and accounts for the delay in streamflow depletion due to removal of water from storage in the aquifer. All of the removal may be assigned to the valley segment in the catchment containing the well with no removal from other valley segments, but this approach is not physically realistic because a real well may capture water from adjacent valley segments. Because of the potentially complex geometry of the stream network, numerical ground-water-flow modeling would be required to rigorously estimate the capture from each valley segment. Keeping with the screening nature of the analysis; however, an approach to use an analytical solution was sought.

Wilson (1993) presented an analysis of streamflow depletion by pumping wells considering ambient flow to the stream. This analysis focused on steady-state solutions of induced infiltration from the stream to identify whether a well induced flow from the stream to the aquifer or whether the stream remained a gaining stream. In the latter case, pumping lowers the potentiometric level in the aquifer and reduces discharge to the stream but does not induce flow from the stream. This situation also may be described as capturing recharge that would have reached the stream in the absence of pumping. A solution is presented for a well between two parallel gaining streams (fig. 2–1).

The solution (Wilson, 1993) can be written as

$$Q_s = -2x'q_a + \frac{Q_w}{\pi}\cos^{-1}\left(\frac{1-\cosh\left(\frac{\pi x'}{L}\right)\cos\left(\frac{\pi d}{L}\right)}{\cosh\left(\frac{\pi x'}{L}\right)-\cos\left(\frac{\pi d}{L}\right)}\right), \quad (2\text{–}1)$$

where

- d is the distance from the well to one of two streams (length),
- x' is the distance along the stream from the point opposite the pumping well to the end of the zone of induced infiltration from the stream (length),
- cosh () is the hyperbolic cosine function (dimensionless),
- q_a is the ambient flow between the two streams per unit length of stream (length squared per unit time), and
- L is the distance between the two parallel streams (length).

Points x_s' and x_s are known as the stagnation points, and induced infiltration from the stream occurs along the distance *-x' to x'* (fig. 2–1).

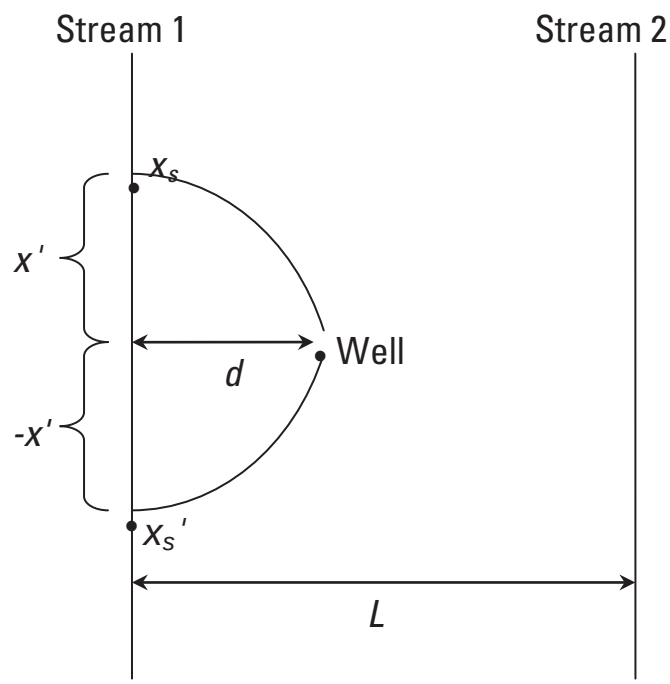

Figure 2–1. Pumping well between two parallel streams with notation used in the Wilson (1993) equation for steady-state streamflow depletion.

The ambient flow per unit length of stream, q_a, may be written as

$$q_a = \frac{NL}{2} + \frac{\Phi_2 - \Phi_1}{L}, \quad (2\text{–}2)$$

where

- N is the recharge rate (length per unit time),
- Φ_i is the state variable (length cubed per unit time) at stream i defined by,
- $\Phi_i = Th_i$ for a confined aquifer, or
- $\Phi = Kh_i^2$ for an unconfined aquifer,
- T is the transmissivity of the aquifer (length squared per unit time), and
- K is the hydraulic conductivity of the aquifer (length per unit time).

The stagnation point, x_s, is found by solving

$$\frac{Q_w}{2Lq_a} = \frac{\cosh\left(\frac{\pi x_S}{L}\right) - \cos(2\delta)}{\sin(2\delta)}, \qquad (2\text{–}3)$$

where

$$\delta = \frac{\pi d}{2L}. \qquad (2\text{–}4)$$

Details regarding the results from this solution are given by Wilson (1993). In summary, at low pumping rates, the well does not induce flow from either stream, and all of the well capture at steady state is from intercepted recharge. Determination of the percentage of this capture from recharge as diminishment of streamflow for each stream can be determined only through numerical ground-water-flow modeling (Wilson, 1993). As the pumping rate is increased, the well induces flow from the nearer stream and then from the second stream. At even higher pumping rates, as defined by the distance between the streams and the ambient flow between the streams controlled by recharge and aquifer conditions as shown in equation 2–3, the source of water to the well is dominated by induced flow from the two streams. At these higher pumping rates, the proportion of water induced by the pumping well from each stream depends only on the inverse of the distance from the well to each stream (Wilson, 1993). This last observation is used to guide the analysis for application of the analytical solution to multiple streams.

Distribution Methods Tested

Several methods based on either distances between a proposed well and the streams in the network or on the areas of the surface-water catchments associated with a proposed well, as approximations to the ground-water catchments, were tested to determine the most appropriate method to distribute water withdrawals between adjacent catchments in the screening tool. The methods distribute streamflow capture among adjacent or neighboring catchments defined as the valley-segment catchments that touch the boundary of the valley-segment catchment containing the proposed pumping well. Nine distribution methods were tested, and each method was computed by means of Python scripts that use geoprocessing commands (Tucker, 2005; van Rossum and Drake, 2006). The methods were inverse distance from valley segment, inverse distance from valley segment squared, inverse distance from catchment center, inverse distance from catchment center squared, transmissivity weighted, transmissivity weighted squared, natural neighbor, buffer around well, and no weighting. No weighting is the solution when all the streamflow depletion is assigned to the valley segment associated with the catchment containing the well.

Inverse Distance From Valley Segment

One distribution method, which is a direct extension of the analysis by Wilson (1993), is to assume that the distribution is directly proportional to the inverse distance from the pumping well to each stream. The contribution of any valley-segment catchment, *i*, is described by

$$f_i = \frac{\frac{1}{d_i^m}}{\sum_{j=1,n} \frac{1}{d_j^m}}, \qquad (2\text{–}5)$$

where

- f_i is the fraction of the pumping attributed to valley segment *i*,
- m is a factor to adjust weighting,
- n is the number of adjacent valley-segment catchments, and
- d_i is the distance from the proposed well to the closest point on the valley segment within catchment *i*.

To allow for close points to have greater influence on the contribution percentages, the factor *m* was included in the algorithm. Two methods of inverse distance weighting were tested: linear, *m*=1; and squared, *m*=2. Inverse distance squared weighting gives greater contribution to close valley segments compared to valley segments further from the proposed well than the linear inverse distance weighting.

Inverse Distance From Catchment Center

The philosophy of the Michigan statewide valley-segment framework is to group short arcs identified in the NHD dataset by hydrology and ecology into larger units. These larger units are the valley segments. Often, catchments associated with the valley segments contain several arcs for the same stream or arcs from different similar streams that join within the catchment. A second weighting scheme is based on this philosophy in that it uses the distance from the well to the adjacent valley-segment catchment centers to compute the contribution for each valley segment:

$$f_i = \frac{\frac{1}{l_i^m}}{\sum_{j=1,n} \frac{1}{l_j^m}}, \qquad (2\text{–}6)$$

where

- l_i is the distance from the proposed well to the center of the valley-segment catchment *i*.

As in the previous case, inverse distance squared weighting also is implemented.

Transmissivity Weighted

The final distance-based weighting scheme uses the approach for computing the equivalent vertical hydraulic conductivity in a layered system. In this case, the transmissivity assigned to each valley-segment catchment also is used to weight the contribution from the catchment in combination with the inverse distance between the pumping well and the valley segment. Valley-segment catchments with low transmissivity will contribute less than adjacent catchments with higher transmissivity. The contribution for valley-segment catchment *i* is given by

$$f_i = \frac{\frac{T_i}{d_i^m}}{\sum_{j=1,n} \frac{T_j}{d_j^m}}, \qquad (2\text{–}7)$$

where

T_i is the transmissivity assigned to valley-segment catchment *i*.

Again, inverse distance squared weighting is implemented for the testing.

Buffer Around Well

In contrast to the distance-based weighting schemes, two area-based schemes were developed. These methods were tested as options that may reproduce the interception of recharge by the pumping well better than the distance-based weightings. The first uses a circular buffer around the well to identify the potentially contributing valley-segment catchments. The fraction of the buffer area attributed to each catchment is used to determine the contribution for each valley-segment catchment. For this method, the size of the buffer is important. If the buffer is very small, then all the weight is assigned to the valley-segment catchment containing the well unless the well is quite close to the catchment boundary. If the buffer is too large, too many neighboring valley segments are assigned a fraction of the streamflow depletion, and the contribution from the catchment containing the well may be too low. To be consistent with the statewide screening, and to allow the hydrogeology of the setting to influence the estimate, a simple well drawdown computation with ad hoc values for drawdown, time, pumping, and storage coefficient was done to determine the buffer radius used in the computations. The Theis solution was used:

$$s = \frac{Q}{4\pi T} W(u) \quad , \quad u = \frac{Sr^2}{4Tt} \cdot \qquad (2\text{–}8)$$

The equation was solved by bisection for each valley-segment catchment to determine the radius, *r*, for a drawdown, *s*, of 0.1 ft after 5 years of pumping, *t*, at 70 gal/min, *Q*, given the transmissivity, *T*, assigned to the valley-segment catchment in the screening tool, and a storage coefficient, *S*, of 0.1.

The contribution for each valley-segment catchment is given by

$$f_i = \frac{a_i}{\sum_{j=1,n} a_j}, \qquad (2\text{-}9)$$

where

n is the number of adjacent valley-segment catchments, and

a_i is the area of the buffer enclosed by valley-segment catchment *i*.

Natural Neighbor

The final method uses natural neighbor weighting to compute the contribution from the adjacent valley-segment catchments. Natural neighbor weighting uses Theissen polygons to define the natural neighbors of the proposed well and to compute areal weighting for the well (Sibson, 1980, 1981). The points defining the Theissen polygons are the closest points from the well to the valley segments that are used in the analytical solution. Natural neighbor weighting is computed by first generating a set of Theissen polygons for these points. A second set of Theissen polygons is then created with the closest valley-segment points and the well location. The overlap between these two sets of polygons is used to estimate the weighting assigned to each of the valley-segment points. If the new polygon generated around the well does not overlap with some of the original Theissen polygons, then the weight assigned to the points in these polygons is zero. If the well falls exactly on one of the valley-segment points, which means that the well is placed on a valley segment, the polygon generated in the second step exactly overlaps one polygon from the first set and the weight assigned to this point is 1. The contribution for each valley-segment catchment is given by

$$f_i = \frac{a_i}{\sum_{j=1,n} a_j}, \qquad (2\text{–}10)$$

where

a_i is the area of influence determined by means of the overlapping areas of the Thiessen polygons for each of the natural neighbors.

The analytical model by Hunt (1999) was used to compute the time-dependent streamflow depletion due to a pumping well. This model provides the fraction of the pumping rate attributed to removal from storage and to streamflow capture. The pumping from a proposed well is distributed between adjacent valley segments by estimating a contribution for each valley-segment catchment. These contributions are assumed to be valid for the entire pumping time for the well. To estimate streamflow depletion for each of the valley segments, the analytical solution is computed for the well and each valley segment independently. These solutions are multiplied by a fraction representing the contribution to the pumping well for

each valley-segment catchment. The sum of the contributions from each valley segment must equal 1 so that the sum of the streamflow depletions for all the contributing valley-segment catchments is equal to the pumping rate as the system reaches steady state. To compute the analytical solution for each valley segment, the distance between the closest point on the valley segment and the proposed well is determined. This distance is used along with the aquifer properties of the catchment containing the well to compute the streamflow depletion with time.

Testing Procedure

The ground-water-flow model for the area around Kalamazoo County, Mich. (Luukkonen and others, 2004) was used to test the distribution methods. The ground-water-flow model is a finite-difference (MODFLOW) simulation model with 6 layers, 154 rows, and 162 columns. MODFLOW is documented by Harbaugh and others (2000). The smallest grid spacing in the model is 660 ft by 660 ft. Valley-segment catchments in the interior of the model that have this finest grid spacing were used in the methods testing. To illustrate the applicability of the analytical model to field problems, a transient simulation with seasonally varying recharge and pumping rates was used as the test case. Luukkonen and others (2004) presented the results for a 9-year transient simulation; but, in this work, the length of the simulation was reduced to 5 years to reduce computer run time.

A method to illustrate streamflow capture by pumping wells (Leake and Reeves, 2008) was used to examine the spatial distribution of streamflow capture from the valley segments. In this method, hypothetical wells are added to the MODFLOW model sequentially on a grid of cells (fig. 2–2). One well is added to a specified cell, and the new simulation is computed. The results from this new simulation are subtracted from base-model results to determine the capture and change in storage caused by the new well. The process is repeated with one new well at a time, generating a grid of results that may be mapped. The fluxes to individual river cells representing the valley segments from the statewide data framework were computed. These fluxes were recorded by use of a river observation file (Hill and others, 2000) to designate the finite-difference cells assigned as river cells to the appropriate valley segments. The river flux output from the system with the new well for each designated valley segment was subtracted from the valley-segment flux computed with the original model to yield the streamflow depletion due to the new well as simulated with the MODFLOW model. Values for streamflow depletion as a percentage of pumping rate for the grid of wells shown in figure 2–2 placed in layer 3 of the model were interpolated by means of inverse distance weighing to produce the map shown in figure 2–3. These streamflow depletions and the spatial pattern produced through this technique are used to access the distribution schemes applied with the analytical model.

The analytical model was solved for the same grid of points as the MODFLOW model illustrated in figure 2–2. Python scripts for the distribution methods used geoprocessing commands (Tucker, 2005; van Rossum and Drake, 2006) to identify the catchment containing the well, to identify the neighboring catchments, and to compute the different weightings. The analytical solution was computed for the well and each of the nearby valley segments sequentially by use of the transmissivity assigned to the valley-segment catchment containing the test point, which for these trials was always valley-segment catchment 3544. The storage coefficient and streamflow-conductance terms for this catchment from the water-withdrawal screening tool also were used.

The streamflow depletion for each valley segment and each distribution method was estimated by multiplying the analytical solution for that valley segment-test point combination by the computed percent contribution for the valley-segment catchment. The resulting streamflow depletions were compared to the depletions computed with the MODFLOW model through the river observation file (Hill and others, 2000) for each valley segment. The results from the ground-water-flow model and the analytical solutions after 5 years were compared to ensure that differences in the solutions resulting from differences in the storage coefficient used in the screening tool and the MODFLOW model do not dominate the analysis. To avoid problems with differences between small estimates of streamflow depletion biasing the analysis, the difference between the MODFLOW results and the analytical model was computed only if either the MODFLOW or the analytical model estimated a streamflow depletion of 5 percent of the pumping rate or greater.

The simplest approach for the screening procedure would be the no-weighting approach. The capture caused by a proposed well would be assigned to the valley segment in the catchment containing the well. In essence, use of this approach assumes that the ground-water divides are coincident with surface-water divides and that the divides do not change in response to pumping. Because ground-water divides will respond to pumping, this should be a poor assumption. Testing reveals that streamflow depletion was overestimated in this approach compared to the MODFLOW model results (figs. 2–3 and 2–4). The minimum streamflow depletion estimated by way of this approach is approximately 63 percent, and the estimated streamflow depletion is greater than 80 percent for much of the valley-segment catchment. These results do not compare well with results generated using the MODFLOW model. For the MODFLOW model, the maximum estimated streamflow depletion for the valley segment was less than 80 percent for most of the catchment and it was less than 20 percent for parts of the valley-segment catchment near the most distant surface-water divides defining the catchment. On the basis of this comparison, the no-weighting approach—although computationally the most straightforward method—was rejected as an option for the screening model.

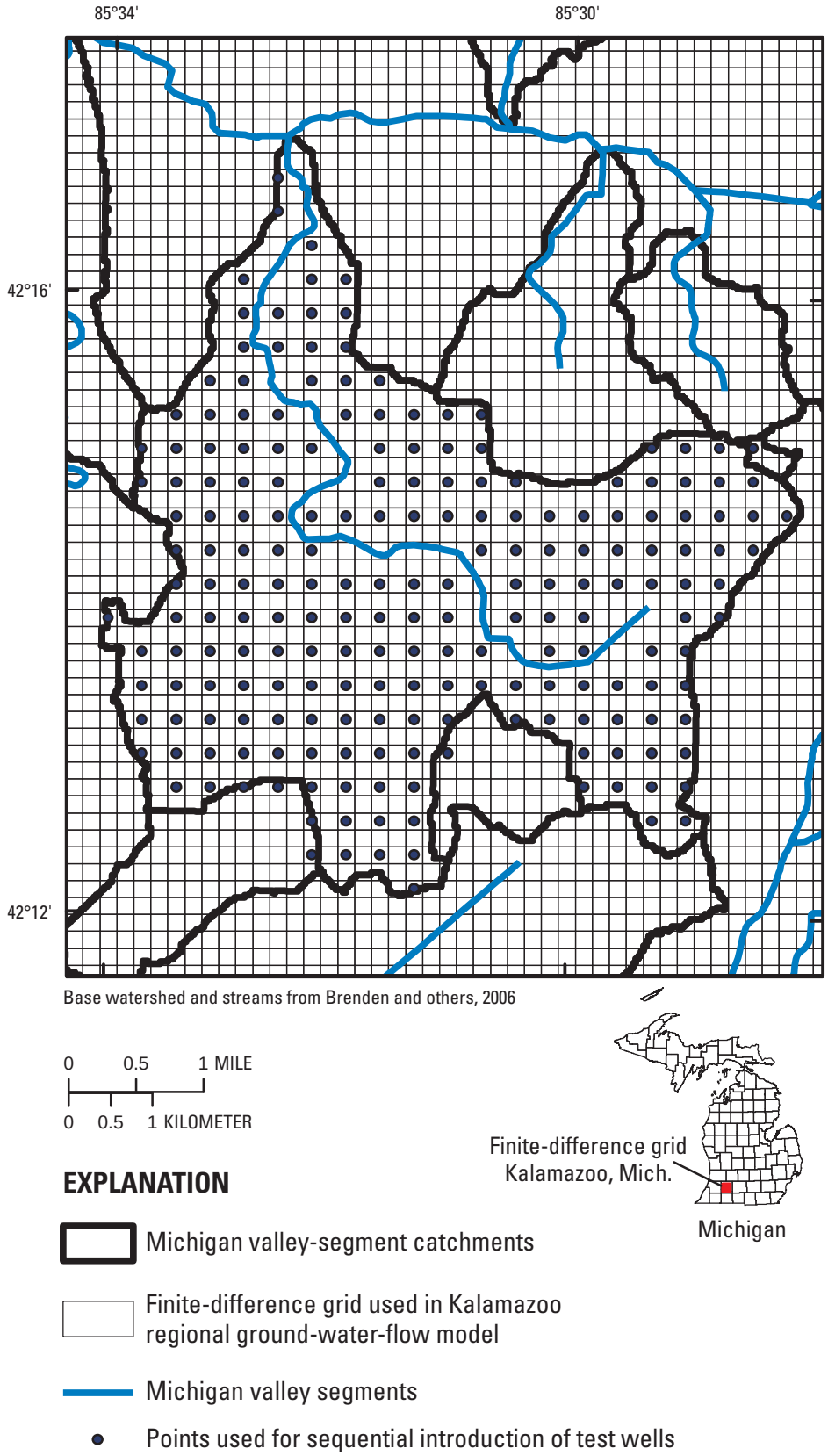

Figure 2–2. A grid of points used to compare the analytical model and different distribution methods to MODFLOW results from the Kalamazoo regional ground-water-flow model.

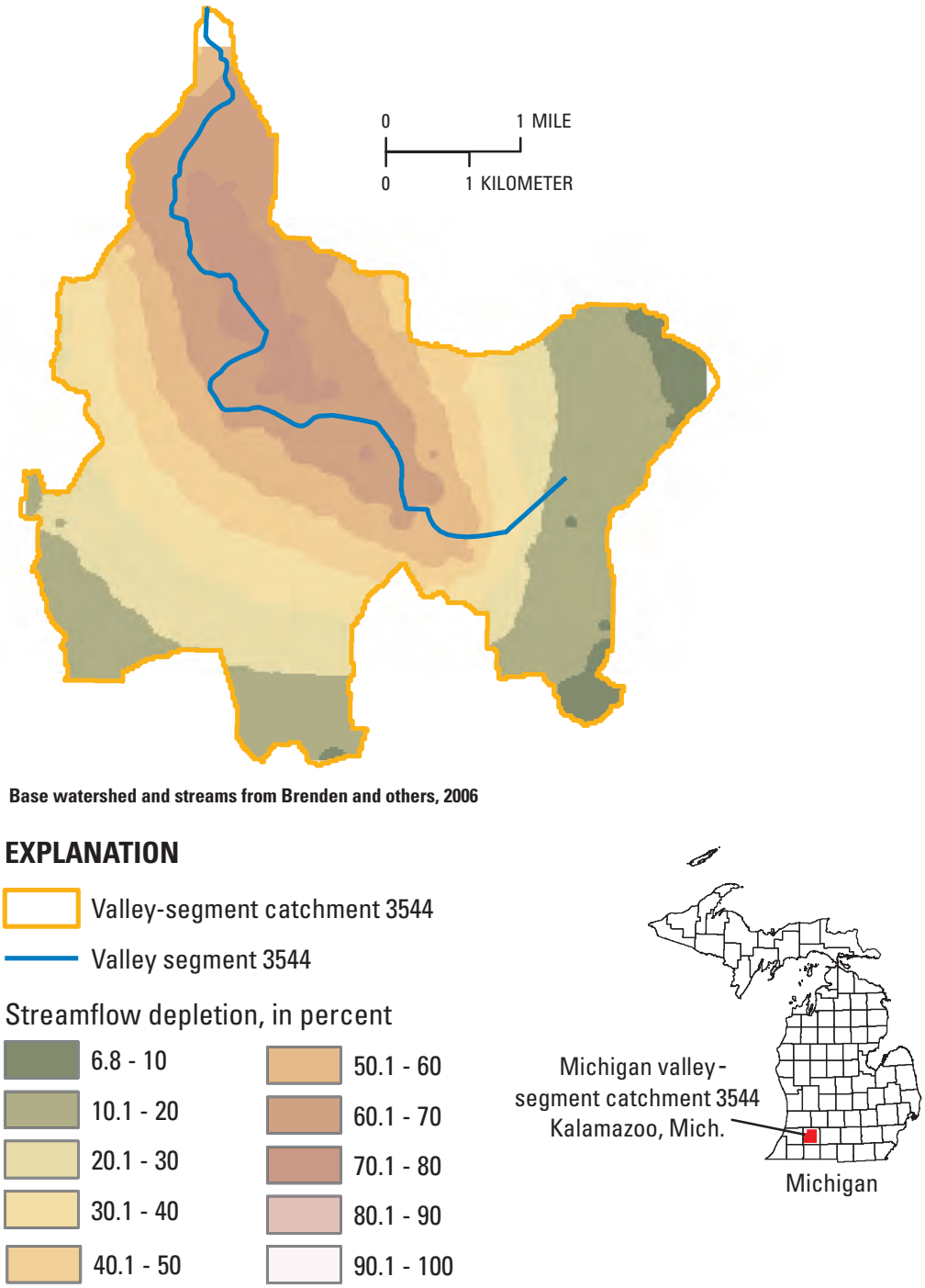

Figure 2–3. Estimated streamflow depletion from valley segment 3544 resulting from a sequential introduction of test wells in the MODFLOW ground-water-flow model for Kalamazoo County, Mich., as a percentage of pumping rate after 5 years of pumping.

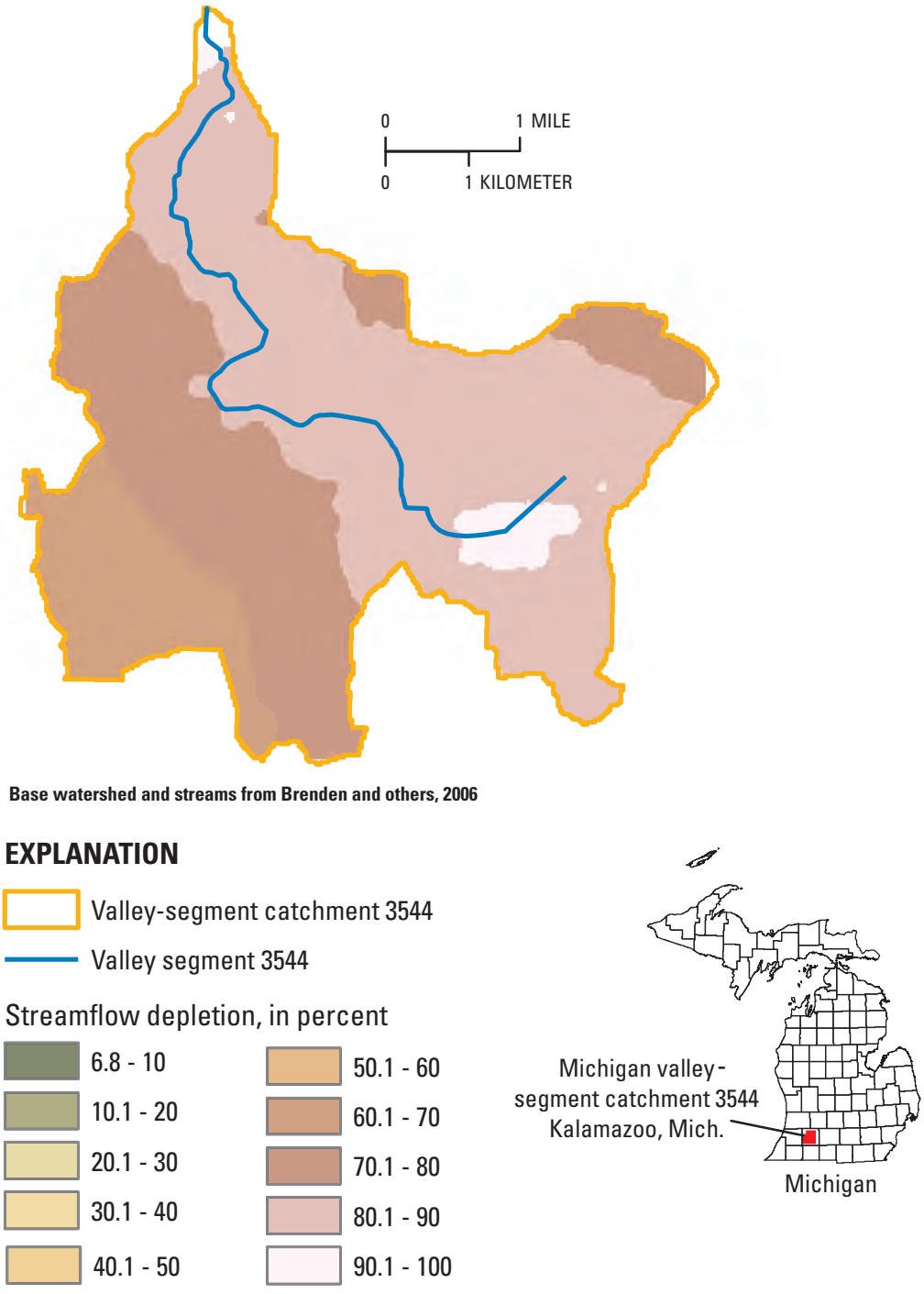

Figure 2–4. Estimated streamflow depletion from valley segment 3544 resulting from a sequential application of the analytical model to test wells with no weighting approach between adjacent valley segments as a percentage of pumping rate after 5 years of pumping.

The distribution approaches that matched the MODFLOW results the best were the inverse distance to valley segment, inverse distance to valley segment squared, and natural neighbor weightings (fig. 2–5). The inverse distance to valley segment squared and natural neighbor approaches overestimate streamflow depletion compared to the MODFLOW results, and the inverse distance to valley segment weighting tends to underestimate the depletion near the stream compared to the MODFLOW results. The transmissivity-weighted approaches (not shown) are not significantly better than the inverse distance to valley segment weightings and require slightly more computational effort and more book-keeping to gather and use the transmissivity of each neighboring valley-segment catchment. The buffer weighting and distance to center weighting (also not shown) did not produce interpolated maps that were reasonable matches to the MODFLOW results, and these methods were rejected. Statistical and ranked comparisons of the weighting methods based on the differences between each method and the MODFLOW results showed that each of the methods performed the best for some of the hypothetical well points and were outperformed at others. None of the methods produced a statistically significant difference in error characteristics compared with the MODFLOW results to help guide the decision. As a result of this testing, the inverse distance to the valley segment method was selected for the screening tool because it produces a reasonable overall pattern of streamflow depletion compared with the MODFLOW tests, it is the most straightforward to implement in the Web application, and it has some theoretical basis in Wilson's analysis (1993).

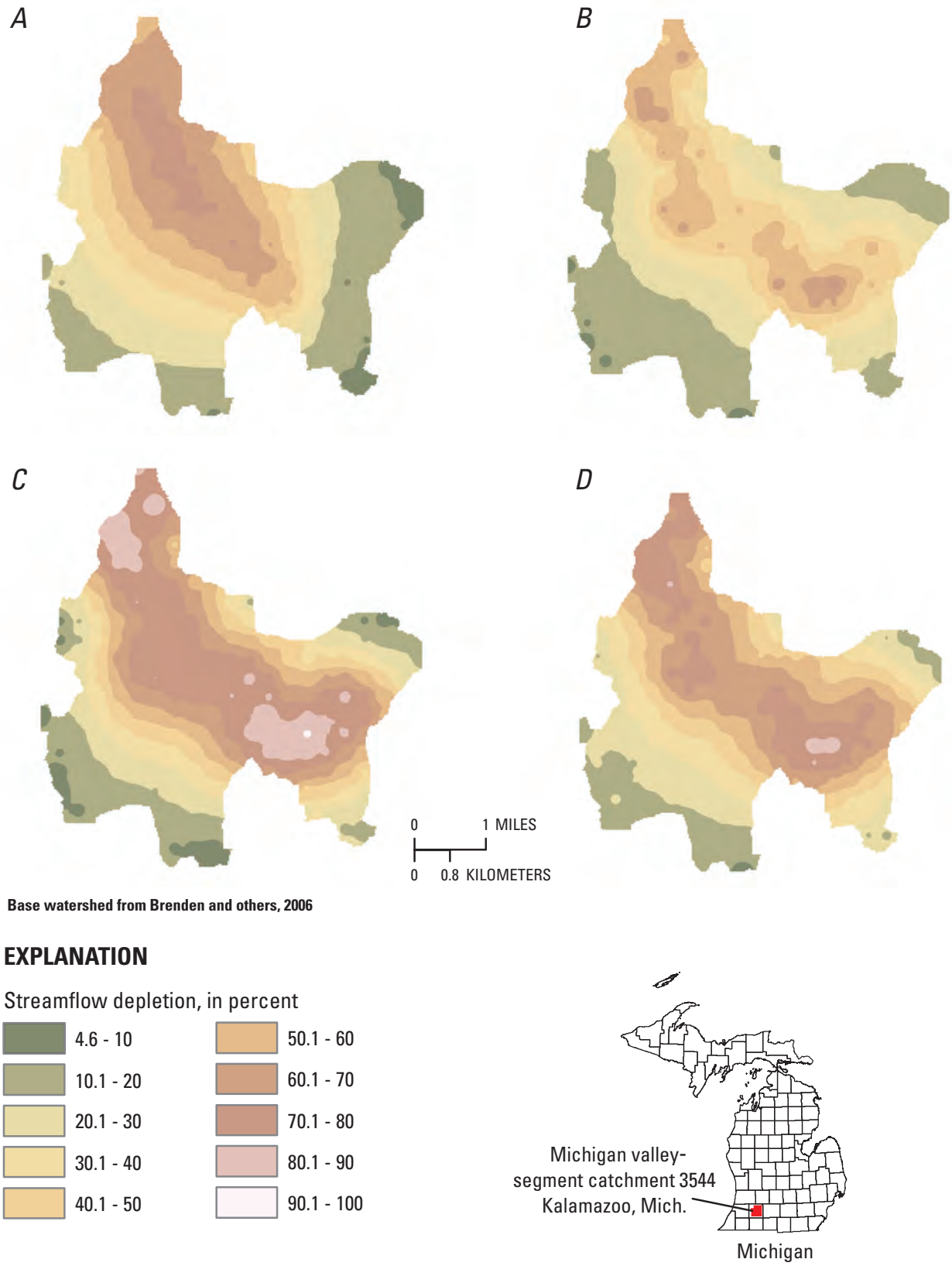

Figure 2–5. Estimated streamflow depletion from valley segment 3544 as a percentage of pumping rate after 5 years of pumping. ***A***, results from a sequential application MODFLOW. Results from sequential application of the analytical model with ***B***, the inverse distance to the stream, ***C***, inverse distance to the stream squared, and ***D***, natural neighbor distribution methods.

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USGS Award No. G09AP00153: Economic Expert, International Upper Great Lakes Study

Basic Information

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End Date:	3/31/2011
Funding Source:	Supplemental
Congressional District:	8
Research Category:	Social Sciences
Focus Category:	Management and Planning, None, None
Descriptors:	Upper Great Lakes, Economic Growth Scenarios, Climate Change, Water Regulation
Principal Investigators:	Jon Bartholic

Publications

There are no publications.

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Project Number: 2009MI162S (extended to FY2009)
Start: 08/07/2009(actual)
End: 03/31/2011(actual)
Funding Source: USGS ("104S")
Congressional District: eighth
Research Category: Social Sciences
Focus Categories: Management and Planning
Descriptors: Upper Great Lakes, Economic Growth Scenarios, Climate Change, Water Regulation
Primary PI: John Hoehn, Professor, Agricultural, Food, and Resource Economics, Michigan State University, 301A Agriculture Hall, East Lansing, MI 48824-1039, PH: 517.353.6735, hoehn@msu.edu
Project Class: Research

Introduction

The plan of work calls for the development of six of economic growth scenarios for the upper Great Lakes region over the next 20 to 40 years. The scenarios develop possible trajectories for economic growth in population and gross regional product. As these scenarios are develop, the research will examine how regional economic growth may influence the way society may choose to regulate water levels in the future through adaptive management.

General Statement

Problem/Demand

The researcher has reviewed the economic and scientific literature to assess current and projected trends and has reviewed the interests and vulnerabilities represented in the work of the technical working groups (TWGs). The researcher is in the process of finalizing the six growth scenarios and writing a final report.

Methodology

The research reviews the literature regard economic growth prospects for the upper Great Lakes in the next 30 to 40 years and summarizes the best economic and scientific analysis in the form of six economic growth scenarios.

Problem and Research Objectives

Six growth scenarios are developed that are consistent with the specifications described in the project plan of work. The first three scenarios are:

1. The current economy going forward 30 to 40 years with no change in population, gross regional product, and other economic factors

2. The current economy going forward 30 to 40 years and growth consistent with current trends.

3. A high growth scenario going forward 30 to 40 years.

The first three scenarios are developed assuming no climate change. The second set of three scenarios are developed incorporated climate change. Climate change considerations are incorporated from the research and summaries of the U.S. Global Change Research Program.

Principle Findings and Significance

The researcher is finalizing the six growth scenarios and writing the final report. The summary and review of literature revealed different prospects for sub-regions with Canada and the United States. The Canadian upper Great Lakes sub-region is the southwestern section of Ontario. Statistics Canada anticipates higher growth in the working population in this sub-region than analysts expect for the U.S. upper Great Lakes sub-region. Since the working population is linked directly with the growth potential of a region, the Canadian sub-region can expect higher rates of economic growth than can the U.S. sub-region of the upper Great Lakes.

Table 1 displays the different levels of growth expected by U.S. and Canadian sub-region for each of the three scenarios with no climate change. In the high scenario, population in the U.S. sub-region grows by 32% by 2050 and in the Canadian sub-region it grows by 52%. The disparity between sub-regions also show up in the gross regional products (GRPs). Under the high scenario, GRP in the U.S. sub-region more than doubles, but GRP in the Canadian sub-region more than triples by 2050. In the U.S. region, growth in the economy paces growth in the working age population so the number of jobs per capita remains constant under the high growth scenario. In the Canadian sub-region, jobs per capita grows by 32%.

Table 1. Total and Percent Growth by Scenario, 2010 to 2050, Upper Great Lakes Region

Three Scenarios, No Climate Change	Population (Thousands or %)	GRP ($Millions or %)	Jobs (Thousands or %)	Jobs per Capita (Number or %)	Personal Income per Job ($)
United States Sub-region					
No Change	10,542	413,005	6,084	0.58	56,759
Low Scenario	7%	97%	13%	6%	54%
High Scenario	32%	114%	32%	0%	62%
Canadian Sub-region					
No Change	12,610	553,016	6,985	0.55	--
Low Scenario	46%	141%	55%	9%	55%
High Scenario	52%	219%	84%	32%	92%

Publications

Not at this time.

Information Transfer Program Introduction

Surrounded by four of the five Great Lakes, over 11,000 inland lakes, 36,000 miles of streams, and a vast groundwater resource, Michigan is fortunate to have an abundant and widespread supply of water. But, as high demand and multiple uses of water increase, the water resources of the state are at risk of increasing degradation due to contaminants, land use impacts, and biological pollutants. Further, water availability issues arise when greatest water use needs coincide with minimal precipitation and low flow conditions. Whether impacts affect water quality or quantity, the need for knowledge and action at the watershed level is critical. The movement of pollutants across a watershed is not constrained by political boundaries, and activities in one political jurisdiction may lead to water degradation in another. Water withdrawals from both surface water and groundwater may result in decreased stream flow or reduced lake levels and lead to ecological and human-related problems. Conflicts between irrigators and domestic users may also increase as withdrawals affect well water supply. These issues require background knowledge of the situation as well as data analysis and interpretation of these data to assess the situation.

The Land Grant Universities are looked upon as a source of reliable, science-based, and nonbiased information. The ability to transfer this information to a wide audience in formats that are easily understood and accessible is a primary objective of the Universities' technology transfer programs. An effective information dissemination and training program on surface water and groundwater quality and quantity facilitates the transfer of information needed to protect the water resources in the state, and helps to inform scientists, agency personnel, legislators, and citizens of the most recent information available so that better decisions can be made. As a result of this program, individuals, groups, and other interested citizens have been able to use this information for developing watershed plans, making decisions and addressing critical water issues such as water withdrawals, biodiversity, shoreline restoration, phosphorus and sediment runoff, and invasive species.

Information Dissemination and Technology Transfer Training Programs

Basic Information

Title:	Information Dissemination and Technology Transfer Training Programs
Project Number:	2009MI140B
Start Date:	3/1/2009
End Date:	2/28/2010
Funding Source:	104B
Congressional District:	8th
Research Category:	Water Quality
Focus Category:	Education, Groundwater, Surface Water
Descriptors:	water quality, water withdrawals, lake ecology, stream ecology, lake leaders,
Principal Investigators:	Lois G Wolfson

Publications

1. Stepenuck, Kristine, Lois Wolfson, Barbara Liukkonen, Jerry Iles, and Timothy Grant. Accepted. Volunteer Monitoring of E. coli in Streams of the Upper Midwestern United States: A Comparison of Methods. J. Env. Monitoring and Assessment.
2. Wolfson, Lois. 2010. Harmful Algal Blooms on the Rise. Lake Effect Newsletter: February, Pages 6, 9. Michigan Chapter, North American Lake Management Society.
3. Wolfson, Lois and Tim Harrigan. 2009. Cow, Streams, and E. coli. Pages 5-7. In Profitable Environmental Options for Livestock Producers, No. 3103. Michigan State University Extension, East Lansing, MI.
4. Wolfson, L. 2009. Surface Water Resources. Pages 206-220. In Schaetzl, R.J., Darden, J.T. and D. Brandt (eds). Michigan Geography and Geology. Pearson Custom Publishing, Boston, MA.

Title: Information Dissemination and Technology Transfer Training Programs
Project Number: 201009MI140B
Start: 03/01/09(actual)
End: 02/28/10 (actual)
Funding Source: USGS ("104B")
Congressional District: eighth
Research Category: Water Quality
Focus Categories: Education, Groundwater, Surface Water
Descriptors: water quality, water withdrawals, lake ecology, stream ecology, lake leaders, phosphorus, decision support systems
Primary PI: Dr. Lois G. Wolfson
Project Class: Information Transfer

INFORMATION TRANSFER PROGRAM.

The following programs were coordinated, developed and delivered for fiscal year 2009-2010.

Lake and Stream Leader's Institute
A new class for 2009 was held in the Lake and Stream Leader's Institute, a cooperative effort of MSU and Michigan Lake and Stream Associations, Inc. The major goals of the Institute has been to develop local water/land resource leaders who promote lake, stream and watershed management partnerships with state natural resource agencies and other citizens, and educate participants on a variety of lake and stream issues ranging from ecology to local government to mediation. Since the Lake and Stream Leaders' inception, the IWR has played a significant role in both the development and implementation of this program and again worked with the coordinators for the 5 day 2009 class. Responsibilities of the IWR staff members included leading training sessions in lake and stream ecology, leading a 3-hour session on Developing a Watershed Management Plan, and helping to develop the curriculum. Other involvement includes logistics and serving on the advisory committee.

Lake and Stream Training and Monitoring
The IWR helped with a variety of lake and stream ecology workshops in 2009. An IWR staff member led two sessions on lake and stream ecology and aquatic plant management during the *Conservation Stewards Program*, a comprehensive eight week program to assist local decision makers, agency personnel, and interested citizens with tools and information concerning land and water ecosystems. The session, co-led by IWR staff and divided into two days, consisted of lectures, interactive sessions, and hands-on lake and stream ecology. Approximately 35 attendees took part in the class. The IWR also co-led three similar sessions for the Oakland County Parks system and a county in the southwest part of the state, all in cooperation with MSU Extension, and part of the *Introduction to Lakes* and the *Watershed Management Short Courses*. The full day classes attracted 35, 30 and 30 participants, respectively. Finally, the IWR helped lead the Four Township Water Resources Council Tour, an annual tour of local lakes within the township. This year the focus was on aquatic plant ecology and management.

The IWR also participated in a one day training workshop with approximately 40 students from

the Ohio Watershed Academy. The training focused on stream monitoring and assessing *E. coli* in streams. The event was sponsored and funded through the Great Lakes Regional Water Program, of which the IWR is a member.

Stormwater Management

IWR staff members worked closely with local communities throughout the Greater Lansing area to implement stormwater management programs. Activities included setting watershed priorities, designing and implementing a broad array of education and outreach programs addressing diverse stormwater management topics, and conducting illicit discharge detection and elimination programs.

Source Water Protection

Under the four-year Water Resources Partnership, a jointly-funded agreement between MSU and the Michigan Department of Natural Resources and Environment (formerly Michigan Department of Environmental Quality), new tools are being developed and used to generate source water protection areas for community water supplies. Using a variety of existing hydrogeological data, recharge areas are delineated and mapped, and then provided to local water supply operators along with training materials to help them understand changes that can be made to protect their drinking water supplies. In November 2009 a fourth pilot project was conducted to further test and enhance the computer program and work with local water supply operators on implementation measures. Ten community water supplies and 342 non-community water supplies were delineated and mapped in Jackson County. Seventy water supply operators attended a day-long program that included in-depth training on source water protection and how the mapping information can be used to plan for new development and/or prevent contamination of the water supply from existing sources. Additionally, three workshops on source water protection and land use planning principles were held in various locations within the state. A total of 75 people attended the sessions. Mapping and training on a regional basis is being planned for 2010-2011. Follow-up activities with the four original pilot counties is also planned in order to assess behavioral changes resulting from the outreach activities.

Conferences

The annual Great Lakes conference focuses on current and emerging issues related to Great Lakes water quality, ecology, fisheries, contaminants, exotic species, policy, and management. In 2009, the IWR co-sponsored the 19th year of this conference. Titled *The Great Lakes: Adapting to a Wave of Change,* the conference focused on food web changes and the near shore shunt, hypoxia in Lake Erie, revitalizing the economy of the Great Lakes, the Great Lakes Compact, and new information on quagga mussels and their impacts on fisheries. The Office of the Great Lakes, Michigan Department of Environmental Quality, co-sponsored the conference along with Michigan Sea Grant Extension Program, the MSU Department of Fisheries and Wildlife, and the CSREES Great Lakes Regional Program. Approximately 160 people attended the meeting, including state and local agency personnel, researchers and educators, environmental organizations, and interested citizens. Of the evaluations returned, 98% rated the conference as good or excellent (the top two choices).

The Institute also co-sponsored a one-day conference on the formation and workings of Lake Boards with the Michigan Chapter of the North American Lake Management Society, and took the lead in conference logistics as well as moderating a concurrent session. The conference

focused on forming Lake Boards, conflicts, regulation authority and other related topics. Also featured was a session on lake ecology and management. The audience included riparians, lake associations, drain commissioners, and agency personnel. An estimated 100 people attended the conference.

Phosphorus Reduction Campaign
In 2009, the IWR played a key role in a phosphorus reduction campaign focused in both urban and agricultural areas. In cooperation with MSU Extension and other outside partners, the IWR helped to distribute thousands of previously written fact sheets on Phosphorus and Lawn Care, produced a survey on the helpfulness of the fact sheet, helped in the development of several new videos, created a new web site to serve as a portal for other information on phosphorus; and developed a tag line for the campaign (Be Phosphorus Smart). The sub-group that IWR helped coordinate began working with some local stores and with a big box store on distribution of materials and training.

Internet-Based Decision Support System
The decision support systems of the Institute are becoming well known throughout the country. Digital Watershed, the flagship web site for the Institute (www.iwr.msu.edu/dw) is constantly expanding and incorporating new models and data layers regularly. It utilizes Bing Maps for providing images nationwide and incorporates models developed at partner Universities. Users from anywhere can enter an address, county, or watershed in the continental United States to obtain information for that surrounding area.

The Water Withdrawal Assessment Tool continues to be refined, and is the official legislatively mandated web-based tool to be used by those anticipating the withdrawal of 100,000 gallons per day or more of either surface water or ground water. In cooperative with USGS and the Michigan Department of Natural Resources and Environment, the tool identifies areas where water withdrawals can have an adverse resource impact on stream fish.

Several other decision support systems are being developed by the IWR with funding from other sources. These include High Impact Targeting for prioritizing areas of high erosion risks, Networked Neighborhoods for Eco-conservation Online, a program that is utilizing social networks and web-based mapping to assist users in implementing low impact practices, such as rain gardens or green roofs in their watersheds; and Social Indicator Data Management and Analysis (SIDMA), a program that helps communities, particularly 319 projects, evaluate behavior changes that have occurred as a result of their watershed management activities.

Events
A number of University wide events are annually held, and the Institute offers its expertise and knowledge by lending support to these events. In FY 2009-10, the following programs and/or exhibits were led and taught by IWR staff: Ag Expo, an agricultural exhibition aimed mainly at farmers and the agricultural community (with attendance within the college's tent estimated at 3500); Grandparent's University, held annually for grandparents and their grandchildren to learn about the University and its offerings (approximately 80 participants for the IWR sessions); the State Finals for the Science Olympiad Groundwater Section, an event for high school students to compete with other students on science-related issues (48 schools); Environmental Monitoring

Competition, for FFA high school students (200 high school students), and the Children's Water Festival, which attracts fourth and fifth graders to learn about water, natural resources, recycling, and other science related activities (5000).

Lectures and Seminars
The Institute uses other mechanisms such as written papers, presentations, and posters to disseminate information to user groups including legislators, community personnel, watershed managers, college students, K-12, 4-H, and interested citizens.

Personnel and Facilities
The Institute of Water Research maintains a variety of computer workstations and servers for its growing web based decision support systems. In addition to computer-related supplies and equipment, the IWR also has video editing and photographic equipment, color printers, and field supplies for its Information Dissemination Program. The Institute's technology transfer program is under the direction of Principal Investigator Dr. Lois Wolfson, with several Institute personnel contributing to the project, including Dr. Jon Bartholic, Director, Ruth Kline-Robach, Outreach Specialist, and Jeremiah Asher and Yi Shi, Information Technology Specialists.

Publications (2009-2010)

Stepenuck, Kristine, Lois Wolfson, Barbara Liukkonen, Jerry Iles, and Timothy Grant. *Accepted.* Volunteer Monitoring of *E. coli* in Streams of the Upper Midwestern United States: A Comparison of Methods. J. Env. Monitoring and Assessment.

Wolfson, Lois. 2010. Harmful Algal Blooms on the Rise. Lake Effect Newsletter: February, Pages 6, 9. Michigan Chapter, North American Lake Management Society.

Wolfson, Lois and Tim Harrigan. 2009. Cow, Streams, and *E. coli.* Pages 5-7. *In* Profitable Environmental Options for Livestock Producers, No. 3103. Michigan State University Extension, East Lansing, MI.

Wolfson, L. 2009. Surface Water Resources. Pages 206-220. *In* Schaetzl, R.J., Darden, J.T. and D. Brandt (eds). Michigan Geography and Geology. Pearson Custom Publishing, Boston, MA.

USGS Summer Intern Program

None.

Student Support					
Category	**Section 104 Base Grant**	**Section 104 NCGP Award**	**NIWR-USGS Internship**	**Supplemental Awards**	**Total**
Undergraduate	1	0	0	0	1
Masters	2	0	0	0	2
Ph.D.	0	0	0	0	0
Post-Doc.	0	0	0	0	0
Total	3	0	0	0	3

Notable Awards and Achievements

2009 MidWest Innovation Award:

Michigan Assesses Impact of Water Withdrawal Michigan: Water Withdrawal Assessment Process Michigan is working to ensure its use of water doesn't have an adverse impact on the Great Lakes ecosystem.

The state developed a water withdrawal assessment process to avoid those problems. The state s Water Withdrawal Assessment Process, one of eight national winners of a Council of State Governments Innovations Award, is part of a regional effort to protect the Great Lakes and prevent large scale water diversion from the basin.

The Great Lakes Compact to which eight states and two Canadian provinces belong prohibits other states and foreign countries from withdrawing water from the lakes, and also requires the member states and provinces to regulate their water use and promote conservation of the lakes. Michigan is the only state to fully implement the compact, according to David A. Hamilton, chief of the Water Management Section in the Land and Water Management Division.

"We had to find ways by which we would measure the impact of water withdrawals and assure they are not going to cause an adverse impact on the aquatic resources or water dependent natural resources in the Great Lakes basin," Hamilton said.

So Michigan developed a collaborative process in which science guided policy, he said. The state developed models of withdrawal impact. For instance, the stream flow throughout the state is calculated, taking into account the diversity of the types of streams in Michigan, Hamilton said. Then, proposed groundwater withdrawal is reviewed for its impact on the amount of water depleted from neighboring streams. The real heart of it is that every stream has been classified according to what type of fish communities live there, he said. Curves were developed to show the impact on the fish populations based on the amount of water withdrawn, according to Hamilton.

Based on the scientific evidence, Michigan lawmakers passed legislation that set standards for the amount of water that could be safely withdrawn, Hamilton said. The laws, passed in 2006, were the first in Michigan to establish water withdrawal regulations. Because Michigan is a water-rich state, Hamilton said some people questioned the need to set the regulations. The compact to avoid diversion of Great Lakes water to other states and regions was just one reason. But Hamilton said there are areas in Michigan that face water shortages. Legislators approved the law and then instructed the Department of Environmental Quality to develop tools to further refine and implement the plan.

An assessment tool is available online for water users to determine the likelihood of an adverse impact of a proposed withdrawal, Hamilton said. Only those that withdraw a large quantity of water 100,000 gallons a day would be required to participate in the assessment. That includes large industries, irrigators and municipalities. It's good for planning industry and development to have an idea ahead of time whether or not they can do something, said Hamilton. He said the assessment tool is efficient in that people can fill out the application online. If there's no impact, they can get automatic authorization through the process. For those cases where there is a potential impact, Hamilton said, the assessment would send them to the state for individual review.

Michigan fully implemented its assessment process in July 2009. Hamilton said other states are looking at Michigan s process and will implement similar programs to address the requirements of the compact.

Title: Community Capacity and Use of Groundwater Information: Social Networks, Coalitions, Abilities, and Stratification in Use of the Water Withdrawal Assessment Tool

Brief: Assesses the potentials and problematics of the Michigan Water Use Law.

Funding Agency: USGS 2009MI137B

1)Fluid Interpretation: Compacts, Legislation, Water Conservation/Efficiency Standards, and Rural Communities, Law and Society Annual Meeting, May 27-30, 2009, Denver, CO
2) Water Conservation and Perceived Water Scarcity? Water Conservation, Compact and Conservation Management in Michigan, American Water Works Association Annual Conference, June 12-18, 2009, San Diego, CA
3) Left Out to Dry: Environmental Justice and Water Rights, American Sociological Association, August 12-16, 2009, San Francisco, CA These have been shaped into three manuscripts, all of which will soon be under review.
While the findings are preliminary, we have presented 3 papers at professional meetings. papers currently under review out of this effort.

Publications from Prior Years