A topographic map of the Flathead Basin, showing a network of rivers and streams. The map uses a color gradient to represent elevation, with higher elevations in yellow and orange, and lower elevations in green and blue. The text is overlaid on the map.

Flathead Basin Topographic & Imagery Collection Project, 2009

Lake County Courthouse

Polson, MT

November 16, 2010

Flathead Basin Topographic & Imagery Collection Project, 2009

**WELCOME
INTRODUCTION**



Lake County

106 Fourth Avenue East, Polson MT 59860

Tiffany Lyden
Lake County Planning Department
406.883.7235
tlyden@lakemt.gov

Meeting Agenda

Presentations:

- Project Overview
Steve Story, MT DNRC
- LiDAR & Imagery Collection
Russ Faux, Watershed Sciences, Inc.
- NRIS Project Data Repository
Gerry Daumiller, NRIS
- Questions & Discussion



Flathead Basin Topographic & Imagery Collection Project, 2009

PROJECT OVERVIEW



Steve Story

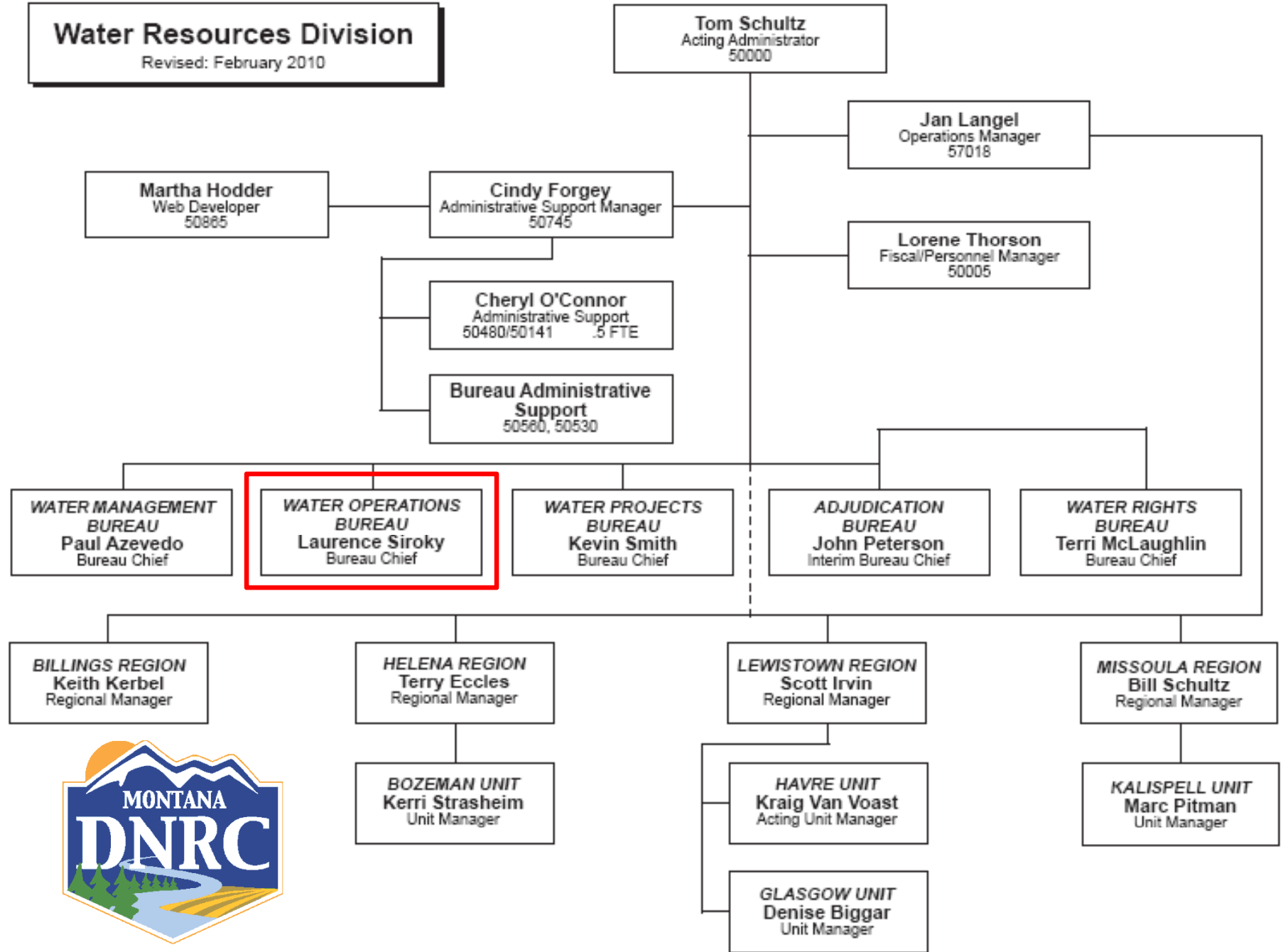
State Floodplain Engineer

406.444.6664

sestory@mt.gov

Water Resources Division

Revised: February 2010



Water Operations Bureau

Revised: February 2010

Laurence Siroky
Bureau Chief
50009

Briona Shipman
Administrative Support
50530

Board of Water Well Contractors

Dam Safety Program

Floodplain Management Program

Water Measurement Program

Water Well Contractors Program

Michele Lemieux
Dam Safety Engineer
50261

Traci Sears
CAP-SSE
Program Specialist
50340

Mary Guokas
Floodplain Outreach
35031

Ali Cornwell
Administrative Support
35038 .5

Steve Story
Floodplain Engineer
50500

Sam Johnson
Floodplain Engineer
56580

Chad Newman
Dam Safety Specialist
35031

Celinda Adair
Map Mod Program Specialist
35085

Chad Hill
Civil Eng. Specialist

Dave Amman
Program Specialist
24015

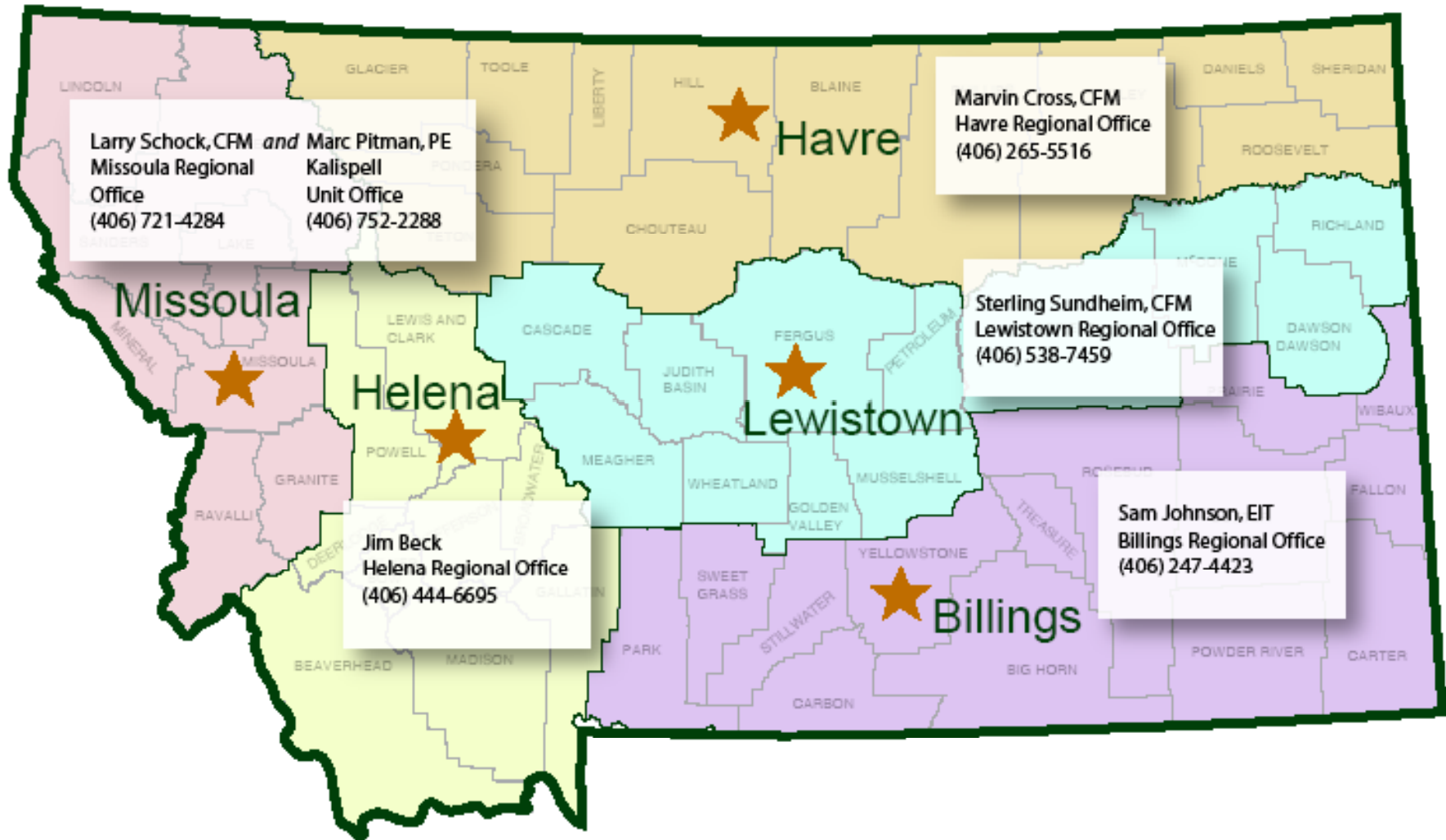
Art Robinson
Program Specialist
58000



1424 9th Avenue

PO Box 201601

Helena, MT 59620-1601 406-444-0862

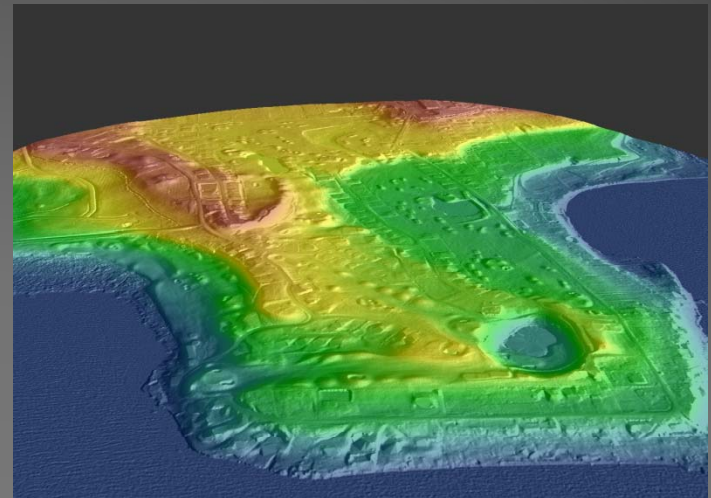


DNRC Regional Engineering Specialists

Project Overview

Presentation Topics:

- Introduction
- Project Development
- Initial Project Tasks
- Contractor Procurement
- Data Acquisition & Products
- Data Distribution

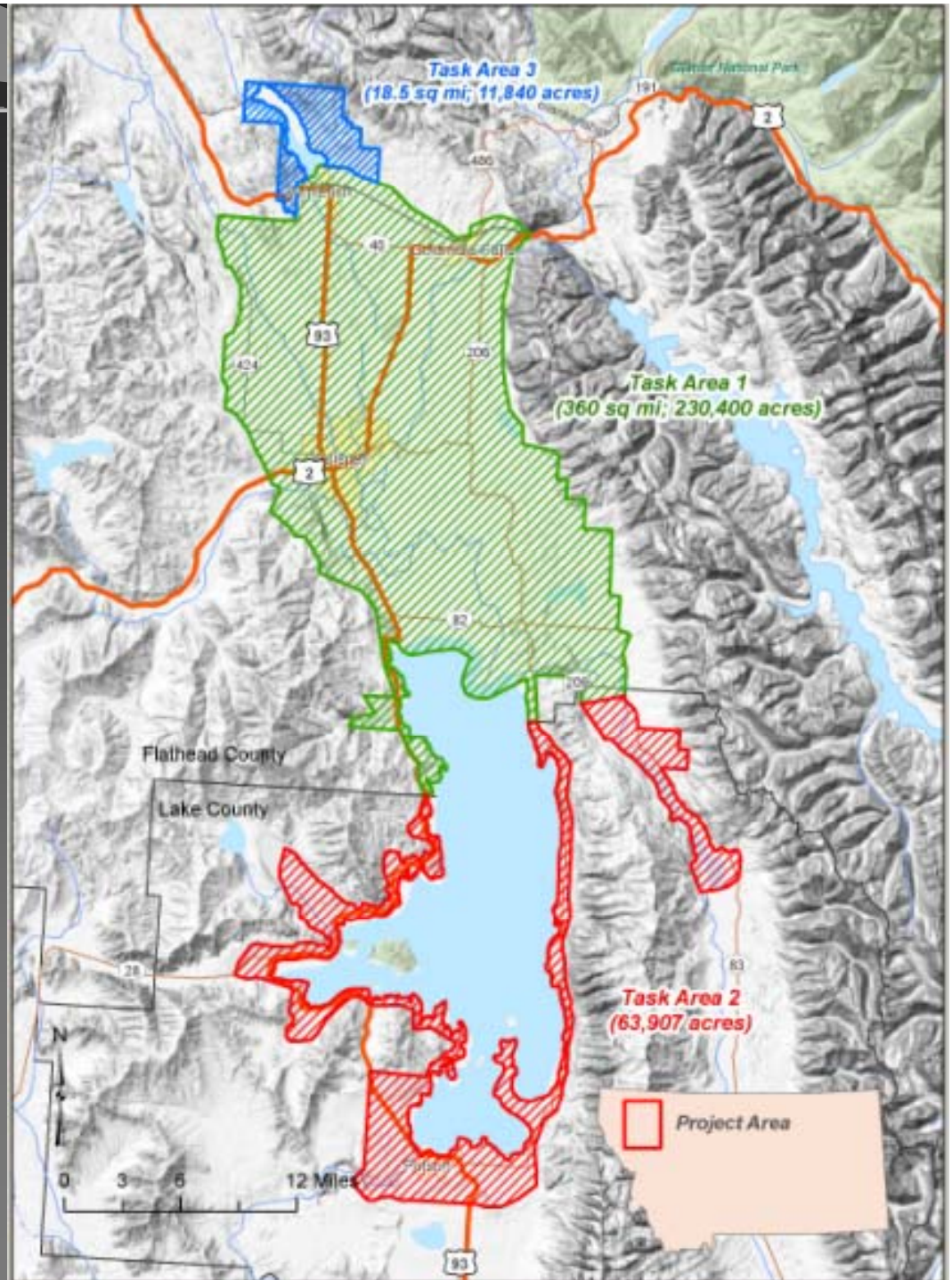


Images Courtesy Watershed Sciences, Inc.

Introduction...

Flathead Basin Lidar & Imagery Project, 2009

- Funding Partners: FBC, Lake County, & City of Whitefish
- 473.5 sq mi Coverage Area
- Products: 2' Contours, DEMs, True Color & Color Infrared



Images Courtesy Watershed Sciences, Inc.

Introduction

Project Timeline:

- Nov 2007 – April 2008: Project Development & Partnering
- May 2008: RDGP & RRGL Grant Applications Submitted
- May 2009: Grant Award Notifications
- June 2009: Prepare Project Specifications & Scope of Work/RFP
- July – Aug 2009: Contractor Procurement & Selection
- Sept. 2009: Contract Award, Flight Acquisition
- March 31, 2010: Project Data Deliverables Due
- Nov. 2010: Public Meetings & Data Available through NRIS

Project Development (Nov. 2007 – April 2008)

Assess Needs & Project Participants:

- Crucial State planning need identified in and around Flathead Lake and Flathead Basin area:
 - Rapid Growth & Development
 - Flood Hazards poorly identified & lack hard-engineering
 - Need detailed topographic mapping and imagery
- DNRC facilitated meetings with local stakeholders:
The Flathead Lakers; Lake County; Flathead County; Flathead Conservation District; Confederated Salish and Kootenai Tribes (CSKT), Whitefish, Kalispell, FEMA, USACE, DEQ, FWP...

Project Development (Nov. 2007 – April 2008)

Assess Needs & Project Participants:

- Project Sponsors/Partners:

- **Flathead Basin Commission (FBC)**
Caryn Miske – Executive Director



- **Lake County**

Sue Shannon & Joel Nelson - Planning Director
Tiffany Lyden - Planner/FPA



- **City of Whitefish**

Nikki Bond - Planner/FPA
David Taylor & Melisa Phelps



Project Development (Nov. 2007 – April 2008)

Assess Needs & Project Participants:

- Project Champions & Supporters:
 - **Flathead Conservation District**
Larry Van Rinsum
 - **Flathead Lake Biological Station (U of M)**
Diane Whited
 - **Flathead County**
Mindy Cochran – GIS Director
 - **Department of Environmental Quality**
Lynda Saul – Wetland Program Coordinator
 - **Others...**
CSKT, FEMA, USACE, The Flathead Lakers ...

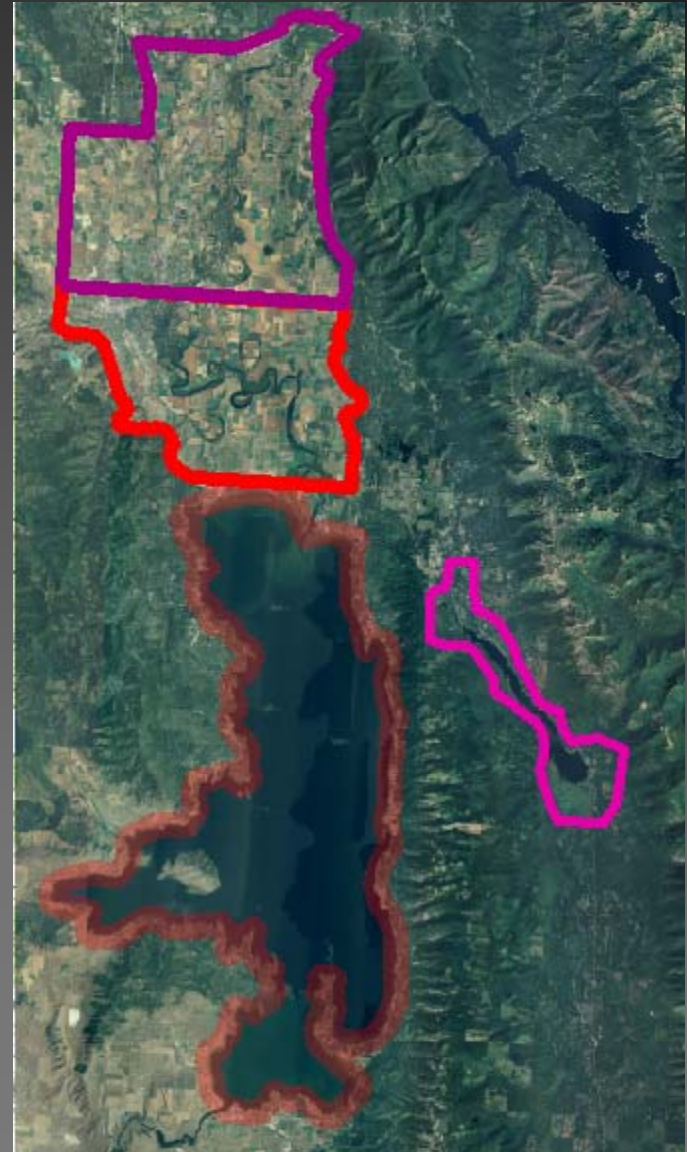
Project Development (Nov. 2007 – April 2008)

Select Project Coverage Area & Initial Estimate Costs:

1. Flathead Lake Shore: \$120 k, 3 mi²
2. Swan Lake Area: \$70 k, 26 sq. mi²
3. Lower Flathead Valley: \$150 k, 82 mi²
4. Upper Flathead Valley: \$195 k, 118 mi²

Total: **\$535,000** and **229 square miles**

Combined Project Cost: **\$445,000**



Project Development (Nov. 2007 – April 2008)

Project Roles & Funding:

- DNRC/WRD – Floodplain Program:
 - Facilitate & Administer the Project: Mike Knutson & Steve Story
 - Grant Proposal Writing: Celinda Adair
- Project Sponsors:
 - **FBC** – Apply for Reclamation & Development Grant Program (RDGP) Grant from State: **\$300,000**
 - **Lake County** – Apply for Renewable Resource Grant & Loan Program (RRGL) Grant from State: **\$100,000**
 - **City of Whitefish** – City General Funds up to **\$30,000**

Grant Awards (May 2009)

Project = Go for Launch ...

- Grant Awards from State Legislature:
 - FBC RDGP: \$294,977 with \$28,010 In-Kind Match Requirement
 - Lake County RRGL: \$100,000 with \$11,163 In-Kind Match
- Initial Tasks:
 - Process Grant Agreements
 - Finalize Project Areas and Solicit new Cost Estimates
 - Determine Schedule
 - Prepare & Process MOUs with Partners/Sponsors
 - Develop Final Project Scope, Specifications, & Contractor Deliverables
 - Contractor Procurement Activities: Prepare RFP, Contractor Selection

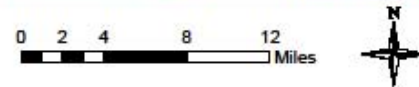
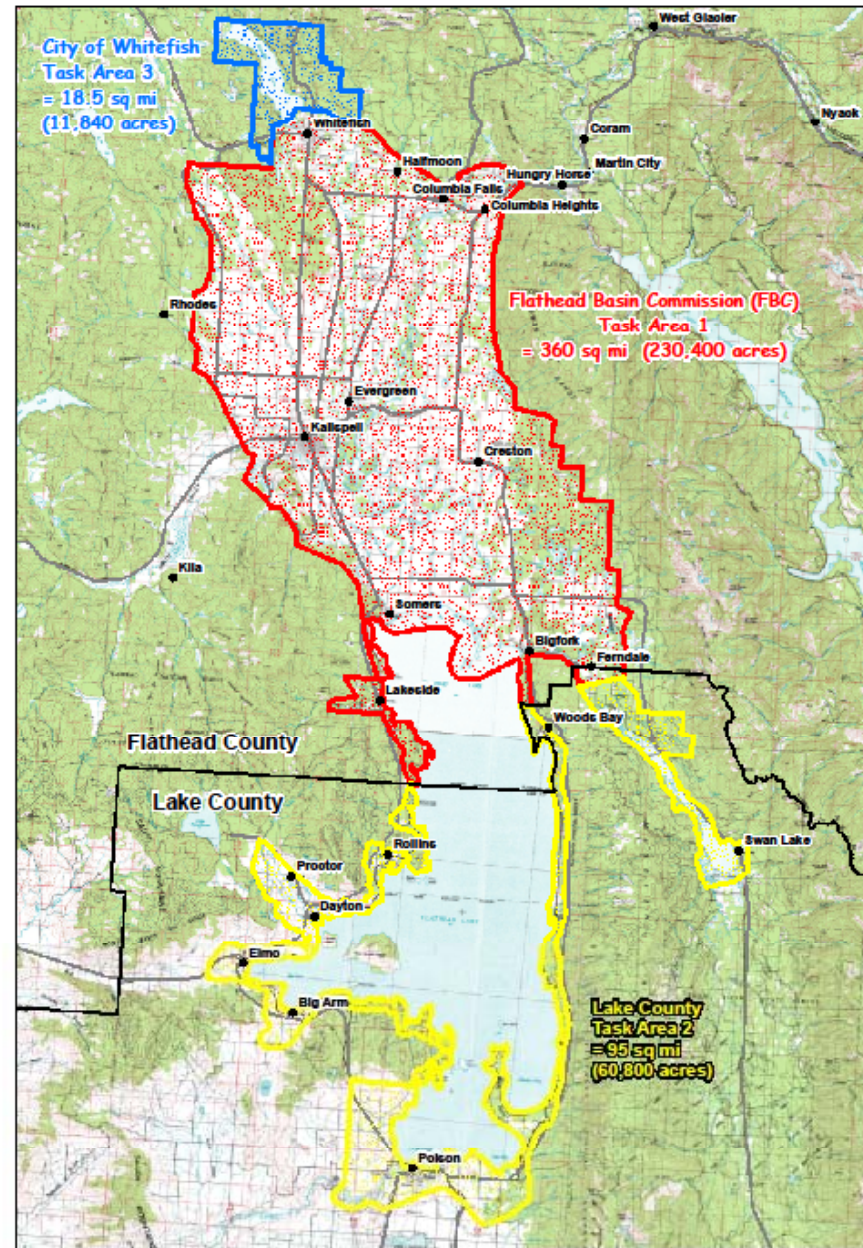
Initial Project Tasks (June 2009)

Finalize Project Areas

- Divide Greater Project Area into Task Areas by Funding Partners
- Total Area: 473.5 mi²

Flathead Basin - LiDAR & Imagery Acquisition Areas

Figure 1



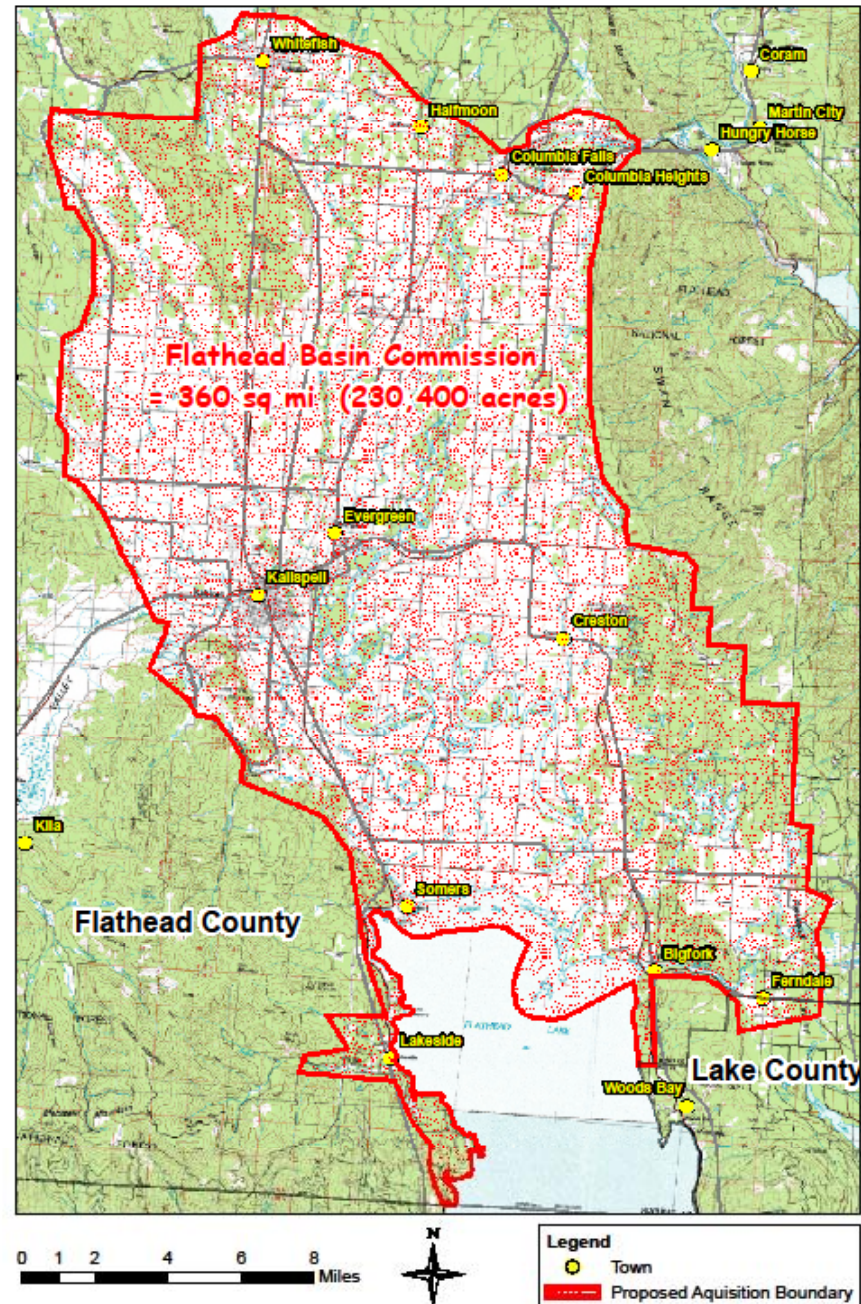
Initial Project Tasks (June 2009)

Finalize Project Areas

- Task Area 1: FBC
Flathead Valley
360 mi²

Figure 2

FBC - TASK AREA 1, Coverage Area



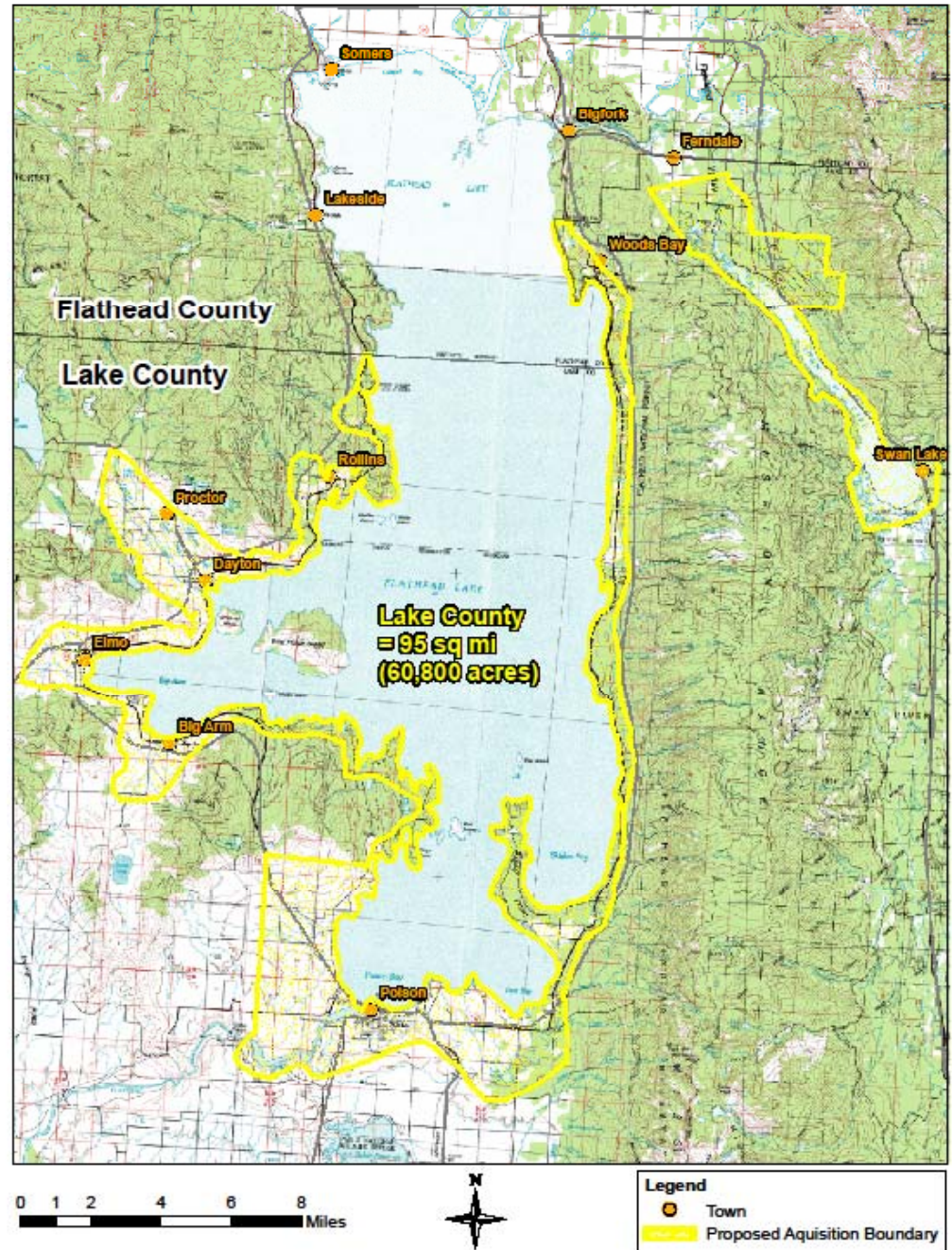
Initial Project Tasks (June 2009)

Finalize Project Areas

- Task Area 2:
Lake County
95 mi²

Figure 3

Lake County - TASK AREA 2, Coverage Area



Initial Project Tasks (June 2009)

Finalize Project Areas

- Task Area 3:
City of Whitefish
18.5 mi²

City of Whitefish - TASK AREA 3, Coverage Area

Figure 4



Initial Project Tasks (June 2009)

Determine Schedule

- New Lake County Mapping used as Leverage for FEMA Countywide DFIRM Conversion Project (RiskMap Program)



- Lake County awarded Countywide DFIRM Conversion Project along with several new detailed floodplain studies.
- **The RiskMap Project Schedule required Topo/LiDAR Acquisition in Fall of 2009 = Dictated Schedule**



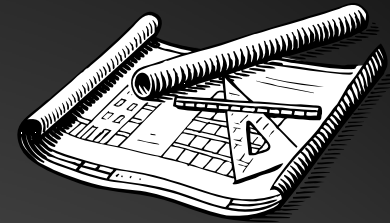
Initial Project Tasks (June 2009)



Project Partner Memorandum of Understandings (MOUs)

- MOUs defined Roles & Responsibilities of Project Partners (DNRC, FBC, Lake County, Whitefish)
 - **DNRC/WRD – Floodplain Program:**
 - Oversee & Administer Project
 - Contractor Procurement
 - Contracting authority and Contract Administer
 - Grant Administration – Quarterly & Final Reports
 - **Partner/Sponsors (FBC, Lake County, Whitefish)**
 - Participate on Contractor Selection Committee
 - Review project documents & Assist DNRC as needed
 - Review/process invoices

Initial Project Tasks (June 2009)

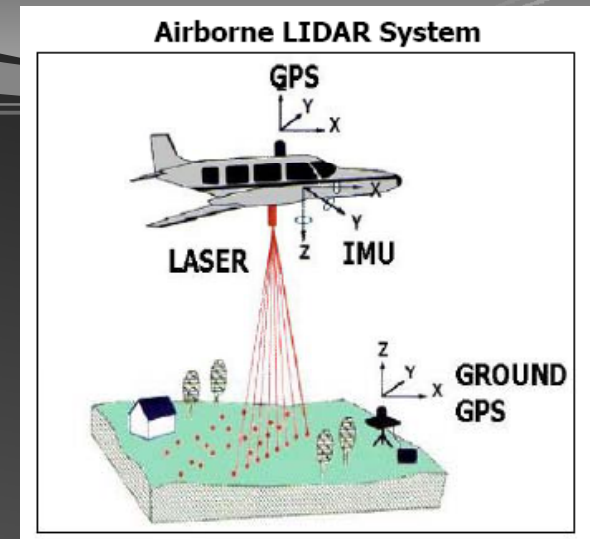


Prepare Project Scope, Specifications, & Data Requirements:

- Updated cost estimates indicated that acquisition costs dropping – competitive market.
- Specifications & Data acquisition options based on cost estimates from several vendors.
- Request for Proposal (RFP) – detailed the:
 - Project Scope & Objectives
 - Budget & Schedule
 - Data Deliverables
 - Performance Standards: FEMA 0.5' RMSE vertical

Initial Project Tasks (June 2009)

Request for Proposal Requirements:



- Project Budget: **\$424,977** total with **\$395,228** available for LiDAR/Imagery (Other for contingency & NRIS)
- Schedule: Acquisition during Fall 2009
 - Lake County Deliverables: **Jan. 10, 2010**
 - FBC/Whitefish Deliverables: **Mar. 31, 2010**
- Data Collection: high resolution digital topographic data (using airborne LiDAR technology) and natural color Orthoimagery (and infrared if possible)

Initial Project Tasks (June 2009)

Request for Proposal/Project Requirements:

The project includes the following key components, for which cost proposals are requested:

Data Acquisition

1.4m LiDAR high resolution digital elevation data at 15 cm RMSE(z)

Natural Color 3 band (4 band collection preferred) Digital Imagery at 1" = 200' scale

Ground Control/Calibration

QA/QC & FEMA Checkpoint Survey

Required Data Process Products (see Section 3.5 for a list of project deliverables)

FGDC & FEMA Compliant Metadata

Hydrographic feature Breaklines

Bare-Earth Digital Elevation Model (DEM) Data

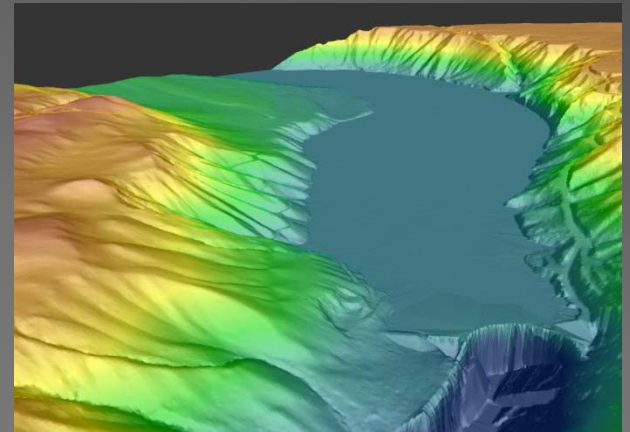
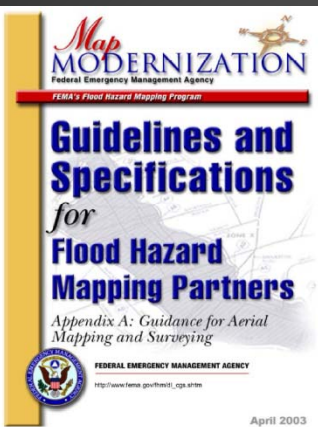
Natural Color Orthoimagery at 1.0 foot pixel resolution

Optional Data Process Products

Bare-earth Digital Terrain Model (DTM)/Breakline enhanced

2' Contours

Color Infrared (CIR) Orthorectified Imagery



Contractor Procurement (Aug-Sept 2009)

Select Qualified Aerial & Mapping Firm following State Procurement Process:

- RFP Issue/Response Dates: July 14 / Aug 14, 2009
- Selection Committee: Representatives from DNRC, FBC, Lake County, City of Whitefish, Flathead Lake Conservation District, and Flathead County
- Received Proposals from 8 Firms.
- Selected Watershed Sciences, Inc
Corvallis, Oregon



LiDAR and Imagery Acquisition

LiDAR Collection:

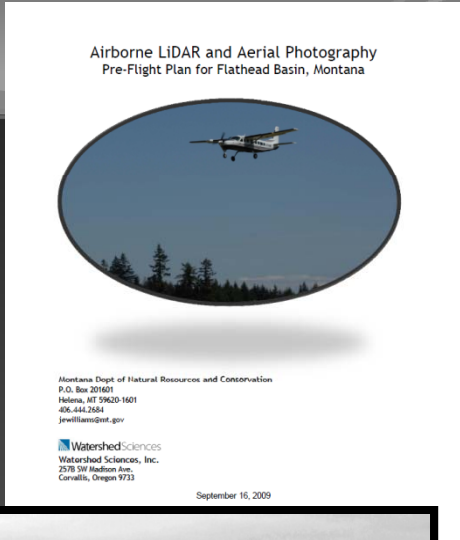
Sept 22-29, 2009

Imagery Collection:

Sept 23-25, 2009

Orthorectified True Color (RGB)

Color Infrared (NIR)



Projection/Datum and Units

	Projection:	Montana State Plane
Datum	Vertical:	NAVD88 Geoid03
	Horizontal:	NAD83 (HARN)
	Units:	U.S. Survey Feet

Images Courtesy Watershed Sciences, Inc.

Data Deliverables:

LiDAR Products:

- Point Data (All & Ground)
- 2-foot Contours
- Digital Elevation Models
 - 3-ft resolution
 - 6-ft res Hyd Enforced

Imagery Products:

- Raw 4 band imagery (Tiff)
- Compressed Mosaic & tiles for RGB & NIR (MrSid)
- Uncompressed Tiles for RGB & NIR (GeoTiff)

Point Data:	<ul style="list-style-type: none"> • All Returns (Las v. 1.2 format, with attributes X,Y,Z, Return Intensity, Return Number, Point Classification, Number of Returns, Scan Angle, GPS Time) • Ground Classified Returns (Las v. 1.2 format, with attributes X,Y,Z, Return Intensity, Return Number, Point Classification, Number of Returns, Scan Angle, GPS Time)
Vector Data:	<ul style="list-style-type: none"> • AOI boundary and tiling area, ESRI <u>Geodatabase</u> feature class • Contour Index and 2 ft. contours, ESRI <u>Geodatabase</u> feature class • <u>Breaklines</u>, ESRI <u>Geodatabase</u> feature class <u>polyline Z</u> format • DEM Tiling Index, ESRI <u>Geodatabase</u> feature class • <u>Orthoimagery</u> Tiling Index, ESRI <u>Geodatabase</u> feature class • <u>Orthoimagery</u> Flight Exposures, ESRI <u>Geodatabase</u> feature class • <i>Updated Roads Layer for survey area, ESRI <u>geodatabase</u>, provided by 3Di(value added product not in contract)</i>
Raster Data:	<ul style="list-style-type: none"> • Elevation Models <ul style="list-style-type: none"> • Bare earth DEM, 3-ft resolution, ESRI Grid format • Bare earth DEM with <u>breaklines</u> enforced, 6-ft resolution, ESRI Grid format • <u>Orthophotos</u> <ul style="list-style-type: none"> • Compressed mosaic (<u>MrSid</u> format 1-ft resolution) • Compressed tiles (<u>MrSid</u> format 1-ft resolution) • Uncompressed tiles (<u>GeoTIFF</u> with <u>worldfile</u> 1-ft resolution) • Compressed near infrared tiles (<u>MrSid</u> format 1-ft resolution) • Compressed near infrared mosaic (<u>MrSid</u> format 1-ft resolution) • Uncompressed near infrared tiles (<u>GeoTIFF</u> with <u>worldfile</u> 1-ft resolution) • Raw 4-Band Imagery (Tiff format)
Data Report:	<ul style="list-style-type: none"> • Full report containing introduction, methodology, and accuracy

Final Project Details

LiDAR & Imagery

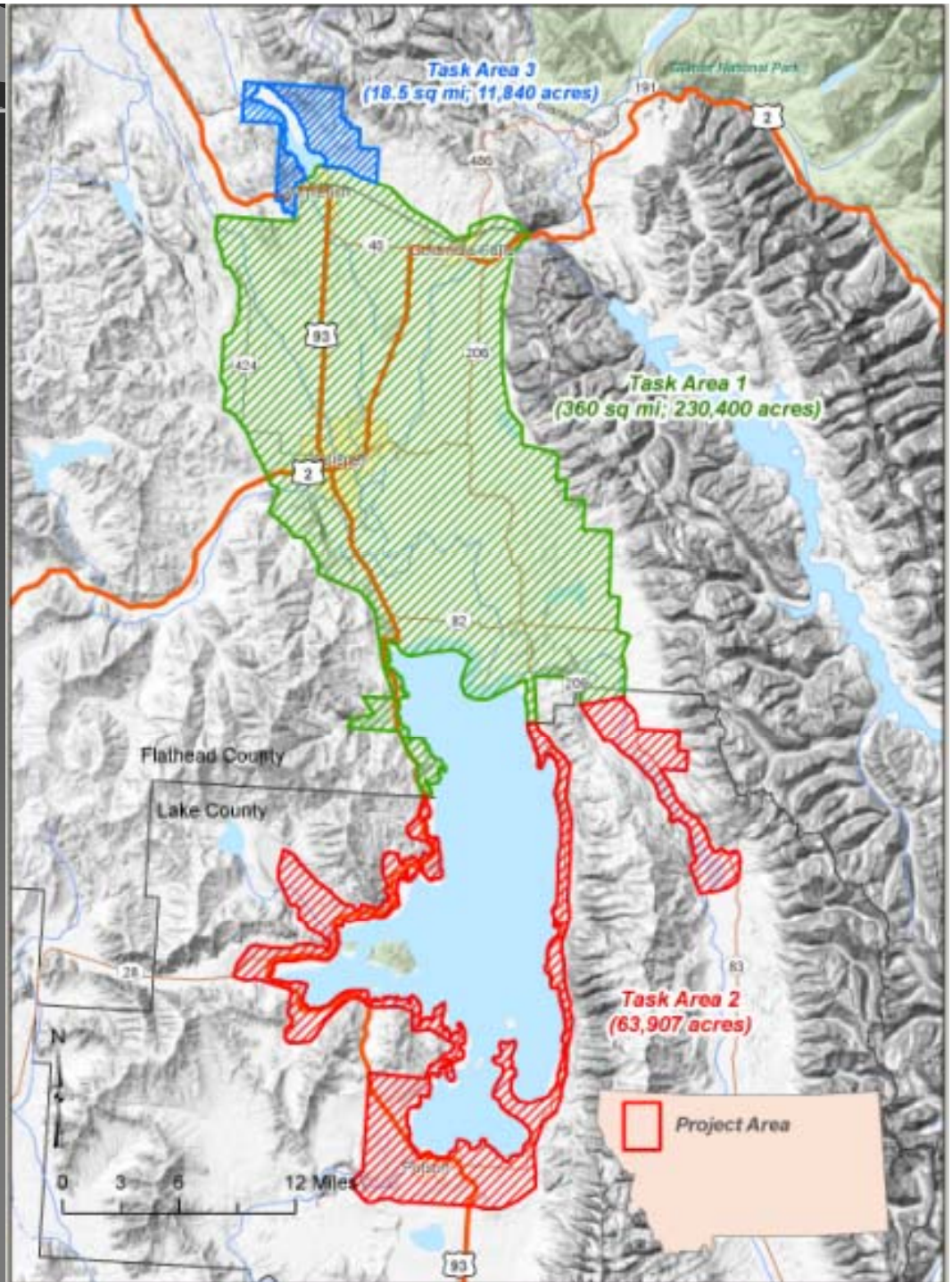
Acquisition & Products:

- Task Area 1: FBC
360 sq.mi, \$272,179
- Task Area 2: Lake County
95 sq.mi, \$93,000
- Task Area 3: City of Whitefish
18.5 sq.mi, \$16,946

Total: 473.5 sq mi, \$382,125

Note: Contractor provided additional 100m LiDAR Buffer increasing area to 501 sq.mi

Avg. Cost: \$763/sq.mi.



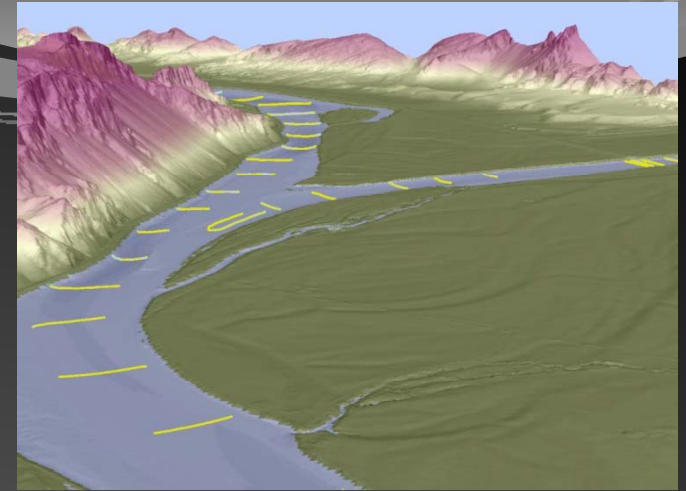
Project Data Distribution

Release to Project Partners:

- Lake County Data submitted to FEMA for QA/QC review prior to release
- DNRC GIS staff performed cursory data review
- Submitted to Partners in May, 2010
- Data publically available (upon request) in May, 2010
- Total Data set: 2 TB

Project Data Hosting through MT State Library/NRIS:

- Contract Agreement with NRIS (\$20,000) to develop online data repository and map viewer



Current Data Use:

Lake County – New Detailed Floodplain Studies as part of the FEMA DFIRM Conversion project:

- Three new studies are underway using the DEM products developed from the LiDAR data.



Images Courtesy Watershed Sciences, Inc.

Alternative Data Uses:

- Wetland & Riparian Zone Mapping
- Vegetation & Canopy Characterization
- Soil & Slope Classification
- Geographic & Geomorphic mapping & assessment
- Channel Migration (CMZ) Studies
- 3D surface modeling
- Environmental & Development Planning
- And many more....

Thank You



Steve Story
sestory@mt.gov
406.444.6664

Image Courtesy Watershed Sciences, Inc.