

# Planning Alternative Corridors for Transmission (PACT)

## A Web-based Decision-Support Tool for Transmission Line Siting

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**Aspen Environmental Group**

**September 11, 2008**



# PACT Project

- **Funding:** CEC Public Interest Energy Research, Environmental Program area, with participation from the transmission research program area
- **Purpose:** To develop decision-support software
- **Schedule:** 2006-2008
- **Organization:** Management Team, Steering Committee, Technical Advisory Groups

# Project Steering Committee: MEMBERS

- **Agency Representatives:**

- CA Energy Commission, CPUC, US Forest Service, US BLM, Native American Heritage Commission, SF BCDC, US Dept. of Defense

- **Utility Representatives:**

- LADWP, PG&E, SMUD, SDG&E, SFPUC, SCE, Western Area Power Admin

- **Other Groups Represented:**

- CA Farm Bureau Federation, CAISO, CA Institute for Energy & the Environment, Energy Policy Initiatives Center, League of CA Cities, League of Women Voters, Regional Council of Rural Counties, So Cal Association of Governments

# Technical Advisory Groups: MEMBERS

- **Aesthetics**
  - CEC, 3 consultants
- **Biology**
  - CEC, PG&E, SCE, USFS, Western, consultants
- **Community Concerns**
  - CEC, PG&E, League of Women Voters, SCE, SMUD, consultants
- **Cultural Resources**
  - CEC, Office of Historic Preservation, several tribal members, Native American Heritage Comm., BLM, SCE
- **Engineering**
  - CEC, SDG&E, SCE, SMUD, consultants
- **Land Use**
  - CEC, CPUC, USFS, League of CA Cities, CA Farm Bureau Fed., SCAG, SANDAG, Trust for Public Land

# PACT Decision Support Roles

- **Analytical support**
- **Represents project complexity**
- **Accommodates project and personnel change**
- **Documents assumptions and results**
- **Communicates within and beyond the project team**

# Planning Steps in a Transmission Project Involving Modeling

1. Define and scope the project
2. Prepare to model
3. Identify corridors/routes
4. Screen and evaluate alternate routes
5. Involve interested stakeholders

# Define the Project Features

The screenshot displays a GIS application interface for defining project features. On the left, a sidebar contains a 'SELECT' tab and an 'EDIT' tab. Below these are several menu items: 'measures', 'Analysis' (with sub-items 'Executive Summary', 'Segment Summary', and 'Sensitivity Analysis'), 'Browse Decision Factors', and a list of categories with expandable options: '+ Aesthetics', '+ Biological Resources', '+ Community', '+ Cultural Resources', '+ Engineering', and '+ Land Use'. The main interface features a 'Legend' panel with a tree view of layers: 'Project Specific' (checked), 'Possible Routes', 'Buffers', 'State Line' (checked), 'Segments' (checked), 'Incorporated Place', 'Municipal Boundaries', 'Counties' (checked), 'Project Boundary', 'Biological Resources', 'Community', 'Cultural Resources', 'Engineering', 'Land Use', and 'Other Useful Layers'. Below the legend are 'Selection' and 'Overview Map' panels. The main map area shows a red project boundary and segments across Yuba, Sutter, and Sacramento counties, with a state line to the east. The status bar at the bottom indicates 'Cursor Position', '0 features selected.', '1: 1100000', '167348.87 x 152796.79 (m)', and 'Powered by MapGuide'.

# Organizing to Model the Decisions

- **Subject-matter experts**
- **Data facilitator to work with specialists and collect available data and their insight and judgment**
- **GIS technician to prepare data for modeling**
- **Facilitator to help teams develop scenarios and interpret results**

# Define the Study Area

- **Area where electrical connections need to be made**
  - To generation
  - To the existing transmission and distribution network
- **Area where project objectives can be maximized**
  - Area that meets electrical needs and supplies electrical benefits

# Collect Data

**SELECT** **EDIT**

measures  
Analysis  
Executive Summary  
Segment Summary  
Sensitivity Analysis  
Browse Decision Factors  
+ Aesthetics  
+ Biological Resources  
+ Community  
+ Cultural Resources  
+ Engineering  
+ Land Use

**Legend**

- Municipal Boundaries
- Counties
- Project Boundary
- Biological Resources
- Habitat and Land
- Preserves and C
- Hydrology
- Community
- Electro Magnetic
- Hospitals
- Community Ce
- Elementry Sci

**Selection**

No Selection

**Overview Map**

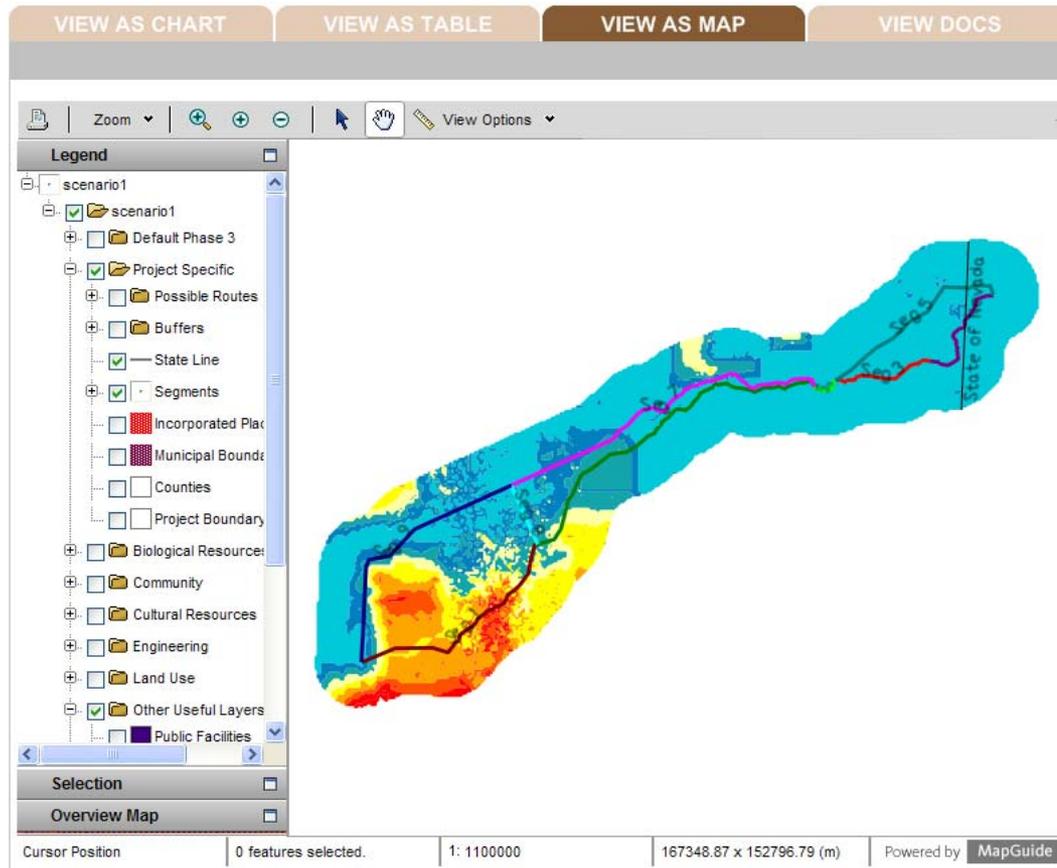
# Planning to Identify Corridors/Routes



# Turn Raw Data into Protected Areas

- **Determine which areas should be excluded for siting the facility (e.g., avoid national parks, railroad rights-of-way)**
- **Determine how important it is to protect the remaining areas**
- **Determine whether to follow other linear facilities (e.g., other power line rights-of-way)**

# Corridor Planning Results



### Step 2: COMPARE

Default 1

Default 2

Apply

### Step 3: VIEW

**SELECT** EDIT

- Measures
  - + Analysis
  - Browse Decision Factors
    - Community
      - Land Use
        - Farmlands
        - Hospitals
        - Land Use
  - + EMF
  - + Biological
  - + Engineering

VIEW AS CHART

VIEW AS TABLE

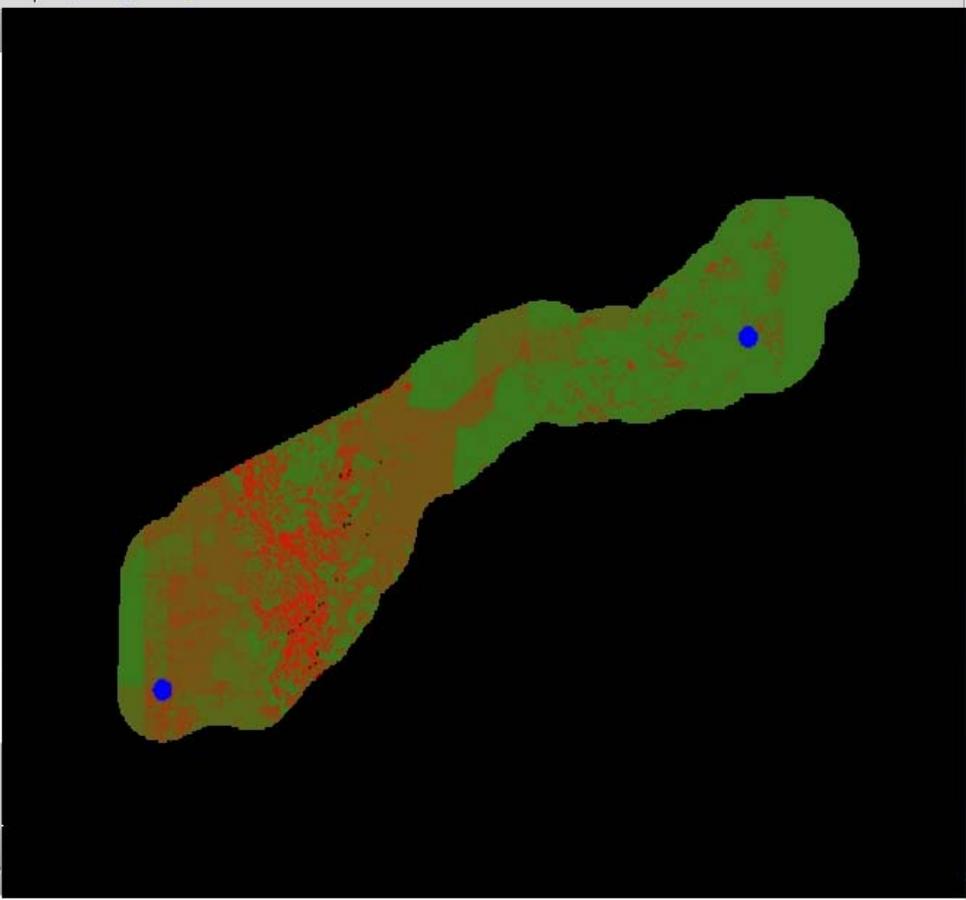
VIEW AS MAP

VIEW DOCS

Zoom View Options

#### Legend

- Project Area
  - Project Area
- Themes
  - Cover Type Vegetation Priority Protection
    - 0
    - 0.1 to 0.2
    - 0.3 to 0.4
    - 0.5
    - 0.6 to 0.7
    - 0.8 to 0.9
    - 1
    - Greater than 1
- Community
  - Land Use
  - EMF
- Biological
- Engineering



Selection

Overview Map

### Step 2: COMPARE

Default 1

Default 2

Apply

### Step 3: VIEW

SELECT EDIT

- Measures
  - + Analysis
  - Browse Decision Factors
    - Community
      - Land Use
        - Farmlands
        - Hospitals
        - Land Use
    - + EMF
    - + Biological
    - + Engineering

VIEW AS CHART

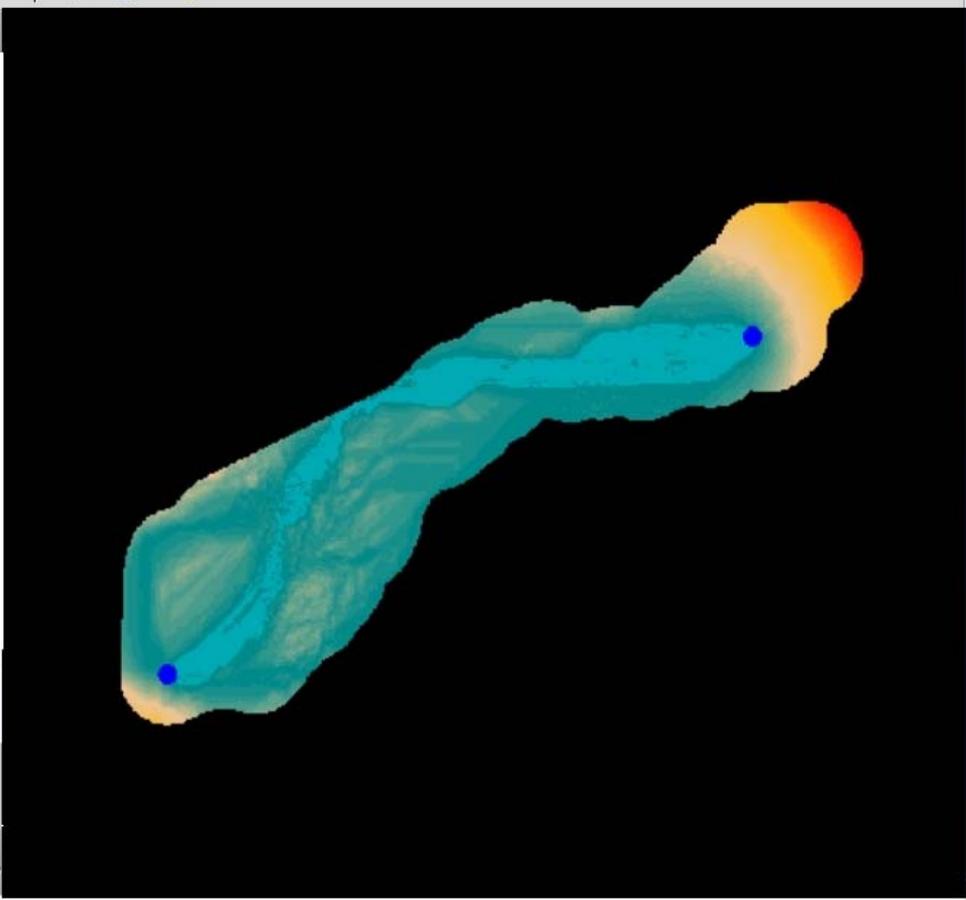
VIEW AS TABLE

VIEW AS MAP

VIEW DOCS

Zoom View Options

- #### Legend
- Corridor
  - Project Area
  - Project Area
  - Themes
  - Community
  - Biological
    - Species
      - Aquatic Refuge
      - Wilderness Areas
      - Vegetation Cover Type
        - Chamise
        - HighDesertMixedShrub
        - MountainSagebrushAlliance
        - BlueOak
        - MontaneMixedChaparral
        - MixedRiparianHardwoods
        - MountainHemlock
        - WetMeadows (Grass/Sedge/Rush)
        - Unknown
        - Owl Habitat
    - Hydrology
    - Engineering



Selection

Overview Map

### Step 2: COMPARE

Default 1

Default 2

Apply

### Step 3: VIEW

SELECT EDIT

- Measures
  - + Analysis
  - Browse Decision Factors
    - Community
      - Land Use
        - Farmlands
        - Hospitals
        - Land Use
    - + EMF
    - + Biological
    - + Engineering

VIEW AS CHART

VIEW AS TABLE

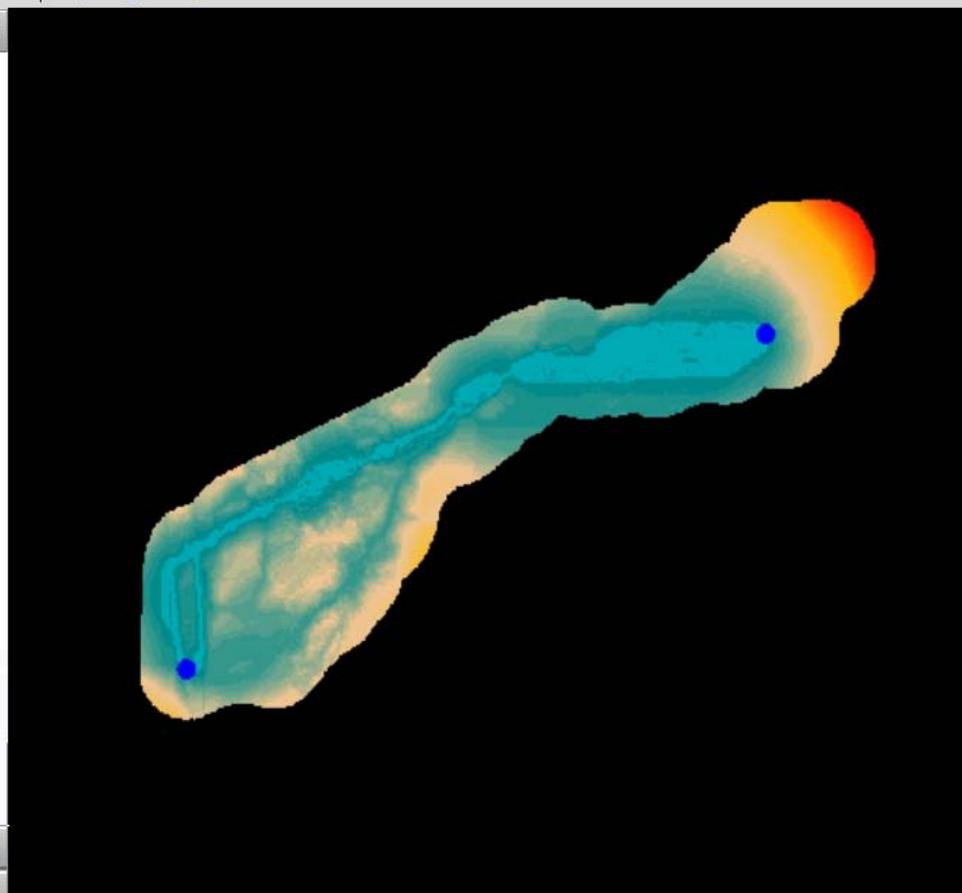
VIEW AS MAP

VIEW DOCS

Zoom View Options

#### Legend

- Corridor
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      - Unknown
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  - Engineering



Selection

Overview Map

# Planning to Screen and Evaluate Sites/Routes

SAVE AS... SAVE

**Step 2: COMPARE**

None

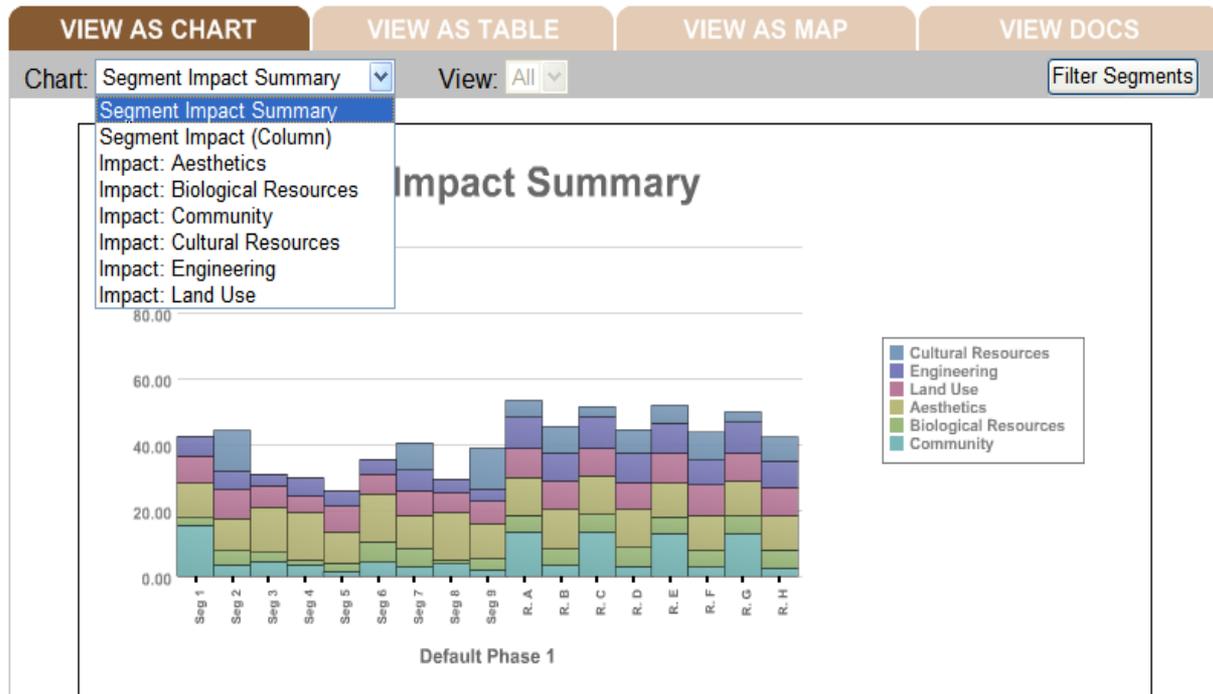
None

Apply

**Step 3: VIEW**

SELECT EDIT

- Measures
- Analysis
  - Executive Summary
  - Segment Summary
  - Sensitivity Analysis
- Browse Decision Factors
  - + Aesthetics
  - + Biological Resources
  - Community
    - + Community (sub)
    - + Electric and Magnetic Fields (EMF)
  - + Cultural Resources
  - + Engineering
  - + Land Use



# Identify Decision Factors

Default Phase 1 ▼

Apply

B: PROJECT PHASE...

C: TAILOR ASSUMPTIONS...

SAVE AS... SAVE

**Step 2: COMPARE**

None ▼

None ▼

Apply

**Step 3: VIEW**

SELECT EDIT

- Measures
  - Analysis
    - Executive Summary
    - Segment Summary
    - Sensitivity Analysis
  - Browse Decision Factors
    - + Aesthetics
    - + Biological Resources
    - Community
      - + Community (sub)
      - + Electric and Magnetic Fields (EMF)
    - + Cultural Resources
    - + Engineering
    - + Land Use

## Executive Summary

The proposed construction of a new 500 kV transmission line, which will import power from potential wind or clean coal generators in Can Montana, Wyoming, Colorado, or other Rocky Mountain states, is meant to improve reliability and meet projected electrical load requirements in this region.

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VIEW AS TABLE
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Table: Segment Impact ▼ View: All ▼ Filter Segments

Segment Impact

Segment Impact By Scenario

Segment Impact							
ID	Default Phase 1						
	Default Scenario using \'Phase 1\'						
	Cultural Resources	Engineering	Land Use	Aesthetics	Biological Resources	Community	SUM
Seg 1	0.00	5.91	8.35	10.46	2.32	15.34	42.37
Seg 2	12.50	5.42	8.79	9.89	4.17	3.41	44.19
Seg 3	0.00	3.62	6.47	13.89	2.53	4.53	31.04
Seg 4	0.00	5.49	4.85	14.58	1.48	3.33	29.73
Seg 5	0.00	4.69	7.56	9.57	2.42	1.54	25.77
Seg 6	0.00	4.35	6.00	14.58	6.22	4.23	35.38
Seg 7	8.33	6.28	7.52	9.89	5.52	2.89	40.43
Seg 8	0.00	4.17	5.90	14.44	1.33	3.55	29.39
Seg 9	12.50	3.77	6.61	10.69	3.37	1.92	38.88
R. A	5.32	9.45	8.56	11.53	4.97	13.54	53.37
R. B	8.32	8.46	8.67	11.81	5.02	3.25	45.52
R. C	3.23	9.60	8.11	11.80	5.35	13.33	51.43

# Collect Additional Data and Measure Factors for Each Alternative

- **Need comparable data on all route segments and related facilities**
- **Information derived from GIS data**
  - Identify the factors that are important (e.g., not all land use categories, but focus on commercial and industrial land use)
- **Field Data**
  - Augment GIS data for areas that are not traditionally mapped (e.g., soil contamination)
- **Expert judgment**
  - To represent more qualitative, less spatial, or more global information (e.g., ability to manage drainage or erosion)

# Aggregate Information to Inform Decisions

- **Determine how to “add up” the factors when they are measured differently**
  - Assign weights to the factors
    - note that this step is independent of the importance of the factor in the field—e.g., residential land is likely to have a high weight, independent of the actual presence of residential land near the alternatives
- **Determine how to add segments to make routes**

# Potential Users of PACT

- **Utility project planners**
- **Transmission line regulators**
- **Environmental review teams; data sharing and peer review**
- **Public and stakeholder groups**
- **Decision makers**

# Planning for Interested Stakeholders

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**Legend**

- scenario1
  - scenario1
    - Default Phase 3
      - Current Character
        - Grade 1.0 - 1.9
        - Grade 2.0 - 2.9
        - Grade 3.0 - 3.9
        - Grade 4.0 - 4.9
        - Grade 5.0 - 5.9
        - Grade 6.0 - 6.9
        - Grade 7.0 - 7.9
        - Grade 8
- Project Specific
  - Possible Routes
  - Buffers
  - State Line
  - Segments
  - Incorporated Place
  - Municipal Bounds

Selection

Overview Map

x: 96414.4339 m, y: 0 features

ID	Default Phase 3			
	Default Scenario using 'Phase 3'			
	Measure (Grade18)	Score (Grade18)	Current Character Contribution	Segment Impact
Seg 1	2.00	25.00	1.67	0.42
Seg 2	7.00	87.50	1.67	1.48
Seg 3	4.00	50.00	1.67	0.83
Seg 4	7.00	87.50	1.67	1.48
Seg 5	4.00	50.00	1.67	0.83
Seg 6				
Seg 7				
Seg 8				
Seg 9				

### Segment Impact Summary

### Segment Impact (Column)

Default Phase 3

manu

Guide

Apply Decisions

1      2      3

Cultural Resources Weight: High  None

Engineering Weight: High  Med

Aesthetics Weight: High  Med

Land Use Weight: High  Med-High

Biological Resources Weight: High  Low

Community Weight: High  High

Weighting Method: Variable  Variable



# Options for Adding Stakeholder Information to the PACT Framework

- **Add stakeholder-supplied data to the web site**
- **Build stakeholder factors into the web site**
- **Allow access to a public version of the Evaluation Web Site**

# Documentation Measures and Assumptions

**Biological Resources a**

will be measured on a scale from 1 to 5. A score of 1 is for a site with no known biological sensitivities, disturbed land (defined further as no threatened, endangered, or sensitive species (no species of concern or CNPS list, wetlands), disturbed habitat not suitable for threatened and endangered species. A score of 5 is for a site with high sensitivity, threatened and endangered species present, extensive mitigation required, likely opposition; and alternative sites recommended (further defined as threatened and endangered and/or FFS species, extensive mitigation, permit(s) difficult to acquire (permits include Incidental Take Authorization, USACO, 1600 Permits, etc.))

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**Biological Resources a Description** More...

**Siting Goal:**  
To minimize biological effects

**Calculation Method:**  
Field Grade

**Grade:**  
Grades range from 1-5. A grade of 1 has the least impact while a grade of 5 has the most impact.

**Proposed Curve:**  
More effect with higher score

SAVE AS... | SAVE

**Step 2: COMPARE**

None | None

Apply

**Step 3: VIEW**

SELECT | EDIT

Apply Decisions

1 2 3

Sensitivity Adjustment:  
100%

Preference Curve:

EDIT

Biological Resources a Weight:  
MedHigh

Method of Calcul:

likely opposition, and alternative sites recommended (further defined as threatened and endangered and/or FFS species, extensive mitigation, permit(s) difficult to acquire (permits include Incidental Take Authorization, USACO, 1600 Permits, etc.))

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**Biological Resources a Description** More...

**Siting Goal:**  
To minimize biological effects

**Calculation Method:**  
Field Grade

**Grade:**  
Grades range from 1-5. A grade of 1 has the least impact while a grade of 5 has the most impact.

**Proposed Curve:**  
More effect with higher score

# Next Steps

- **Validation**
- **Training**
- **Hosting**

Thank You

