# Water Level Visualizer - Testing Guide

## 🧪 Testing the Mobile Web App

This guide provides step-by-step instructions for testing the Water Level Visualizer mobile web app.

## ⚡ Quick Start Testing

### **1. Start the Development Server**

cd tools/Visualizer

npm run dev

The app will be available at http://localhost:3000

### **2. Test Build Process**

npm run build

Verify that the build completes successfully without errors.

## 📱 Manual Testing Checklist

### **🏠 Homepage Testing**

* **Page loads correctly** with title and description
* **Database upload area** displays with drag-and-drop functionality
* **Feature cards** show all four main features
* **Responsive design** works on different screen sizes
* **Getting started info** displays correctly

### **📁 Database Upload Testing**

#### **Valid File Upload**

* **Drag and drop** a valid .db file works
* **Click to browse** file selection works
* **Progress indicator** shows during upload
* **Success message** appears after successful upload
* **Database appears** in the database selector

#### **Invalid File Handling**

* **Wrong file type** (e.g., .txt) shows error message
* **Oversized file** (>100MB) shows size limit error
* **Corrupted database** shows validation error
* **Empty file** shows appropriate error

#### **Database Validation**

* **Schema validation** checks for required tables
* **Wells count** is calculated and displayed correctly
* **File size** is formatted properly (KB/MB)
* **Upload date** shows current timestamp

### **🗂️ Database Selection Testing**

* **Multiple databases** can be uploaded and stored
* **Database cards** show metadata (wells count, size, date)
* **Delete functionality** removes databases
* **Selection** navigates to wells browser
* **Local storage** persists databases between sessions

### **🔍 Wells Browser Testing**

#### **Data Loading**

* **Wells load** from selected database
* **Loading states** show appropriate spinners
* **Error handling** displays when database is unavailable
* **Empty state** shows when no wells found

#### **Search and Filtering**

* **Search by well number** filters results correctly
* **Search by CAE number** works
* **Search by field name** filters properly
* **Data availability filter** (with/without data) works
* **Well field dropdown** populates and filters correctly

#### **Table Functionality**

* **Sorting by well number** works (asc/desc)
* **Sorting by CAE number** works
* **Sorting by last reading date** works
* **Pagination** works with large datasets
* **Data type badges** show correctly (T, M, Tel)
* **Row clicking** navigates to plot page

#### **Mobile Optimization**

* **Touch targets** are large enough (44px minimum)
* **Horizontal scrolling** works on small screens
* **Responsive table** adapts to screen size

### **📊 Plot Viewer Testing**

#### **Page Navigation**

* **URL with well number** loads correct well data
* **Back button** returns to wells browser
* **Breadcrumb navigation** works
* **Header shows** well information correctly

#### **Data Loading**

* **Water level data** loads and displays
* **Manual readings** load separately
* **Temperature data** loads when available
* **Loading states** show during data fetch
* **Error states** handle missing wells gracefully

#### **Chart Functionality**

* **Line chart** renders water level data
* **Manual readings** show as scatter points
* **Temperature line** displays when enabled
* **Tooltips** show detailed information on hover/tap
* **Legend** displays correctly
* **Axis labels** show appropriate units

#### **Chart Controls**

* **Data type toggles** show/hide chart lines
* **Date range presets** filter data correctly
* **Custom date range** allows manual selection
* **Brush navigation** works for large datasets
* **Zoom and pan** work on mobile devices

#### **Chart Interactions (Mobile)**

* **Touch and drag** pans the chart
* **Pinch to zoom** works on mobile
* **Tap data points** shows tooltips
* **Double tap** resets zoom level

### **🧮 Recharge Results Testing**

#### **Page Access**

* **Recharge button** navigates from plot page
* **URL routing** works for recharge pages
* **Back navigation** returns to plot

#### **Results Display**

* **Method summary cards** show RISE, MRC, EMR results
* **Results table** displays all calculations
* **Date formatting** is consistent
* **Value formatting** shows proper units
* **Empty state** handles wells without calculations

#### **Method Information**

* **Method descriptions** are informative
* **Calculation metadata** displays correctly
* **Export buttons** are present (functionality TBD)

### **📱 Mobile Optimization Testing**

#### **Touch Interface**

* **All buttons** have adequate touch targets
* **Scroll behavior** works smoothly
* **Touch feedback** provides appropriate responses
* **Gesture navigation** doesn't conflict with browser

#### **Responsive Design**

* **Phone portrait** (320px+) layouts work
* **Phone landscape** layouts adapt
* **Tablet portrait** (768px+) layouts work
* **Desktop** (1024px+) layouts utilize space well

#### **Performance**

* **Initial page load** is under 3 seconds
* **Chart rendering** is smooth
* **Data loading** shows progress appropriately
* **Memory usage** doesn't grow excessively

## 🔍 Browser Testing

### **Supported Browsers**

Test on these browsers and versions:

#### **Mobile Browsers**

* **Safari iOS** (14+)
* **Chrome Android** (90+)
* **Samsung Internet** (latest)
* **Firefox Mobile** (latest)

#### **Desktop Browsers**

* **Chrome** (90+)
* **Firefox** (90+)
* **Safari** (14+)
* **Edge** (90+)

### **Browser-Specific Testing**

* **File upload** works in all browsers
* **LocalStorage** persists data correctly
* **Chart interactions** work consistently
* **CSS animations** render smoothly

## 🐛 Common Issues and Solutions

### **Database Upload Issues**

* **File not uploading**: Check file size and format
* **Validation errors**: Ensure database has required tables
* **Browser compatibility**: Try a different browser

### **Chart Display Issues**

* **Chart not rendering**: Check browser console for errors
* **Performance issues**: Reduce data range or enable downsampling
* **Touch interactions not working**: Ensure browser supports touch events

### **Data Loading Issues**

* **Wells not loading**: Check database file integrity
* **Slow performance**: Try with smaller database or date range
* **Missing data**: Verify database contains expected tables

## 📊 Performance Testing

### **Load Testing**

* **Large databases** (1000+ wells) load efficiently
* **Large datasets** (10000+ readings) render smoothly
* **Multiple databases** can be stored without issues
* **Memory usage** stays reasonable during extended use

### **Network Testing**

* **Slow connections** (3G) still usable
* **Offline usage** works with stored databases
* **Progressive loading** handles poor connectivity

## ✅ Test Results

### **Test Environment**

* **Date**: [Fill in test date]
* **Browser**: [Fill in browser and version]
* **Device**: [Fill in device type and OS]
* **Database**: [Fill in test database details]

### **Pass/Fail Summary**

* **Homepage**: ✅ Pass / ❌ Fail
* **Database Upload**: ✅ Pass / ❌ Fail
* **Wells Browser**: ✅ Pass / ❌ Fail
* **Plot Viewer**: ✅ Pass / ❌ Fail
* **Recharge Results**: ✅ Pass / ❌ Fail
* **Mobile Optimization**: ✅ Pass / ❌ Fail

### **Notes**

[Add any additional testing notes or issues discovered]

## 🚀 Automated Testing (Future)

For future development, consider adding:

* **Unit tests** for database operations
* **Component tests** for React components
* **Integration tests** for user workflows
* **Performance tests** for large datasets
* **Accessibility tests** for screen readers

## 📞 Reporting Issues

When reporting issues, include:

1. **Steps to reproduce** the issue
2. **Expected vs actual behavior**
3. **Browser and device information**
4. **Console error messages** (if any)
5. **Database file characteristics** (size, well count, etc.)