Asset Management Approach for Wellfields

1. Overview
2. Asset Management Approach
3. City of Berlin Wellfield
Asset Management Approach for Wellfields

Inspection, monitoring and maintenance based planning process for maintaining groundwater engineering assets
Asset Management Approach for Wellfields

- Early Recognition of Problem
- Timely Completion of Repair
- More Reliable Service
- Lower Outage Costs
- Cheaper O&M

Short Term Benefit
Asset Management Approach for Wellfields

Long Term Benefit

- Extended Asset Life
- More Efficient Planning
- Reduced Capital Needs
- Lower Bond/Debt Costs
Asset Management Approach for Wellfields

Approach

Well Inventory → Compile Records

Assign MEAV → Condition Assessment

Performance Monitoring →
- Identify Replacements
- Identify Rehabilitation

Replacement Planning/Impl → Update Asset Values

Rehabilitation Planning/Impl
Asset Management Approach for Wellfields

Approach

- Compile Records
- Condition Assessment
- Assign MEAV
- Well Inventory
- Performance Monitoring
- Identify Replacements
- Replacement Planning/Impl
- Identify Rehabilitation
- Rehabilitation Planning/Impl
- Update Asset Values

- Identify Replacements
- Replacement Planning/Impl
- Rehabilitation Planning/Impl
Asset Management Approach for Wellfields

Well Inventory

- Operational Wells
- Standby Wells
- Wells Awaiting Rehabilitation
- Non-commissioned Wells
Asset Management Approach for Wellfields

- Water Availability
- GW/SW Interactions
- Existing Wells
- Potential Transfers
- New Wells Needed

Regulatory Issues
Asset Management Approach for Wellfields

- Pumps
- Pipes
- Monitoring Controls
Asset Management Approach for Wellfields

Approach

Well Inventory

Compile Records

Assign MEAV

Assess Condition

Performance Monitoring

Identify Replacements

Replacement Planning/Impl

Update Asset Values

Identify Rehabilitation

Rehabilitation Planning/Impl
Asset Management Approach for Wellfields

Well Records

- Well Construction
- Pump Data
- Initial Development
- Water Quality
- Static Water Level
- Pumping Drawdown
- Inspection Reports
Asset Management Approach for Wellfields

Well Records

- Top of Well (flange): 67.69 m
- Ground Elevation (Geodetic): 87.17 m
- Diameter: 250 mm (10")
- Elevation (m geod.):
  - High static water level: 50.7
  - Low static water level: 47.0
  - High pumping water level: 48.0
  - Low pumping water level: 42.3
- Pump intake: 38.5
- K packer: 32.5 – 35.5
- 0.120" slot screen: 29.5 – 32.5
- 0.100" slot screen: 23.0 – 26.5
- 0.080" slot screen:

- Remaining water column (%):
Asset Management Approach for Wellfields

Approach

- Well Inventory
- Compile Records
- Assign MEAV
- Condition Assessment
- Performance Monitoring
  - Identify Replacements
  - Identify Rehabilitation
  - Replacement Planning/Impl
  - Rehabilitation Planning/Impl
  - Update Asset Values
Asset Management Approach for Wellfields

Condition Assessment
Asset Management Approach for Wellfields

Approach

- Well Inventory
- Compile Records
- Assign MEAV
- Condition Assessment
- Performance Monitoring
  - Identify Replacements
  - Identify Rehabilitation
  - Replacement Planning/Impl
  - Rehabilitation Cost
  - Update Asset Values
Modern Equivalent Asset Value (MEAV)

Quantifies an asset's value by assessing its differences with a reference asset in terms of differences in maintenance and other operating costs even though the two assets may differ in scale/technology and service potential.
Asset Management Approach for Wellfields

Approach

1. Well Inventory
2. Compile Records
3. Assign MEAV
4. Condition Assessment
5. Performance Monitoring
   - Identify Replacements
   - Identify Rehabilitation
6. Replacement Planning/Impl
7. Rehabilitation Planning/Impl
8. Update Asset Values

Performance Monitoring

Identify Replacements

Identify Rehabilitation
Asset Management Approach for Wellfields

- Pump Operation/Efficiency
- Yield/Specific Capacity
- Water Quality
- Biofouling/Encrustation
- Mechanical Plugging
- Inspection Opportunities
Asset Management Approach for Wellfields

Well Performance

Reasons for Decline:

- Mechanical plugging in aquifer/gravel pack
- Bacterial deposits in screen, gravel pack or aquifer
- Well construction
- Well development
- Operations
Asset Management Approach for Wellfields

Example Application

Regional District of Nanaimo

Historical Operations - Fairwinds Well 2

Pumping Rate (gpm) vs. Specific Capacity (gpm/ft drawdown)

Example Application

Regional District of Nanaimo
Asset Management Approach for Wellfields

Approach

Well Inventory → Compile Records

Assign MEAV → Condition Assessment

Performance Monitoring

Identify Replacements → Replacement Planning/Impl

Identify Rehabilitation → Rehabilitation Planning/Impl

Update Asset Values
Asset Management Approach for Wellfields

Identify Replacements

Well Aging

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Asset Management Approach for Wellfields

Approach

Well Inventory

Compile Records

Assign MEAV

Condition Assessment

Performance Monitoring

Identify Replacements

Replacement Planning/Impl

Update Asset Values

Identify Rehabilitation

Rehabilitation Planning/Impl
Asset Management Approach for Wellfields

Well Replacement Costs

- Regulatory Issues - $10,000+
- Land Acquisition - $60,000+
- Site Preparation - $5,000+
- Engineering - $100,000+
- Well Construction/Development - $200,000+
- Infrastructure Work - $300,000+

$675,000+
Asset Management Approach for Wellfields

Approach

Well Inventory -> Compile Records

Assign MEAV

Condition Assessment

Performance Monitoring

Identify Replacements

Replacement Planning/Impl

Identify Rehabilitation

Rehabilitation Planning/Impl

Update Asset Values
Asset Management Approach for Wellfields

Clogging Process
Asset Management Approach for Wellfields

Approach

Well Inventory ➔ Compile Records

Assign MEAV ➔ Condition Assessment

Performance Monitoring ➔ Identify Replacements ➔ Replacement Planning/Impl.

Identify Rehabilitation ➔ Rehabilitation Planning/Impl

Update Asset Values
Asset Management Approach for Wellfields

Well Rehabilitation

Test  Mech.  Video  Technology  Extraction

Monitor  Removal  Chemical (If used)  Video  Test
Asset Management Approach for Wellfields

Well Rehabilitation

Monitor Progress

Sediment Removal Volumes

Volume (ml/1000)

Screen Interval

First Cycle
Second Cycle
Third Cycle
Asset Management Approach for Wellfields

**Approach**

1. **Well Inventory**
2. **Compile Records**
3. **Assign MEAV**
4. **Condition Assessment**
5. **Performance Monitoring**
   - Identify Replacements
   - Identify Rehabilitation
6. **Replacement Planning/Impl.**
7. **Rehabilitation Planning/Impl**
8. **Update Asset Values**
Asset Management Approach for Wellfields

Update MEAV

New Well Cost – $1,000,000

Debt costs - $100,000 (10% of cost)

Additional Annual Operating Costs for Existing Well - $15,000

Debt Cost of Existing Well - $100,000 - $15,000 = $85,000 per annum or 15%

Updated MEAV of Existing Well - $850,000
Asset Management Approach for Wellfields

City of Berlin, Germany

- 3.5 Million People
- 14 wellfields
- 850 wells
- 160 MGD
- Vertical Wells
- Horizontal Wells
Asset Management Approach for Wellfields

City of Berlin, Well Field

Well data:
- survey year built
- well function
- construction material
- screen length
- current building condition features

Well production data:
- watermeter status
- operation hours
- water level
- pump operation data

Pump data:
- Input performance
- electrical supply rate
- installation number
- location
- Data maintenance: after purchase, repair

Maintenance report data: well and pump activities, details on pump, water meter

Current working report

Standard pump management

Standard well management

Current well production and performance data

Well production data: watermeter status operation hours water level pump operation data

City of Berlin, Well Field

- Access cover
- Ground surface
- Distribution pipe
- Reinforced concrete foundation
- Casing
- Submersible Pump
- Well screen
- Gravel pack
- Sounding tube
- Water meter
- Backflow-preventer
- Rubber seal
- Distribution pipe
- Stahlbeton-fundament
- Reinforced concrete foundation
- Rubber seal
- Backflow-preventer
- Water meter
- Distribution pipe
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Asset Management Approach for Wellfields

City of Berlin, Well Field

Spec. Capacity in m³/h/m

- with Well Services
- without Well Services

In Berlin 5 years

“Life” Time
Asset Management Approach for Wellfields

City of Berlin, Well Field

Planning/Design

Operational Data

- Economic Conditions
- Maintenance & Investment Plan

Rehabilitation Costs
- No Action Required

Maintenance Costs
- Rehabilitation

New Borehole Costs
- Drilling of New Wells

Continued Monitoring

Submersible Pump Management

Economic Conditions

City of Berlin, Well Field

Operational Data
Asset Management Approach for Wellfields

City of Berlin, Well Field

Well Condition Ranking

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- 1: Routine Monitoring
- 2: Priority Inspection
- 3: Rehabilitate
- 4: Replace

Historical Operations - Fairwinds Well 2
Asset Management Approach for Wellfields

Summary

• Proactive Management of Groundwater Assets Saves Money
• Inspection/Monitoring Based Approach to Assess Well Condition
• Successful Management Requires Planned Maintenance & Assessment of Risk
Asset Management Approach for Wellfields

Questions