AGENDA

• Review Project Purpose and Goals

• Project Approach and Strategy to Achieve Project Goals
  – Future (2035) Potable Water Demand
  – Screening of Alternatives
  – Evaluation of Alternatives

• Summary and Comparison of Alternatives

• Conclusions and Recommendations
PURPOSE AND GOALS

Feasibility Study of Catalina Island Desalination Treatment System
Project Purpose and Goals

Reliable Potable Water Source for the City of Avalon and potentially Hamilton Cove

- 2000 Santa Catalina Island Census = 3,916
- 2010 Santa Catalina Island Census = 4,096
- 1980 City of Avalon Census = 2,022
- 1990 City of Avalon Census = 2,918
- 2000 City of Avalon = 3,127
- 2010 City of Avalon = 3,728
Project Purpose and Goals

1. Evaluate the Current (2006 – 2016 Maximum MDD) and Future (2035) Water Demand and Desalination Supply

2. Evaluate Alternatives to Meet Demand with Desalination and Storage Capacity; Minimize Future Drought Impact on Avalon and Hamilton Cove

3. Identify Recommended Alternative and Implementation Plan
Project Constraints, Considerations, and Assumptions

1. Stakeholder input was received for demand forecast and plan achieves 2035 Maximum Day Demand projection.

2. Coordinate approvals with required agencies having jurisdiction.

3. Allow phased approach to maintain desalination operational capacity no less than 230,000 GPD.

4. Connection of desalination distribution to Hamilton Cove is completed in conjunction.

5. Consider upgrading the existing discharge and adding a new system within the existing ocean border.

6. Desalination Facility can be operated with a higher recovery and still achieve the required water quality.

7. System’s redundancy accomplished with Middle Ranch wells and Wrigley Reservoir.

8. Pipeline from the mainland assumed not feasible.

9. Develop additional desalination supply due to drought cycles.

10. Improvements reside in exiting infrastructure or SCE-owned land.
Santa Catalina Island Location

Santa Catalina Island Tourism:
- High fluctuations of minimum and maximum peak demand
- High peaking factor

Remote Location Impacts:
- Extended Project Schedule
- Increased Construction Cost
Current (2006 – 2016 Maximum MDD) Potable Water Demand

Feasibility Study of Catalina Island Desalination Treatment System
Current Potable Water Demand (2006 – 2016 Maximum MDD) for Avalon and Hamilton Cove

- **Average Day Demand**: 731,316 GPD
- **Maximum Day Demand**: 1,344,723 GPD
- **Peak Hour Demand**: 2,915,341 GPD
Current (2006 – 2016 Maximum MDD) System

- ADD During Max Month = 731,316 GPD
- MDD = 1,344,723 GPD
- PHD = 2,915,341 GPD

Well No. 1
Well No. 2

Operational Seawater Source
• 576,000 GPD

Plant No. 1
Plant No. 2

Current

Operational Production
• 230,000 GPD

Storage of Baker Tanks
• Storage Capacity
  • Total = 375,000 GAL
  • Operational = 250,000 GAL
  • Minimum = 125,000 GAL

4-hr PHD Requirement
• 489,890 GAL
Current (2006 – 2016 Maximum MDD) System

Brine Outfall
Plant No. 1
Plant No. 2
Future Potable Water Demand

Feasibility Study of Catalina Island Desalination Treatment System
Future (2035) Demand

Future Potable Water Demand (2035) for Avalon and Hamilton Cove

- **Current (2006-2016 Maximum MDD)**
  - Average Day Demand: 731,316
  - Maximum Day Demand: 1,344,723
  - Peak Hour Demand: 2,915,341

- **Future (2035 in GPD)**
  - Average Day Demand: 769,670
  - Maximum Day Demand: 1,415,247
  - Peak Hour Demand: 3,068,236
Current (2006 – 2016 Maximum MDD) System

- ADD During Max Month = 731,316 GPD
- MDD = 1,344,723 GPD
- PHD = 2,915,341 GPD

Operational Seawater Source
- 576,000 GPD

Operational Production
- 230,000 GPD

Storage of Baker Tanks
- Storage Capacity
  - Total = 375,000 GAL
  - Operational = 250,000 GAL
  - Minimum = 125,000 GAL
- 4-hr PHD Requirement
  - 489,890 GAL
Current (2006 – 2016 Maximum MDD) System at Existing Desalination Facility Capacity (Deficit)

- ADD During Max Month = 731,316 GPD
- MDD = 1,344,723 GPD
- PHD = 2,915,341 GPD

Operational Seawater Source
- 576,000 GPD

Required Seawater Source
- 1,462,632 GPD

Seawater Source Deficit
- 864,000 GPD

Operational Production
- 230,000 GPD

Treatment Capacity with New Seawater Source
- 731,316 GPD

Desalination Treatment Deficit
- 501,316 GPD

Storage Deficit
- Total = 375,000 GAL
- Operational = 250,000 GAL
- Minimum = 125,000 GAL
- 4-hr PHD Requirement
- 489,890 GAL

Storage of Baker Tanks
- Storage Capacity
  - Total = 375,000 GAL
  - Operational = 250,000 GAL
  - Minimum = 125,000 GAL

Catalina Desalination Feasibility Study 2017
Future (2035) System

ADD During Max Month = 769,670 GPD
MDD = 1,415,247 GPD
PHD = 3,068,236 GPD

Operational Seawater Source
- 576,000 GPD

Seawater Source Capacity
- 1,539,340 GPD
- 2,880,000 GPD

Seawater Source Deficit
- 963,340 GPD
- 2,304,000 GPD

Operational Production
- 230,000 GPD

Production Capacity
- 769,670 GPD
- 1,440,000 GPD

Desalination Treatment Deficit
- 539,670 GPD
- 1,210,000 GPD

Storage of Baker Tanks
- Storage Capacity
  - Total = 375,000 GAL
  - Operational = 250,000 GAL
  - Minimum = 125,000 GAL
- 4-hr PHD Requirement
  - 511,373 GAL
- Additional Storage Required
  - 1,830,000 GAL
  - 640,000 GAL

Notes:
1 Number of new wells dependent on alternative selected and phase
2 Capacity provided based on facility’s production capacity; Values may vary based on alternative and/or phase selected as a balance between treatment and storage is achieved
Development and Evaluation of Alternatives

Feasibility Study of Catalina Island Desalination Treatment System
Desalination System Variables
Alternatives:

- **INTAKE**
- **TREATMENT**
- **STORAGE**
## Alternatives

<table>
<thead>
<tr>
<th></th>
<th>Alternative No. 1</th>
<th>Alternative No. 2</th>
<th>Alternative No. 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>0.77 MGD Production</td>
<td>1.0 MGD Production</td>
<td>1.44 MGD Production</td>
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<tr>
<td>Feed (GPD)</td>
<td>1,539,340</td>
<td>2,016,000</td>
<td>2,880,000</td>
</tr>
<tr>
<td>Treatment Capacity (GPD)</td>
<td>769,670</td>
<td>1,008,000</td>
<td>1,440,000</td>
</tr>
<tr>
<td>Total Wells (GPD)</td>
<td>1,539,340</td>
<td>2,016,000</td>
<td>2,880,000</td>
</tr>
<tr>
<td>Existing Wells (GPD)</td>
<td>576,000</td>
<td>576,000</td>
<td>576,000</td>
</tr>
<tr>
<td>New Wells (GPD)</td>
<td>963,340</td>
<td>1,440,000</td>
<td>2,304,000</td>
</tr>
</tbody>
</table>

### STORAGE

<table>
<thead>
<tr>
<th></th>
<th>Alternative No. 1</th>
<th>Alternative No. 2</th>
<th>Alternative No. 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL Added Storage (MG)</td>
<td>1.83</td>
<td>1.41</td>
<td>0.64</td>
</tr>
<tr>
<td>4-hr PHD (MG) included in total added</td>
<td>0.51</td>
<td>0.51</td>
<td>0.51</td>
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</table>
Summary and Comparison of Alternatives

Feasibility Study of Catalina Island Desalination Treatment System
Relationship between Treatment and Storage

Flow (GPD)

Time (hours)

STORAGE REQUIRED
Alternative No. 1 – 769,670 GPD

- System Enhancements
  - Source
    - Source Enhancement: 963,340 GPD
  - Treatment
    - Current Operational Production: 230,000 GPD
    - Treatment Enhancement: 539,670 GPD
    - 769,670 GPD Total Treatment Capacity
  - Storage
    - Storage Enhancement: 1.83 MG New Storage
Alternative No. 2 – 1,008,000 GPD

- System Enhancements
  - Source
    - Source Enhancement: 1,440,000 GPD
  - Treatment
    - Current Operational Production: 230,000 GPD
    - Treatment Enhancement: 778,000 GPD
    - 1,008,000 GPD Total Treatment Capacity
- Storage
  - Storage Enhancement: 1.41 MG New Storage
Alternative No. 3 – 1,440,000 GPD

- System Enhancements
  - Source
    - Source Enhancement: 2,304,000 GPD
  - Treatment
    - Current Operational Production: 230,000 GPD
    - Treatment Enhancement: 1,210,000 GPD
    - 1,440,000 GPD Total Treatment Capacity
  - Storage
    - Storage Enhancement: 0.64 MG New Storage
Conclusions and Recommendations

Feasibility Study of Catalina Island Desalination Treatment System
## Comparative Probable Cost Estimates

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Alt 1</th>
<th>Alt 2</th>
<th>Alt 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Produced Treatment Capacity (Current plus Added)</td>
<td>769,670 GPD</td>
<td>1,008,000 GPD</td>
<td>1,440,000 GPD</td>
</tr>
<tr>
<td>Current Operational Production</td>
<td>230,000 GPD</td>
<td>230,000 GPD</td>
<td>230,000 GPD</td>
</tr>
<tr>
<td>Capacity Added to Existing</td>
<td>539,670 GPD</td>
<td>778,000 GPD</td>
<td>1,210,000 GPD</td>
</tr>
<tr>
<td>Total Wells (GPD) (New plus 2 existing)</td>
<td>1,539,340</td>
<td>2,016,000</td>
<td>2,880,000</td>
</tr>
<tr>
<td>New Wells (GPD)</td>
<td>963,340</td>
<td>1,440,000</td>
<td>2,304,000</td>
</tr>
<tr>
<td>Added Storage (MG)</td>
<td>1.83</td>
<td>1.41</td>
<td>0.64</td>
</tr>
<tr>
<td>Total Probable Capital Cost</td>
<td>$19,418,000</td>
<td>$21,752,000</td>
<td>$25,734,000</td>
</tr>
<tr>
<td>Annual Probable O&amp;M Cost</td>
<td>$931,697</td>
<td>$1,135,655</td>
<td>$1,546,228</td>
</tr>
<tr>
<td>Total Probable Capital Cost ($ per 1000 Gal Desalinated Water Over 20 Years)</td>
<td>$7.74</td>
<td>$8.68</td>
<td>$10.31</td>
</tr>
<tr>
<td>Total Probable Capital Cost ($ per Acre-Foot Desalinated Water Over 20 Years)</td>
<td>$2,522</td>
<td>$2,830</td>
<td>$3,360</td>
</tr>
</tbody>
</table>
Phasing Approach Schematic

- Phase 5. Add treatment capacity as needed
- Phase 4. Add treatment capacity as needed
- Alternative 1 Phase 3. First Stage Demand Complete (Procurement and Installation of Equipment for First Stage Demand, Additional Storage, RO Equipment)
- Alternative 1 Phase 2. Auxiliary System Complete (100% Construction of the Auxiliary Facilities, Building, Piping with Blind Connections for 100% Plant Capacity, CIP System Enhancements, New Seawater Wells)
- Alternative 1 Phase 1. Engineering Complete (100% Total Project Design) and 0.5 MG Storage
Alternative No. 1 – Implementation Plan
## Alternative No. 1 – Implementation Plan with 3 Phases

<table>
<thead>
<tr>
<th>Description</th>
<th>Alternative No. 1 – Phase 1</th>
<th>Alternative No. 1 – Phase 2</th>
<th>Alternative No. 1 – Phase 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>ADD EQ 0.5 MG</td>
<td>ADD 3 Wells</td>
<td>ADD 1.33 MD Storage and REPLACE ONE RO</td>
</tr>
<tr>
<td>Feed (GPD)</td>
<td>576,000</td>
<td>1,539,340</td>
<td>1,539,340</td>
</tr>
<tr>
<td>Treatment Capacity (GPD)</td>
<td>230,000</td>
<td>570,000</td>
<td>769,670</td>
</tr>
<tr>
<td>Total Wells (GPD)</td>
<td>576,000</td>
<td>1,539,340</td>
<td>1,539,340</td>
</tr>
<tr>
<td>Existing Wells (GPD)</td>
<td>576,000</td>
<td>576,000</td>
<td>576,000</td>
</tr>
<tr>
<td>Added New Wells (GPD)</td>
<td>0</td>
<td>963,340</td>
<td>963,340</td>
</tr>
<tr>
<td><strong>STORAGE</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Added Storage in Each Phase (MG)</td>
<td>0.5</td>
<td>0</td>
<td>1.33</td>
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<tr>
<td>TOTAL STORAGE ADDED</td>
<td>0.5</td>
<td>0.5</td>
<td>1.83</td>
</tr>
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</table>
Supplemental Slides
### Screening of Alternatives

Evaluation of the various potential alternatives. The screening identifies applicable alternative to further evaluate.

| Criteria: Does the potential alternative address each criteria favorably | Potential Alternative |
|---|---|---|---|---|
| Project Construction Environmental and/or Archaeological/Risk/ Affects | Barge Water from Mainland | Pipeline Water from Mainland | 0.54M GPD Desalination Facility Enhancement (0.77M GPD Total) with 1.83 MG Storage Enhancement | 0.78M GPD Desalination Facility Enhancement (1.0M GPD Total) with 1.41 MG Storage Enhancement | 1.2M GPD Desalination Facility Enhancement (1.4M GPD Total) with 0.64 MG Storage Enhancement |
| Y | N | Y | Y | Y |
| Water Quality Effects | Y | N | Y | Y | Y |
| Operational Reliability | N | N | Y | Y | Y |
| Drought Mitigation | Y | Y | Y | Y | Y |
| Political / Public Acceptance/ Effects | Y | N | Y | Y | Y |
| Engineering Feasibility | Y | N | Y | Y | Y |
| Project Capital Cost | N | N | Y | Y | Y |
| Project Operating Cost | N | N | Y | Y | Y |
| Design | Y | N | Y | Y | Y |
| Constructability | Y | N | Y | Y | Y |
| Economic Analysis | N | N | Y | Y | Y |
| Energy Analysis | N | N | Y | Y | Y |
| Qualifies as an Alternative | N | N | Y | Y | Y |
Relationship between Treatment and Storage

Data imperative for making appropriate, cost-effective decisions

Large Treatment Capacity; Small Storage Volume

Small Treatment Capacity; Large Storage Volume
Existing Baker Tanks

- **Maximum** = Total Volume = 375,000 gal
- **Minimum** = Required Volume Maintained in Baker Tanks = 125,000 gal
- **Operational Capacity** = Maximum – Minimum = 250,000 gal
## Avalon Demand Considerations

<table>
<thead>
<tr>
<th></th>
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<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Values</td>
<td>GPD GPM</td>
<td>GPD GPM</td>
<td>Formula</td>
</tr>
<tr>
<td>Average Day Demand (ADD) During Maximum Month</td>
<td>731,316 508</td>
<td>769,670 534</td>
<td>Maximum(10 Year Historical Gallons/Month) SSO Data (2012-2016) and DPH Report Data (2006-2016) Future (Tab 4.0)</td>
</tr>
<tr>
<td>Maximum Day Demand (MDD)</td>
<td>1,344,723 934</td>
<td>1,415,247 983</td>
<td>ADD*PF&lt;sup&gt;1&lt;/sup&gt; Peaking Factor&lt;sup&gt;1&lt;/sup&gt; (PF) 1.84 Average 10 Year Monthly (June-Sep) Divided by Max 10 Year Monthly (June-Sep) [Consistent with Boyle]</td>
</tr>
<tr>
<td>Peak Hour Demand (PHD)</td>
<td>2,915,341 2,025</td>
<td>3,068,236 2,131</td>
<td>MDD*PF&lt;sup&gt;2&lt;/sup&gt; Peaking Factor&lt;sup&gt;2&lt;/sup&gt; (PF) 2.17 See Tab 5.0</td>
</tr>
<tr>
<td>System Requirements to Meet 4 Hour PHD (Gallons)</td>
<td>485,890</td>
<td>511,373</td>
<td></td>
</tr>
<tr>
<td>Minimum Day Demand (Gallons)</td>
<td>143,148 99</td>
<td>Unknown</td>
<td>Minimum day demand is lowest demand (Avalon only) between 6/1-11/1/16. Date of low demand was 10/27/16. Things to consider: this occurred when 40% conservation efforts were in effect, SCE may be flexible to meet the operating limit of standard equipment (i.e. if 100 GPM), consider the source production limits (if we only are able to operate one sea well, the typical flow rate is 200 GPM/well).</td>
</tr>
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</table>
## Detailed Probable Cost Estimates

<table>
<thead>
<tr>
<th>Item Equipment</th>
<th>Description</th>
<th>Alt 1</th>
<th>Alt 2</th>
<th>Alt 3</th>
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<tbody>
<tr>
<td>1 New RO Skids</td>
<td>$540,000</td>
<td>$1,080,000</td>
<td>$2,250,000</td>
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</tr>
<tr>
<td>2 Energy Recovery Devices</td>
<td>$30,000</td>
<td>$60,000</td>
<td>$120,000</td>
<td></td>
</tr>
<tr>
<td>3 Space Chemical Metering Pumps</td>
<td>$3,000</td>
<td>$5,000</td>
<td>$10,000</td>
<td></td>
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<tr>
<td>4 Spare Product Water Pumps</td>
<td>$9,500</td>
<td>$19,000</td>
<td>$38,000</td>
<td></td>
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<tr>
<td>5 Piping on RO Skids</td>
<td>$5,000</td>
<td>$10,000</td>
<td>$20,000</td>
<td></td>
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<tr>
<td>6 Intake Wells</td>
<td>$1,500,000</td>
<td>$2,500,000</td>
<td>$4,000,000</td>
<td></td>
</tr>
<tr>
<td>7 Storage Volume¹</td>
<td>$3,660,000</td>
<td>$2,820,000</td>
<td>$1,280,000</td>
<td></td>
</tr>
<tr>
<td>8 Re-clad Existing Structure</td>
<td>$223,000</td>
<td>$223,000</td>
<td>$223,000</td>
<td></td>
</tr>
<tr>
<td>9 Engineering (10% of Capital Cost)</td>
<td>$895,575</td>
<td>$974,100</td>
<td>$1,157,700</td>
<td></td>
</tr>
<tr>
<td>10 Electrical and Instrumentation (15% of Capital Cost)</td>
<td>$343,304</td>
<td>$384,555</td>
<td>$454,935</td>
<td></td>
</tr>
<tr>
<td>11 Permitting (5% of Capital Cost)</td>
<td>$343,304</td>
<td>$384,555</td>
<td>$454,935</td>
<td></td>
</tr>
<tr>
<td>12 Oversight &amp; Project Management (5% of Capital Cost)</td>
<td>$343,304</td>
<td>$384,555</td>
<td>$454,935</td>
<td></td>
</tr>
<tr>
<td>13 Grant Compliance / Administrative Support (2% of Capital Cost)</td>
<td>$137,322</td>
<td>$153,822</td>
<td>$181,974</td>
<td></td>
</tr>
<tr>
<td>14 Sampling &amp; Testing (2% of Capital Cost)</td>
<td>$137,322</td>
<td>$153,822</td>
<td>$181,974</td>
<td></td>
</tr>
<tr>
<td>15 Utilities (2% of Capital Cost)</td>
<td>$137,322</td>
<td>$153,822</td>
<td>$181,974</td>
<td></td>
</tr>
<tr>
<td>16 Construction (15% of Capital Cost)</td>
<td>$1,029,911</td>
<td>$1,153,665</td>
<td>$1,364,805</td>
<td></td>
</tr>
<tr>
<td>17 Commissioning (2% of Capital Cost)</td>
<td>$137,322</td>
<td>$153,822</td>
<td>$181,974</td>
<td></td>
</tr>
<tr>
<td>Alternative Improvements</td>
<td>$9,818,487</td>
<td>$10,998,273</td>
<td>$13,011,141</td>
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<tr>
<td>Taxes (10.25%)</td>
<td>$1,007,000</td>
<td>$1,128,000</td>
<td>$1,334,000</td>
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<td>Material Mark-up for Transportation to Catalina Island (10%)</td>
<td>$982,000</td>
<td>$1,100,000</td>
<td>$1,302,000</td>
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<tr>
<td>Contractor Mobilization and Overhead and Profit (6% + 15%)</td>
<td>$2,062,000</td>
<td>$2,310,000</td>
<td>$2,733,000</td>
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<tr>
<td>Project Subtotal</td>
<td>$13,869,487</td>
<td>$15,536,273</td>
<td>$18,380,141</td>
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<tr>
<td>Contingency (40%)</td>
<td>$5,548,000</td>
<td>$6,215,000</td>
<td>$7,353,000</td>
<td></td>
</tr>
<tr>
<td>Total Probable Cost (Rounded)</td>
<td>$19,418,000</td>
<td>$21,752,000</td>
<td>$25,734,000</td>
<td></td>
</tr>
<tr>
<td>Annual Probable O&amp;M Costs (Per Year) – 20%</td>
<td>$931,697</td>
<td>$1,135,655</td>
<td>$1,546,228</td>
<td></td>
</tr>
<tr>
<td>Total Probable Capital Cost ($ per 1000 Gal Desalinated Water Over 20 Years)</td>
<td>$7.74</td>
<td>$8.68</td>
<td>$10.31</td>
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<td>$2,522</td>
<td>$2,830</td>
<td>$3,360</td>
<td></td>
</tr>
</tbody>
</table>

¹Storage volume includes Operational Storage, Equalizing Storage, and Standby Storage.
New Structure vs. Existing Structure

Modify Existing Structure (A) or Construct a New Facility (B)
Phasing

DESALINATION FACILITY – PLANT NO. 1

288,000 GPD

288,000 GPD

288,000 GPD

288,000 GPD