## SHOP DRAWING AND SAMPLE TRANSMITTAL/REVIEW FORM

### General Information
- **Contractor:** ARB Inc.
  - 26000 Commercentre Drive
  - Lake Forrest, CA 92630
  - Phone: (949) 598-9242
  - Fax: (949) 587-5786
- **Subcontractor:**
  - 26000 Commercentre Drive
  - Lake Forrest, CA 92630
  - Phone: (949) 598-9242
  - Fax: (949) 587-5786
- **Engineer:** HDR Engineering, Inc.
  - 2030 10th. Street
  - Los Osos, CA 93402
  - Phone: (805) 534-1341
  - Fax: (805) 534-1493
- **Supplier:**
  - 2030 10th. Street
  - Los Osos, CA 93402
  - Phone: (805) 534-1341
  - Fax: (805) 534-1493
- **Los Osos Wastewater Collection Area:** A & D

### CPM Activity No. and Specification Package Section
- CPM Activity No.: 02140-1
- Specification Package Section: Drawing / Detail

### Drawing Details
<table>
<thead>
<tr>
<th>Number Of Copies</th>
<th>Type</th>
<th>Product Description / Manufacturer</th>
<th>Contractor Remarks</th>
<th>Review Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 Paper</td>
<td></td>
<td>Dewatering Plan</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 PDF</td>
<td></td>
<td>Dewatering Plan</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Deviations
- Deviations: None

### Related Submittal(s)

### By this submittal, I hereby represent that I have
determined and verified all field measurements,
construction criteria, material, dimensions, catalog
numbers and similar data and I have checked and
coordinated each item with other applicable shop
drawings and other requirements of the contract
documents, except for the deviations listed: (If none,
state none)

### Authorized Signature

### REVIEW COMMENTS:

### FOR REVIEW USE ONLY

### SIGNATURE

### Two Copies Returned To Contractor On (Date):

### Review Action Explanation:
1. Approved
2. Approved as Noted
3. Approved as Noted/Confirm
4. Approved as Noted/Resubmit
5. Not Approved
6. Comments Attached
7. Receipt Acknowledged
The dewatering plan for the above mentioned project is based on the design assumptions from the 'Dewatering Plan' designed by CDM Smith, March 2012. Soils are assumed to be a mix of alluvium and sand deposits. An estimated range of hydraulic conductivity of 10 to 50 gpd/ft² and an aquifer thickness of 60 feet have been assumed. Pump rates and estimated duration of the initial draw-down are based upon the worst-case scenario: Ground water at existing grade, with a 20 foot deep excavation, resulting in a desired draw-down of 22 feet.
DEWATERING DESIGN NARRATIVE

Work areas shall be dewatered 1,000 feet at a time. Groundwater observation wells shall be provided at 500ft. intervals within the areas of active dewatering.

Area D2 shall be dewatered through the use of sumps and pumps as only nuisance water is expected to be encountered. Groundwater shall be pumped into a baffled sedimentation tank; tested and treated as required by the project specifications and in accordance with the SWPPP BMP’s and thereafter trucked to the Fairchild Detention Basin.

Area D3 shall be dewatered through the use of 30 foot deep well points which shall be spaced at 50, 75 or 100 feet, as the contractor deems best suited to each area. Each well point shall consist of a 24 inch diameter well, an 8 inch casing, 15 feet of well screen, filter pack and a submersible pump. Pumps shall discharge into a 6 inch diameter header pipe, which shall outlet into a baffled sedimentation tank. Groundwater shall be tested and treated as required by the project specifications and in accordance with the SWPPP BMP’s and pumped into the Fairchild Detention Basin.

Areas D1, A1, A2, A3 and A4 shall be dewatered through the use of 30 foot deep well points which shall be spaced at 50, 75 or 100 feet, as the contractor deems best suited to each area. Each well point shall consist of a 24 inch diameter well, an 8 inch casing, 15 feet of well screen, filter pack and a submersible pump. Pumps shall discharge into a 6 inch diameter header pipe, which shall outlet into a baffled sedimentation tank which shall then outlet into the proposed 16 inch force main running along Los Osos Valley Road where it shall be gravity fed into the Mid-Town Retention Site.

Settlement monitoring points shall be established on or near existing improvements within the dewatering system’s radius of influence. These points shall be monitored daily during the initial draw-down, and weekly once the steady state has been achieved. Pumps shall run continuously for 14 days, or until desired draw-down is observed in observation wells. If desired draw-down is not observed within 14 days, additional wells shall be added.
Dewatering Plan for Case '50ft spacing'

Soil and groundwater qualities were taken from "Appendix D Dewatering Plan", performed by CDM Smith, Dated March 2012

Soils Based on Above Report: Soils: SW, SM. A hydraulic conductivity range of 10 ft/day to 50 ft/day has been used to determine expected pumping rates.

30' Dewatering Wells
Permeability Based on Design Soil Parameters:

<table>
<thead>
<tr>
<th>Range of Permeability of Natural Soils</th>
<th>Permeability (µ/sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Openwork Gravel (GP)</td>
<td>10000 to 10000</td>
</tr>
<tr>
<td>Uniform Gravel (GP)</td>
<td>2000 to 3000</td>
</tr>
<tr>
<td>Well Graded Gravel (GW)</td>
<td>50 to 2000</td>
</tr>
<tr>
<td>Uniform Sand (SP)</td>
<td>10 to 1000</td>
</tr>
<tr>
<td>Well Graded Sand (SW)</td>
<td>10 to 50</td>
</tr>
<tr>
<td>Silty Sand (SM)</td>
<td>1 to 10</td>
</tr>
<tr>
<td>Clayey Sand (SC)</td>
<td>0.5 to 1</td>
</tr>
<tr>
<td>Silt (ML)</td>
<td>0.1 to 0.0001</td>
</tr>
</tbody>
</table>

Conversion Factors for Units of Permeability

<table>
<thead>
<tr>
<th>UNIT</th>
<th>Multiply by to Convert to µ/sec</th>
<th>Multiply µ/sec by to get unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>cm x 10⁻² per sec cm³/s</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Gallons Per Day Per Square Foot</td>
<td>0.46948357</td>
<td>2.13</td>
</tr>
<tr>
<td>Feet Per Minute</td>
<td>5081</td>
<td>0.000197</td>
</tr>
<tr>
<td>Feet Per Day</td>
<td>3.53</td>
<td>0.283286</td>
</tr>
<tr>
<td>Inches Per Year</td>
<td>0.0008056</td>
<td>1241</td>
</tr>
<tr>
<td>Meters Per Day</td>
<td>11.57</td>
<td>0.08643</td>
</tr>
<tr>
<td>Feet Per Year</td>
<td>0.00967118</td>
<td>103.4</td>
</tr>
</tbody>
</table>

Estimated depth of aquifer: 60 ft

30 ft deep well:
- Ground Level: 100 elev
- Water surface level: 100 elev
- Dewater elevation: 78 elev
- Pump Intake elevation: 70 elev
- h_w = 38 ft

Expect that permeability K can range from 35.30 (µ/sec) to 176.50 (µ/sec)

75.19 gal/day/ft² to 176.50 gal/day/ft²

\[ V = \frac{\pi K (L_H - L_I)}{\ln R_0} = \frac{(K (L_H - L_I))}{2L} \]
Steady State:
Total wells = 21

\[ R_0 = \frac{3(H-h)K}{H} = 392 \text{ FT} \]
\[ h = 38 \text{ FT} \]
\[ K = 35.30 \text{ (\mu/sec)} \]
\[ Q = \pi K(H^2-h_w^2) \ln \frac{R_0}{r} + 2XK(H^2-h_w^2) = Q = K(H^2-h_w^2)455 \ln R_0/r_w \]

Equivalent radius (R_e) = 17.8 ft
X = 1000 ft
r_e = 1 ft

Estimate Q

<table>
<thead>
<tr>
<th>K = 75.189 gal/day/ft²</th>
</tr>
</thead>
<tbody>
<tr>
<td>H = 60 ft</td>
</tr>
<tr>
<td>h_w = 38 ft</td>
</tr>
<tr>
<td>R_0 = 392 ft</td>
</tr>
<tr>
<td>r_e = 1 ft</td>
</tr>
<tr>
<td>ln R_0/r_e = 6.97</td>
</tr>
<tr>
<td>Q = 499684 gpd</td>
</tr>
<tr>
<td>Q = 346 gpm</td>
</tr>
<tr>
<td>Q = 16 gpm per well</td>
</tr>
</tbody>
</table>

Estimate Q

<table>
<thead>
<tr>
<th>K = 375.945 gal/day/ft²</th>
</tr>
</thead>
<tbody>
<tr>
<td>H = 60 ft</td>
</tr>
<tr>
<td>h_w = 38 ft</td>
</tr>
<tr>
<td>R_0 = 877 ft</td>
</tr>
<tr>
<td>r_e = 1 ft</td>
</tr>
<tr>
<td>ln R_0/r_e = 6.78</td>
</tr>
<tr>
<td>Q = 1300170 gpd</td>
</tr>
<tr>
<td>Q = 54,174 gph</td>
</tr>
<tr>
<td>Q = 903 gpm</td>
</tr>
<tr>
<td>Q = 43 gpm per well</td>
</tr>
</tbody>
</table>

Initial Drawdown:
Approximate draw-down time based on field data:
Uniform to Well Graded Gravel: 2 - 3 days
Uniform to Well Graded Sand: 4 - 6 days
Silty and Clayey Sand: 7 - 12 days
Silt and Clay: more than 12 days

Estimated permeability = 375.9 gal/day/ft²
Q (steady state) = 43 gpm per well
Estimated draw-down time = 11 days
Estimated rate of draw-down = 2.0 ft per log cycle
Pumping coefficient = 1.5
Q_i = 64 gpm per well
Initial Flow rate = 92,869 gpd per well
Steady State Flow rate = 61,913 gpd per well

Summary:

<table>
<thead>
<tr>
<th>Estimated Flows</th>
<th>Quantity (gal)</th>
<th>Time (days)</th>
<th>Q (gpd)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial Drawdown</td>
<td>1,021,562</td>
<td>11</td>
<td>92,869</td>
</tr>
<tr>
<td>Steady State</td>
<td>61,913</td>
<td>1</td>
<td>61,913</td>
</tr>
</tbody>
</table>

Pump Requirements

<table>
<thead>
<tr>
<th>Q (gpd)</th>
<th>Qty Pumps</th>
<th>Capacity (gpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial Drawdown</td>
<td>92,869</td>
<td>64</td>
</tr>
<tr>
<td>Steady State</td>
<td>61,913</td>
<td>43</td>
</tr>
</tbody>
</table>
Sedimentation and Turbidity Control:

Pump to Retention
Length L = 50 ft
Width W = 8 ft
Depth D = 8 ft
Volume = 3200 cf
Volume = 23936 gal
Surface area $A_s$ = 400 sf

<table>
<thead>
<tr>
<th>Particle</th>
<th>Particle Description</th>
<th>Settling Velocity $V_s$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td>(mm)</td>
<td>(fps)</td>
</tr>
<tr>
<td>0.5</td>
<td>coarse sand</td>
<td>0.19</td>
</tr>
<tr>
<td>0.2</td>
<td>medium sand</td>
<td>0.067</td>
</tr>
<tr>
<td>0.1</td>
<td>fine sand</td>
<td>0.023</td>
</tr>
<tr>
<td>0.05</td>
<td>coarse silt</td>
<td>0.0062</td>
</tr>
<tr>
<td>0.02</td>
<td>medium silt</td>
<td>0.000096</td>
</tr>
<tr>
<td>0.01</td>
<td>fine silt</td>
<td>0.00024</td>
</tr>
<tr>
<td>0.005</td>
<td>clay</td>
<td>0.0006</td>
</tr>
</tbody>
</table>

Summary from below calculations:

<table>
<thead>
<tr>
<th>Sedimentation</th>
<th>Detention Time (hr)</th>
<th>Velocity $V_s$ (ft/sec)</th>
<th>solids (cf/day)</th>
<th>Overflow Rate (gpd/sf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial Drawdown</td>
<td>6.19</td>
<td>0.000428</td>
<td>0.62</td>
<td>232</td>
</tr>
<tr>
<td>Steady State</td>
<td>9.28</td>
<td>0.000287</td>
<td>0.41</td>
<td>155</td>
</tr>
</tbody>
</table>

Note: Discharge with a turbidity in excess of 50 NTUs or 110% of the ambient stream turbidity, which ever is less is prohibited. A turbidity test will be required if a visual test does not confirm this.

Initial Drawdown

<table>
<thead>
<tr>
<th>Estimated Flows</th>
<th>Quantity (gal)</th>
<th>Time (days)</th>
<th>Q (gpd)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial Drawdown</td>
<td>1,021,562</td>
<td>11</td>
<td>92,869</td>
</tr>
</tbody>
</table>

Detention time = volume of tank/flow per unit time = 6.186 Hr
Volume = 3200 cf
Q = 92,869 gpd

Velocity $V_s = 1.2 \frac{Q}{A_s} = 0.000428$ ft/sec sufficient time to settle particles

$A_s = 400$ sf
Q = 92,869 gpd

Estimated solids =suspended solids/unit volume x Q = 0.62 cf/day
suspended solids
Q = 92,869 gpd

Overflow rate =Q/LW = 232 gpd/sf
Q = 92,869 gpd
L = 50
W = 8
Steady State

<table>
<thead>
<tr>
<th>Estimated Flows</th>
<th>Quantity (gal)</th>
<th>Time (days)</th>
<th>Q (gpd)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steady State</td>
<td>61,913</td>
<td>1</td>
<td>61,913</td>
</tr>
<tr>
<td>Total Initial Steady State</td>
<td>61,913</td>
<td>1</td>
<td>61,913</td>
</tr>
</tbody>
</table>

Detention time = volume of tank/flow per unit time = 9.28 Hr

Velocity \( V_s = \frac{Q}{A_s} = 0.000287 \text{ ft/sec} \) sufficient time to settle particles

\[ A_s = 400 \text{ sf} \]
\[ Q = 61,913 \text{ gpd} \]

Estimated solids = suspended solids/unit volume \( x Q = 0.41 \text{ cf/day} \)

\[ Q = 61,913 \text{ gpd} \]
\[ \text{suspended solids} = 5 \text{ ppm} \]

Overflow rate \( = \frac{Q}{LW} = 154.8 \text{ gpd/sf} \)

\[ Q = 61,913 \text{ gpd} \]
\[ L = 50 \text{ ft} \]
\[ W = 8 \text{ ft} \]
Check Screen Diameter:
  Pump Capacity (gpm): \( Q = 123 \) (from well calculations, spaced at 100ft)
  Minimum Well Diameter (in): \( d = 6 \) (per table 18.1 Powers 1992)
  Well Screen Diameter (in): \( D = 8 \) \( D \geq d \) OK

Check Screen Length:
  Well Screen Length (ft): \( L_w = 15 \)
  Flow per linear foot of screen (gpm/ft): \( q = \frac{Q}{L} \) \( q = 8.2 \)

Check Screen Entrance Velocity (Slotted PVC Screen):
  Well Screen Diameter (in): \( D = 8 \)
  Well Screen Slot Size (in): \( s_w = 0.030 \)
  Area of Opening (in²/ft): \( A_o = 25.9 \) (per table 18.2 Powers 1992)
  Screen Entrance Velocity (fpm): \( v_s = 19.2 \frac{q}{A_o} \) \( v_s = 6 \)
  Recommended Velocity (fpm): \( v_r = 6 \) (per table 18.3 Powers 1992)
  \( v_s = v_r \) OK

Check Gravel Filter Pack (Powers 1992):
  Soil Properties (based upon grain distribution graph from the Geotechnical Report, by Fugro West, Inc. March 4, 2004):
    90% Passing Size (mm): \( D_{90a} = 0.30 \) (US STD Sieve #48)
    60% Passing Size (mm): \( D_{60a} = 0.25 \) (US STD Sieve #60)
    50% Passing Size (mm): \( D_{50a} = 0.21 \) (US STD Sieve #65)
    10% Passing Size (mm): \( D_{10a} = 0.08 \) (US STD Sieve #200)
  Gradation:
    \( C_u = \frac{D_{60a}}{D_{10a}} \) \( C_u = 3.1 \)

Filter Pack Properties:
  Filter factor for uniform soils: \( F_m = 8 \) (per figure 18.14 Powers 1992)
  Allowable Filter 50% Passing (mm):
    \( D_{50f} = F \cdot D_{50a} \) \( D_{50f} = 1.68 \) (US STD Sieve #12)
  Filter 90% Passing Size (mm):
    \( D_{90f} = F \cdot D_{90a} \) \( D_{90f} = 2.4 \) (US STD Sieve #8)
  Filter 60% Passing Size (mm):
    \( D_{60f} = F \cdot D_{60a} \) \( D_{60f} = 2 \) (US STD Sieve #10)
  Filter 10% Passing Size (mm):
    \( D_{10f} = F \cdot D_{10a} \) \( D_{10f} = 0.64 \) (US STD Sieve #30)
MANUFACTURER'S CERTIFICATION
GAREY AGGREGATE PLANT
1/4" x #8 BACKFILL AGGREGATE

The Garey 1/4" x #8 Backfill Aggregate supplied by CalPortland Construction is produced at the Garey, California Plant, SMARA No. 91-42-0014. The typical physical properties of the aggregate are summarized below and represent material that was sampled during routine quality control testing.

Gradation:

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Cumulative Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2&quot; (12.5 mm)</td>
<td>100</td>
</tr>
<tr>
<td>3/8&quot; (9.50 mm)</td>
<td>99</td>
</tr>
<tr>
<td>1/4&quot; (6.30 mm)</td>
<td>98</td>
</tr>
<tr>
<td>#4 (4.75 mm)</td>
<td>64</td>
</tr>
<tr>
<td>#8 (2.36 mm)</td>
<td>3</td>
</tr>
<tr>
<td>#16 (1.18 mm)</td>
<td>1</td>
</tr>
</tbody>
</table>

Specific Gravity, Bulk SSD: 2.54
Cleanness Value, CT 227: 60
Durability Index, CT 229: 50
Voids (Rodded), C 29: 39

Patrick W. Imhoff, P.E.
Technical Service Manager
Mechanical Sieve Analysis Results

<table>
<thead>
<tr>
<th>GRAVEL</th>
<th>SAND</th>
<th>SILT or CLAY</th>
</tr>
</thead>
<tbody>
<tr>
<td>coarse</td>
<td>fine</td>
<td>coarse</td>
</tr>
<tr>
<td></td>
<td></td>
<td>medium</td>
</tr>
<tr>
<td></td>
<td></td>
<td>fine</td>
</tr>
</tbody>
</table>

- **Symbol**: Δ
- **Sample**: 1-4
- **Depth (ft)**: 18.5
- **Description and Classification**: Silty SAND (SM)
- **Coarse**: —
- **Fine**: —

**Project**: Los Osos Wastewater Project
**Performed by**: Gregg Fiegel, Ph.D., P.E.
**Test Method**: ASTM D422

CFS Geotechnical Consultants

MECHANICAL SIEVE ANALYSIS RESULTS

Los Osos Wastewater Project
Los Osos, California
Project No. 991001

Figure B-2a
GENERAL NOTES:
1. DUE TO NATURAL VARIATIONS IN SOIL STRATA PUMPING RATES MAY VARY FROM THOSE SHOWN ON THIS PLAN. THIS PLAN SHALL BE MODIFIED AS REQUIRED TO MAINTAIN THE SPECIFIED DEWATERING ELEVATION TO ALLOW CONSTRUCTION TO PROCEED ON DRY, STABLE SUGARBEADS IF CONDITIONS ARE ENCOUNTERED SUCH THAT THE PUMPING RATES ARE MORE THAN THOSE SHOWN ON THIS PLAN OUR OFFICE SHALL BE NOTIFIED IMMEDIATELY.
2. DURING THE DEWATERING PROCESS THE CONTRACTOR SHALL DESIGNATE A COMPETENT PERSON AT THE SITE WHERE THIS PLAN IS IN USE TO BE RESPONSIBLE FOR ENSURING THAT THE INTENT OF THIS PLAN IS MAINTAINED AT ALL TIMES.
3. DESIGN BASED ON TECHNICAL MEMORANDUM "APPROVAL OF DEWATERING PLAN" BY CMK S.F. DATED MARCH 2013.
4. VERIFY LOCATION OF ALL EXISTING UNDERGROUND UTILITIES AND/OR PIPES PRIOR TO COMMENCING WELL PLACEMENT TO AVOID POTENTIAL CONFLICTS.
5. SLENS AND DRAINAGE DITCHES SHALL NOT BE PERMITTED IF THEY RESULT IN INCREASED LOSS OF FINES OR SLOPE INSTABILITY WELLS SHALL BE MONITORED AND MODIFIED IF NECESSARY TO PREVENT THE CONTINUOUS PUMPING OF FINES.
6. SEE SHEET 2 FOR ESTIMATED FLOWS AND PUMP REQUIREMENTS.
7. AFTER WITHDRAWAL, PUMP SPEED AND/OR NUMBER OF ACTIVE WELLS MAY BE MODIFIED AS LONG AS MAINLINE DEWATERING PIPING IS MAINTAINED AS SHOWN ON PLAN.
8. PROVIDE OBSERVATION WELLS AT 50 FT.

Dewatering Notes:
1. PLACE WELLS WITH OFFSETS AS SHOWN ON PLAN.
2. WELL SPACING SHALL BE AS SHOWN ON PLAN.
3. PROVIDE, TAKE MEASUREMENTS, AND MAINTAIN OBSERVATION WELLS. ACTIVE WELLS MAY DOUBLE AS OBSERVATION WELLS.
4. PUMPS SHALL BE POWERED WITH 3-PHASE POWER WHERE POSSIBLE.
5. PROVIDE BACKUP GENERATORS, AUTO ALARMS AND DEALERS TO LIMIT INTERRUPTIONS IN DEWATERING.

Groundwater Disposal:
1. DISCHARGE PUMPS INTO AN 8 INCH PVC HEADER WHICH SHALL DISCHARGE INTO A BATTLED BAKED TANK.
2. PERFORM WATER QUALITY ANALYSES AS REQUIRED BY PROJECT SPECIFICATIONS.
3. TREAT WATER AS REQUIRED BY PROJECT SPECIFICATIONS AND IN ACCORDANCE WITH THE STEEL WELD'S PRIOR TO DISPOSAL.
4. PRIORITIZE USE OF WATER FOR CONSTRUCTION PURPOSES. DISPOSE OF REMAINING WATERS AS FOLLOWS:
   4.1. WATER PUMPED FROM AREA 02 SHALL BE LOADED ONTO TRUCKS AND DUMPED INTO THE FAIRCHILD DETENTION BASIN.
   4.2. WATER FROM AREA 03 SHALL BE PIPPED TO THE FAIRCHILD DETENTION BASIN.
   4.3. WATER PUMPED FROM AREAS 01, 02, A2, A3, A1, AND A4 SHALL BE PIPPED TO THE MIS-TOWN DETENTION SITE.

WELL ABANDONMENT SEQUENCE:
1. REMOVE PUMP AND ASSOCIATED PIPING AND CABLE, ETC.
2. REMOVE WELL CASING.
3. REMOVE THE TOP FIVE FEET OF GRAVEL PACK AND REPLACE WITH NATIVE FILL OR CLASS II AGGREGATE BASE.

ARB, INC.
26000 COMMERCENTRE DRIVE
LAKES FOREST, CA 92630

LOS OSOS WASTE WATER COLLECTION SYSTEM
DEWATERING PLAN
LOS OSOS, CA

TYPICAL DEWATERING PLAN
FOR AREAS "A" & "D"

INDEX:
SHEET S/1 COVER PAGE
SHEET S/2 WELLS AT 50 FT
SHEET S/3 WELLS AT 75 FT
SHEET S/4 WELLS AT 100 FT
SHEET S/5 DETAILS

VICINITY MAP